申报	系列：教师系列专职辅导员
	专业：学生思想政治教育
	职称：教授

业绩成果材料

（申报人的业绩成果材料包括论文、科研项目、获奖以及其他成果等）

单　位（二级单位）电子工程学院（人工智能学院）

姓　名　梁耀明

材料核对人:　　单位盖章:

核对时间:

华南农业大学制

目　录

荣誉证书

CERTIFICATE OF HONOR

梁雅晶老师：

荣获首届全国大学生职业规划大赛广东省分赛大学生职业发展与就业指导课程教学赛道高教组

金　奖

团队其他主要成员：赵凤、孙理超、梁耀明、田立

特发此证，以资鼓励。

广东省教育厅

二〇二四年三月

附件6

2023年度教育部人文社会科学研究专项任务项目
（高校辅导员研究）立项一览表

序号	项目名称	项目批准号	申请人	学校名称
1	数智时代行业特色高校学生劳动教育的创新与实践研究	23JDSZ3081	马文婷	安徽理工大学
2	基于网络舆情群体极化的高校思想政治教育质效提升路径研究	23JDSZ3030	高晓妹	安徽医科大学
3	跨界与融合：IP形象在高校文化育人中的实践路径研究	23JDSZ3109	孙蓉	北京联合大学
4	“双一流”高校辅导员双线晋升实施机制研究	23JDSZ3025	丰华文	北京体育大学
5	新时代高校辅导员政治引领力提升研究	23JDSZ3068	刘健康	滨州医学院
6	基于大数据技术的大学生心理健康提升研究	23JDSZ3159	徐晴	常熟理工学院
7	基于生涯发展的高职院校实践育人共同体构建研究	23JDSZ3027	冯益芙	常州纺织服装职业技术学院
8	新时代中国共产党劳动教育话语体系建构研究	23JDSZ3149	吴玉剑	常州工程职业技术学院
9	产教融合背景下中国特色学徒制提升高校毕业生就业质量的路径研究——以江苏省为例	23JDSZ3036	何从娜	常州工业职业技术学院
10	新时代高校辅导员提升政治引领力路径研究	23JDSZ3169	杨晓庆	成都医学院
11	新时代大学生志愿服务寓于劳动教育的融合研究	23JDSZ3114	唐珏	大连海洋大学
12	大学生隐匿性心理健康危机网格化管理对策研究	23JDSZ3124	王雷	大连交通大学
13	伟大建党精神涵育时代新人的有效路径研究	23JDSZ3052	李丹妮	大连理工大学

序号	项目名称	项目批准号	申请人	学校名称
62	袁隆平的科学家精神融入新时代农林类院校的校园文化建设研究	23JDSZ3118	田建湘	湖南农业大学
63	数字赋能高职辅导员职业创新能力培育体系构建研究	23JDSZ3193	赵健	湖南铁路科技职业技术学院
64	数字时代视域下高校学生行为画像与精准思政教育策略研究	23JDSZ3151	夏晓天	湖南邮电职业技术学院
65	新医科背景下地方高校医学生实践育人共同体构建研究	23JDSZ3018	董建新	湖州师范学院
66	数智赋能高校“一站式”学生社区综合管理模式构建研究	23JDSZ3011	陈怡帆	华北电力大学
67	数智赋能高校红色文化教育精准供给研究	23JDSZ3134	王亚薇	华北理工大学
68	高校安全风险“双控”应急管理体系构建及风险防范化解研究	23JDSZ3194	赵树果	华北理工大学
69	书院制下“一站式”学生社区综合育人模式研究	23JDSZ3060	梁宏亮	华东师范大学
70	青年学生网络符号消费观教育引导研究	23JDSZ3130	王文胜	华东政法大学
71	ChatGPT对高校思想政治工作的影响研究	23JDSZ3006	曾庆醒	华南理工大学
72	大学生“微时空”交往的责任意识及培育研究	23JDSZ3142	魏争	华南理工大学
73	新时代研究生“导学思政”的理论建构及实践优化	23JDSZ3049	孔晓娟	华南农业大学
74	基于选择实验的高校辅导员职业稳定性激励机制研究	23JDSZ3061	梁耀明	华南农业大学
75	人工智能赋能高校思政教育的风险识别与防范研究	23JDSZ3083	马志凤	华中科技大学
76	高校师生样板党支部结对共建的运行机制和路径优化研究	23JDSZ3147	吴珊	华中农业大学
77	红色文化资源全面提升大学生思想政治教育质量的路径研究	23JDSZ3041	黄诚	怀化学院

A表：

教育部人文社会科学研究项目

申 请 评 审 书

项 目 类 别：	高校辅导员研究
学 科 门 类：	马克思主义/思想政治教育
课 题 名 称：	基于选择实验的高校辅导员职业稳定性激励机制研究（19）
项目负责人：	梁耀明
所 在 学 校：	华南农业大学（盖章）
学 校 代 码：	10564
申 请 日 期：	2023-4

教 育 部 社 会 科 学 司 制

广东省哲学社会科学规划专项小组

粤社科规专通〔2024〕7号

广东省哲学社会科学规划2024年度一般项目立项通知书

梁耀明同志：

经专家评审及省哲学社会科学工作领导小组审批，您申报的广东省哲学社会科学规划2024年度一般项目《粤港澳大湾区高校数字素养教育助推青年学生高质量就业研究》获准立项，批准号：GD24CYJ47，资助经费3.0万元，第一次拨款2.1万元，预留经费0.9万元。请尽快登录广东省哲学社会科学规划项目管理平台认真填报预算，个人填报时间为2月27日-3月15日12点，单位审核时间为2月27日-3月15日17点。逾时未填报立项预算视

为放弃立项。

填写立项回执后，项目申请书即成为立项协议，对项目负责人及其所在单位具有约束力。项目负责人所在单位须对立项协议的履行承担保证责任。项目负责人及所在单位须了解和执行以下规定：

1.课题组须学习并遵守《广东省哲学社会科学规划项目管理办法》。对于出现违规行为的，省哲学社会科学规划专项小组依据《广东省哲学社会科学规划项目管理办法》的相关规定进行处理。

2.立项项目经费不再追加。课题组如不接受，省哲学社会科学规划专项小组将撤销该项目立项。而立项经费一经接受，课题组将不得以资助经费不足为由，擅自变更原设计的最终成果形式和内容。

3.项目研究过程中，如有变更项目负责人、延长完成时间、改变成果内容或形式、变更项目管理单位、变更或增补课题组成员、申请终止项目等重要事项，项目负责人或所在单位必须按要求填写《广东省哲学社会科学规划项目重要事项变更审批表》（可在广东社科规划网“下载专区”下载），及时报省哲学社会科学规划专项小组审批。

4.项目研究的阶段性成果发表时，必须注明“广东省哲学社会科学规划项目（项目编号）”字样。

5.项目成果的鉴定结项由省哲学社会科学规划专项小

组组织，实行匿名鉴定制度。项目负责人及所在单位须在规定时间内向省哲学社会科学规划专项小组提交项目结项材料。结项所需材料、装印要求等具体事项，请登录广东社科规划网站“结项信息”栏目查看。在规定时间内不提交结项材料，将作撤项处理。

6.成果鉴定等级分为优秀、良好、合格和不合格四个等次。通过结项的，将拨付预留经费。不合格即未能通过结项，其预留经费不予拨付，课题组需修改后半年内重新申请结项鉴定。二次鉴定仍不能通过的，将作撤项处理。

7.为提高成果质量，项目的最终成果（专著、研究报告）必须经鉴定结项后方能出版。对于违反规定擅自出版的，将作撤项处理，省哲学社会科学规划专项小组将不再受理该项目的结项鉴定申请，并通知项目负责人所在单位不再拨付预留经费。

8.被撤项的项目负责人三年内不得申报国家社科基金项目和省哲学社会科学规划项目。

以上规定，项目负责人及所在单位应严格遵守。如有异议，可不接受资助，立项协议自行废止。

联系人：冯甜恬

电话：（020）83825078

地址：广州市天河北路 618 号广东社科中心 B 座 928

室

邮编：510635

广东省哲学社会科学规划专项小组

2024 年 2 月 27 日

广东省教育科学规划领导小组办公室

广东省教育科学规划领导小组办公室关于公布2023年度教育科学规划课题（高等教育专项）立项名单的通知

各有关高校：

为深入学习贯彻党的二十大精神和习近平总书记关于教育的重要论述，提升高等教育内涵发展水平，为我省在推进中国式现代化建设中走在前列提供有力人才保障和智力支撑，2023年省教育科学规划领导小组办公室组织开展教育科学规划课题（高等教育专项）的遴选工作。经学校推荐、省教育科学规划办组织专家评审，现将批准立项的2023年度教育科学规划课题（高等教育专项）（见附件）下达各高校。

请各高校按照国家和省相关科研平台项目管理办法，统筹安排项目资金，督促项目承担人按照项目申请书开展研究工作，协助解决项目实施过程中遇到的困难和问题，加强项目管理和经费使用管理，确保研究项目如期完成目标任务。省教育科学规划办将适时组织抽查工作。

附件：2023年度广东省教育科学规划课题（高等教育专项）立项名单

广东省教育科学规划领导小组办公室

2023年9月21日

（联系人及电话：曾俊伟、马思思，020-37627742、37628271）

公开方式：主动公开

校对人：马思思

附件

2023年度广东省教育科学规划课题（高等教育专项）立项名单

1.党的二十大精神研究研究专题				
序号	项目编号	项目名称	负责人姓名	所属学校
1	2023GXJK002	粤东西北地区医学人才引育机制研究--以粤东地区S医学院及其附属医院为例	范继斌	汕头大学
2	2023GXJK003	中国式现代化的战略支撑：内在逻辑、现实挑战与主要进路研究	沈海军	汕头大学
3	2023GXJK004	新时代临床专硕研究生思想迁移研究	彭浩晟	广东医科大学
4	2023GXJK005	“双减”背景下校外体育培训机构进校园评价体系研究	潘峰	广州体育学院
5	2023GXJK006	广东省县域中小学生身体姿态及心理危机研究：基于舞动治疗的干预	杜熙茹	广州体育学院
6	2023GXJK007	“三位一体”视角下的粤港澳大湾区动画应用型人才改革研究	黄爱民	广东技术师范大学
7	2023GXJK008	新文科应用型人才的数字素养与技能提升策略研究	杨时	广东第二师范学院
8	2023GXJK009	基于家庭教育期待的义务教育“破卷”政策路径优化研究	杨晓霞	广州大学
9	2023GXJK010	精神性视角下中国大学生职业决策自我效能感的促进机制研究	李盛楠	广州大学
10	2023GXJK011	影响家庭教育投入的心理机制研究：基于价值观的双视角实证分析	刘世雄	深圳大学
11	2023GXJK012	教育科技人才一体化推进的制度变迁阻力与实施路径研究	段从宇	深圳大学
12	2023GXJK013	高等教育赋能粤港澳大湾区高水平人才高地建设研究	李鹏虎	深圳大学
13	2023GXJK014	基于党的二十大精神指引下的红色音乐作品目录编纂及思政元素分析	杨晓琛	韶关学院
14	2023GXJK015	后疫情时期大学生心理健康素养与专业心理求助态度的关系研究	方必基	韶关学院
15	2023GXJK016	中国式现代化进程中教育、科技、人才一体推进的理论逻辑与实施路径	谢霄男	东莞理工学院
16	2023GXJK017	中学阶段的科学教育机会公平及其影响因素——基于大陆与港澳地区的比较研究	相楠	哈尔滨工业大学（深圳）
17	2023GXJK018	中国式现代化建设中传承中华文明的内涵与价值研究	林典	广东环境保护工程职业学院
18	2023GXJK019	总体国家安全观视域下大学生国家安全教育常态化长效化机制研究	王迪生	广东体育职业技术学院
19	2023GXJK020	新时代大思政视域下高职院校落实“育人的根本在于立德”教育理念的实践路径探索	陈银平	广州城市职业学院
20	2023GXJK021	党的二十大精神融入“匠心-匠技-匠魂”三课堂探索与实践	李继伟	广州城市职业学院
21	2023GXJK022	职业院校思想政治教育一体化建设机制研究	郭慕卿	河源职业技术学院
22	2023GXJK023	全面推进党的二十大精神要点高质量融入高职院校思想政治理论课方式研究	张书光	惠州工程职业学院
23	2023GXJK024	双高背景下专业群推动产教融合、科教融汇的实践路径探索	彭勇	东莞职业技术学院

234	2023GXJK235	基于中国式现代化的广东省高校实验教学体系改革与创新研究	李琰	暨南大学
235	2023GXJK236	人工智能背景下以计算思维为目标的大学计算机基础教学改革研究	何振宇	暨南大学
236	2023GXJK237	依托医学教学平台，整合虚拟仿真课程的实践应用研究	张明亚	暨南大学
237	2023GXJK238	基于VR沉浸式视角下的大湾区高校廉洁文化教育路径创新研究	李雷鸣	华南农业大学
238	2023GXJK239	教育生态视域下岭南群艺文化融入高校美育的实践路径研究	李春阳	华南农业大学
239	2023GXJK240	基于视听说多模态“英语口语语法学练共同体模式”建构研究	余乐斌	华南农业大学
240	2023GXJK241	高校数字素养教育助推湾区青年学生高质量充分就业研究	梁耀明	华南农业大学
241	2023GXJK242	“三全育人”视阈下艺术类专业大学生科创能力培养模式研究	石娟娟	华南农业大学
242	2023GXJK243	新文科背景下数智化会计人才培养研究	陈艳艳	华南农业大学
243	2023GXJK244	具身认知视域下武术文化创新视觉设计研究	罗哲辉	华南农业大学
244	2023GXJK245	高校思想政治教育与职业生涯教育有效契合研究	朱钧陶	华南农业大学
245	2023GXJK246	大学生数字创业意向影响因素和干预策略研究	徐峰	华南农业大学
246	2023GXJK247	高质量发展视域下产教融合效能影响因素及优化策略研究	李高扬	华南农业大学
247	2023GXJK248	粤港澳大湾区高校音乐类非遗文化的传承与协同创新发展研究	胡远慧	华南农业大学
248	2023GXJK249	体教融合促进大学体育高质量发展研究	周华锋	华南农业大学
249	2023GXJK250	高等教育数字赋能与共同富裕研究	李尚蒲	华南农业大学
250	2023GXJK251	面向乡村振兴的粤港澳农林院校卓越人才培养机制研究	彭思喜	华南农业大学
251	2023GXJK252	健康传播视角下高校医学生健康科普能力提升路径研究	昌敬惠	南方医科大学
252	2023GXJK253	粤港澳大湾区助产学本科专业知识图谱的构建	翟巾帼	南方医科大学
253	2023GXJK254	人工智能时代青年医学生意识形态风险生成、识别与管理研究	张露文	南方医科大学
254	2023GXJK255	健康中国背景下高校乳腺疾病科普教育的探索与实践	李文姬	南方医科大学
255	2023GXJK256	基于中西医协同视角的全科医学专硕创新培养模式研究	郁爽	南方医科大学
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项 目 名 称：高校数字素养教育助推湾区青年学生高质量充分就业研究

学 科 分 类：教育学-教育学

项目负责人：梁耀明

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项目信息	项目名称	高校数字素养教育助推湾区青年学生高质量充分就业研究		
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摘要	
	随着人工智能的迅猛发展，大量新兴工作岗位涌现，同时也提出了对传统工作内容较高的数字素养要求。在实现高质量充分就业的过程中，适应未来工作需要的能力发展是至关重要的。然而，当前高校数字素养教育存在明显欠缺。本研究采用选择实验和真实实验相结合的实证研究方法，旨在探索高校数字素养教育对湾区青年学生就业的助推作用及其影响机制。通过劳动力市场对青年学生数字素养的需求分析、数字素养与劳动力市场需求匹配度分析以及数字素养教育对高质量充分就业水平的影响分析，从课程设置和教学内容、教学方法和资源投入、评价体系和认证机制等方面探索高校数字素养教育的优化路径。本研究将深入揭示数字素养教育对青年学生高质量充分就业的影响机制，为培养适应人工智能时代要求的“一流”人才相关政策的制定提供新的思路和启示。因此，本研究的重要性在于为数字素养教育的优化提供了理论和实践基础，为高校数字素养教育的改革和发展提供参考。

关键字	数字素养，高质量充分就业，湾区青年学生

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Article

Glimpsing the Future of Animal Welfare through a Bottle of Milk: Insights from Chinese University Students

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Abstract: The consumption patterns of university students hold the power to significantly influence market trends. This study illuminates the escalating emphasis on animal welfare in these students' purchasing choices, specifically concerning milk products. Utilizing a discrete choice experiment, we identified a pronounced preference among students for milk products with animal welfare certifications. Students were segmented into three categories based on their motivations: "Quality–Oriented" (20.55%), "Emotionally Intuitive" (30.67%), and "Quality–Emotion Balanced" (48.77%). The "Emotionally Intuitive" group manifested the most robust inclination toward such certifications. Based on these findings, we recommend tailored market strategies targeting these distinct segments. Moreover, our findings emphasize the importance of intensifying animal welfare education, shaping a market aligned with animal welfare principles, and fostering a broader societal environment attuned to animal welfare.

Keywords: animal welfare; consumption preferences; university students; milk; discrete choice experiment

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1. Introduction

In the current global context, animal welfare is more than just an ethical concern; it has become a symbol of societal progress and cultural evolution [1,2]. Ensuring better living standards for animals is linked not only to their rights but also to environmental conservation, human health, and food security. Global trends in food choices reflect the increasing awareness regarding the sources of our food and the ethics behind its production. The dairy industry, in particular, has been under the lens, with consumers globally showing heightened interest in the welfare of dairy animals. Factors such as the humane treatment of animals, the environmental impact of dairy farming, and health implications have taken center stage in influencing consumer choices [3]. In response to significant global socioeconomic changes, many countries are increasingly recognizing the importance of animal welfare [4]. China, undergoing significant sociocultural and economic changes, is emphasizing its dedication to this issue. This growing awareness is evident in consumer behavior, especially among younger generations, with an increased preference for products that focus on animal welfare [5].

In China, factors like rapid urbanization, increased globalization, and a growing emphasis on health and the environment have changed consumer behaviors. Chinese consumers, particularly of the younger generation, increasingly want to know the origins of their food and the ethics of its production. For dairy products such as milk, brand reputation regarding animal welfare, perceived health advantages, and product authenticity are major determinants in their purchasing decisions [6]. Recent research in animal welfare

has focused on products associated with animal welfare [7–9]. Studies have shown a clear preference among consumers for products labeled as animal-friendly [10–12]. In the context of dairy, decisions often hinge on the perceived integrity of the product, with animal welfare being a significant consideration [3].

It is worth noting that in China, milk is not just viewed as a drink but often considered a symbol of nutrition and health, especially for the younger generation. This sentiment magnifies the importance of animal welfare in dairy purchases. If consumers believe that the animals were treated well, they implicitly trust the quality and health benefits of the derived milk [13]. However, there remains a gap in understanding the consumption patterns of Chinese university students. These students, as representatives of the younger generation and its mindset, are likely to become key supporters and promoters of animal welfare [14,15]. Investigating their awareness, inclinations, and consumption patterns can provide valuable insights into regional tendencies and potential shifts in animal welfare perceptions.

Milk, a staple in many university students' diets, is directly linked to the welfare of dairy cattle. With numerous dairy brands in the market, students' choices often reflect their awareness and concern for animal welfare. Given the role of university students as a reflection of societal values and their position as future primary consumers [15], it is crucial to understand their preferences regarding dairy products. Hence, our study primarily focuses on understanding the consumption behaviors and attitudes of Chinese university students toward milk products endorsed for animal welfare. By doing this, we intend to identify the primary drivers behind their purchasing decisions and understand the potential implications for the livestock industry at large.

In light of this, the following hypotheses are proposed in our study:

(1) Chinese university students have a distinct preference for milk products emphasizing animal welfare;
(2) Factors such as the product's perceived integrity, brand reputation, and associated health benefits significantly influence their purchasing decisions.

We will explore these consumption preferences in depth through choice experiments. Our goal is to uncover the underlying factors influencing this group's buying behaviors, thereby providing a detailed analysis of their purchase patterns. These insights can be invaluable for the livestock industry, offering crucial market data to inform future strategies and initiatives.

Our research provides key contributions to the academic field. By examining the specific demographic of university students, we present a detailed consumer profile to both livestock and marketing sectors. This thorough study offers strategic insights, helping to optimize product positioning and clarify brand narratives. More than merely recording consumer trends, our research delves into the underlying psychological drivers of these preferences, offering marketers a richer, more informed viewpoint. This insight is valuable in addressing consumer demands more effectively. While our study primarily focuses on the Chinese context, particularly the Guangdong Province, the shifts in China's stance on animal welfare likely resonate in other emerging markets. Such countries can gain insights from China's path, adapting strategies that align with their unique cultural and market scenarios, thus furthering the global commitment to animal welfare.

2. Materials and Methods

2.1. Discrete Choice Experiment Design

The discrete choice experiment (DCE) provides a methodological framework to evaluate consumers' preferences and determine their willingness to pay [16]. In the domain of milk consumption, several factors influence consumer decisions, including conventional quality criteria like color, aroma, protein content, nutritional profile, safety, appearance, and convenience [17,18]. Additionally, aspects of ecological ethics, notably animal welfare and environmental conservation, also play a role [19,20]. Within a DCE, participants make choices from a set of product or service options, distinguished by various attributes and their levels [13,21]. These choices allow researchers to ascertain the relative importance of

specific attributes and levels. The introduction of a monetary attribute facilitates quantification of the willingness to pay for different options [10]. For this investigation, the DCE approach is utilized to explore Chinese university students' preferences for milk products with an emphasis on animal welfare.

The selection of attributes and their corresponding levels is a crucial step in the design of any discrete choice experiment. These choices should be both theoretically meaningful and relevant to the context of the study. Our process in determining these attributes spanned two primary phases:

Phase 1. Our initial step was to survey various bottled milk brands available at campus supermarkets. Through a careful examination of the packaging, we cataloged a range of attributes, such as price, brand, shelf life, production date, nutrient content (emphasizing levels of protein, calcium, and fat), milk source, preservation method, packaging design, sterilization method, and other specific certifications or labels that were prominently displayed.

Phase 2. Seeking empirical validation of our observations, we undertook a preliminary survey with 41 participants to ascertain the primary attributes they consider while purchasing milk. The results affirmed our observations from Phase 1 in addition to providing a quantifiable measure of their significance. Here are the salient findings: price (63.41%), brand (60.98%), freshness, encapsulated by both shelf life (60.98%) and production date (58.54%), nutrient content with specifics on protein (48.78%), calcium (41.46%), and fat (31.71%), milk source (29.27%), preservation method (29.27%), packaging (24.39%), sterilization method (14.63%), and others (0%).

After these primary phases, we prioritized our attributes for the study. We retained the top four attributes based on their salience from our survey results and introduced an additional "certification or label" category. Notably, while our market survey revealed a scarcity of milk products with specific animal welfare labeling, the importance of this criterion in our research necessitated its inclusion. Thus, animal welfare was incorporated as a distinct certification attribute. Concurrently, in recognizing the well-established significance of organic certifications in milk consumption and their widespread acknowledgment in the market, we also integrated "organic certification". This approach allowed us to compare the significance of animal welfare alongside the prevailing organic certification, ensuring a comprehensive representation of market certifications.

The selection of attributes and their corresponding levels is instrumental in generating meaningful insights from a DCE. Based on the specifics of milk consumption and the prevailing market dynamics, we outline the rationale for our attribute choices, subsequently providing an explanation for the designated levels.

Brand: In the dairy sector, brand name acts as a proxy for a slew of factors, from perceived quality and taste to overall trustworthiness. With the current market composed of both local and foreign players, it is pivotal to distinguish between "Domestic" and "International" brands. This not only reflects consumers' potential biases toward familiar local brands versus the perceived premium nature of international ones, but also gauges brand loyalty in the face of growing international market penetration.

Label: As consumer conscience veers toward ethical and environmentally responsible choices, labels gain prominence [22]. They not only ensure consumer confidence in product quality and safety but also represent specific ethical standards. The absence or presence of an "Organic" label sheds light on eco-friendly agricultural practices and consumer concern for environmental sustainability. The "Animal Welfare" label, while less commonplace, carries a significant ethical weight. It emphasizes the humane treatment of dairy livestock and showcases a consumer's active support for animal rights. The inclusion of the "No label" category aids in gauging baseline preferences, effectively capturing the weightage consumers assign to these ethical considerations.

Protein Content: A primary motive behind milk consumption is its nutritive value. Protein stands out as a vital metric. Differentiating between protein contents—3.2, 3.6, and

4.0 g per 100 mL—acknowledges the array of choices that the market presents, tapping into health-driven consumer segments that prioritize protein intake.

Shelf Life: The dairy industry, where product freshness can dictate consumption choices, renders shelf life a crucial attribute. Our levels of 1, 3, and 5 months span the continuum of available products, ranging from those demanding imminent consumption to ones assuring extended freshness. This differentiation caters to varying consumer demands, from those prioritizing freshness to those valuing convenience [23].

Price: The price of milk is a composite reflection of factors such as brand, production methods, and perceived quality. By demarcating four distinct price points (CNY 2.8, 4.8, 6.8, and 8.8), we encapsulate the prevalent market pricing spectrum. This gradation permits an exploration of consumer price sensitivity, especially when juxtaposed against other attributes. To determine these price points, we referenced the average prices for 250 mL of pure milk on the major Chinese e-commerce platforms, Taobao and Jingdong. Furthermore, our choice of price points was deliberately influenced by cultural and psychological pricing strategies; the number "8" is considered auspicious in Chinese culture, symbolizing wealth due to its pronunciation akin to "fa", and a price of CNY 8.8, while nearly identical to CNY 9.0, is perceived as significantly more appealing due to this cultural context and the psychological impression of receiving a better deal [24].

Table 1 lists the milk attributes and their levels considered in our study. From these, 216 product or service options can be generated, leading to 23,220 possible combinations. To manage the experiment and avoid potential interactions between factors, we used the Ngene1.2.1 software and the D-optimal fractional factorial design, selecting 36 combinations to assess the importance of animal welfare attributes in milk to university students. To reduce choice overload, we divided these combinations into six groups, each with six choice tasks.

Table 1. Attributes and their levels for the choice experiment.

Attributes	Description	Levels
Brand	Includes domestic and international brands	Domestic, International
Label	Indicates whether the milk meets animal welfare or organic certification standards	No label, Organic, Animal welfare
Protein	Protein content per 100 mL of milk (g)	3.2, 3.6, 4.0
Shelf Life	Shelf life of packaged food under specified storage conditions (months)	1, 3, 5
Price	Price per 250 mL milk bottle (CNY/bottle)	2.8, 4.8, 6.8, 8.8

Figure 1 provides a sample of the choice sets used in the study. To enhance the realism of the experiment, each set includes two hypothetical alternatives and a "no purchase" option. Participants are given different choice scenarios based on their birth month. For example, those born in January or July are presented with the first set of choice tasks. To minimize potential hypothetical bias, participants are introduced to a "cheap-talk" script before the experiment begins, a method known to reduce biases according to Cummings and Taylor (1999) [25].

Attributes		
Brand	International	Domestic
Label	Animal welfare	No label
Protein	3.2 g/100 mL	3.6 g/100 mL
Shelf Life	One month	Trimester
Price	8.8 CNY/bottle	2.8 CNY/bottle
I will buy:		
A. Milk A	B. Milk B	C. Neither of these milks

Figure 1. Representative choice set.

2.2. Survey Design

Guangdong, with its intertwining of animal welfare concerns and local developmental intricacies shaped by unique cultural influences, emerged as our chosen research setting. As an early frontrunner in China's economic globalization, Guangdong's extensive exposure to international cultures and rapid alignment with global standards makes it an intriguing region for exploring evolving concepts like animal welfare.

Its significant GDP of CNY 12.91 trillion in 2022 (approximately USD 1.89 trillion at year-end exchange rates) reflects not only economic strength but also changing consumer preferences. Economic growth often corresponds to an increase in health-conscious lifestyles and a heightened awareness of areas like animal welfare and environmental conservation. Guangdong's diverse cultural spectrum, from its Cantonese culinary traditions to regional identities such as Guangfu, Chaoshan, and Hakka, creates a complex but cohesive context. This setting offers valuable insights into regional influences on animal welfare perceptions.

We employed "Wenjuanxing", a leading survey platform in China, and primarily targeted undergraduate and graduate students in Guangdong. Our survey covered multiple dimensions, including respondent demographics, household dynamics, prevalent milk consumption patterns, and a detailed DCE focusing on the monetary valuation of animal welfare in relation to milk quality attributes.

Before the large-scale distribution of our survey, we initiated an exhaustive evaluation process. Our research team conducted the initial review, assessing the survey's integrity and relevance. We then sought external feedback from a diverse panel of domain experts, including professionals in statistics and econometrics, scholars in consumer behavior, and experts in animal welfare. Their diverse expertise was crucial in refining our instrument. In addition to the academic and professional experts, feedback from undergraduate and postgraduate students ensured that our questions resonated well with the target demographic. Their suggestions primarily revolved around refining the phrasing of questions, ensuring the comprehensive coverage of pertinent information, and optimizing the sequence of the questionnaire sections. Following these meticulous stages of validation, the survey was disseminated in March 2023.

To ensure robust statistical insights and to meet the strict requirements of the DCE, we followed established guidelines related to choice experiment designs in our sample size calculation [26,27]. We divided the 36 choice sets into six clusters, necessitating a minimum of 167 respondents. By the end of our data collection phase in August 2023, we had

1036 responses. Following a detailed data curation process, 978 valid responses remained, leading to a total of 5868 fully realized choice experiments. All statistical analysis was carried out using Stata 17.0 (Stata Corp., College Station, TX, USA, 2021) [28] and R 4.1.2 (R Core Team, Vienna, Austria, 2021) [29]. For a detailed breakdown of the demographic characteristics of our respondents, please refer to Section 2.4.1 and Table 2.

Table 2. Detailed demographic and consumption characteristics of respondents.

Characteristics	Value	Characteristics	Value
Gender (%)		Milk Purchasing Channel (%)	
Male	41.00	Online	58.69
Female	59.00	Offline	41.31
Age		Years of Milk Consumption (%)	
Mean (S.D.)	20.82 (2.15)	≤1	7.98
Education Level (%)		1–3	11.35
Undergraduate	85.17	4–6	17.79
Graduate	14.83	7–10	13.70
Place of Residence (%)		≥11	49.18
Urban	85.79	BMI (kg/m^2)(%)	
Rural	14.21	≤18.50	17.79
Monthly Living Expense		18.50–23.99	65.03
Mean (S.D.)	1732.34 (693.86)	≥24.00	17.18

Note: The provided BMI classification adheres to the guidelines set forth by the National Health Commission of the People's Republic of China. The delineation criteria are as follows: underweight for a BMI of less than 18.5 kg/m^2, normal weight ranges between 18.5 and 23.9 kg/m^2, overweight lies between 24.0 and 27.9 kg/m^2, and obesity is categorized as a BMI of 28 kg/m^2 or above.

2.3. Statistical Analysis

To explore the preferences of college students for milk labeled with animal welfare certifications, we employed a DCE. The design of this DCE is grounded in the principle that when consumers select from multiple alternatives, their choices reflect their intrinsic valuations of the different attributes of the products.

Central to the discussion on consumer choices is the concept of utility. In the random utility model, utility is conceptualized as consisting of a deterministic component (which depends on the attributes of the option) and a random component. Specifically, the utility for individual n in context t for choosing option I from choice set C can be represented as

$$U = V_{nit} + \varepsilon_{nit} \tag{1}$$

In this framework, if $U_{nit} > U_{njt}$ for all j not equal to I, individual n would opt for choice i. Building on this, the probability of individual n choosing option I is

$$P_{nit} = Prob(V_{nit} + \varepsilon_{nit} > V_{njt} + \varepsilon_{njt}) \tag{2}$$

for all j in C and j not equal to i.

For the traditional Logit model, homogeneity in consumer preferences is typically assumed. However, it is well understood that consumer preferences are heterogeneous in practice. To capture this heterogeneity, we adopted the Mixed Logit model, which permits in-sample variation in preferences. In the model, the deterministic part of the utility can be described as

$$V_{nit} = \beta' \chi_{nit} \tag{3}$$

where β is a vector of random parameters representing consumer preferences and χ_{nit} is a vector of all attributes in choice i. According to Train and Sonnier (2003) [30], the probability that individual n in scenario t selects option I from choice set C is given as

$$P_{nit} = \int \frac{exp(V_{nit})}{\sum_j exp(V_{njt})} f(\beta) d\beta \tag{4}$$

where $f(.)$ denotes the distribution of the random parameters. If a parameter is fixed at β_c (i.e., non-random), its distribution collapses, meaning $f(\beta_c)$ approaches infinity, while $f(\beta)$ equals zero elsewhere.

To articulate and quantify the value assessments by consumers, we turn to the concept of willingness to pay (*WTP*). Based on the model estimates, the *WTP* for a particular attribute can be defined as

$$WTP = -\beta_k / \beta_p \quad (5)$$

where β_k is the estimated coefficient for the k^{th} attribute, and β_p is the estimated price coefficient. Given the ordinal nature of this utility, we further employed a parametric bootstrap method to generate 95% confidence intervals for the *WTP* valuations.

In summary, the combined use of choice experiments and the Mixed Logit model provides us with a robust tool to delve into the intrinsic valuations by college students for milk labeled with animal welfare certifications, offering valuable insights for market strategies and food policies.

2.4. Sample Description

2.4.1. Demographic Characteristics

Our sample's core characteristics and consumption behaviors are detailed in Table 2. The surveyed individuals' average age was 20.82 years, and females were predominant at 59.00%. A significant portion (85.79%) hailed from urban zones in contrast to the 14.21% who were from rural backgrounds. Examining academic qualifications, those pursuing undergraduate and associate degrees made up 85.17%, leaving postgraduates at 14.83%. On average, the monthly expenditures among the respondents amounted to CNY 1732.34.

The ways in which milk was procured underscores the digital shift and need for convenience among university goers: 58.69% leaned toward online buying. Significantly, nearly half (49.18%) of the participants have been consistent milk consumers for more than 11 years, reinforcing the beverage's continued role in their diets. A glance at the BMI statistics indicates that 65.03% of our sample are within the normal weight range. Those falling into the underweight bracket represent 17.79%, closely followed by the overweight or obese category at 17.18%.

2.4.2. Perceptions of Animal Welfare

In the current investigation, we delved into university students' perceptions of animal welfare. This was carried out across four distinct dimensions, namely the juxtaposition of life versus welfare, prioritizing human welfare over animal welfare, the economic implications of welfare-focused farming, and discerning between genuine welfare concerns and business objectives. The selection of these particular dimensions was motivated by the ongoing debates and misconceptions surrounding the realm of animal welfare in today's society.

Participants expressed their views on each dimension using a 5-point Likert scale. A score of "1" corresponds to "strongly disagree" while "5" resonates with "strongly agree". The outcomes, as presented in Table 3, reveal satisfactory reliability for each dimension, with Cronbach's alpha values consistently exceeding 0.75. An overall reliability score of 0.85 was achieved, which signals a high degree of reliability in the measurements. When viewed holistically, the sampled university students exhibit a generally affirmative stance toward animal welfare. The majority took issue with the statement that farm animals' welfare is inconsequential given their eventual fate of being consumed, implying a recognition of the importance of ensuring animal well-being irrespective of their ultimate purpose. An additional insight derived from Table 3 is the students' perspective on the financial implications of welfare-centric farming. While there was acknowledgment of its associated costs, the majority did not see this as a significant barrier to embracing the concept of animal welfare. Moreover, the relatively lower mean values for some statements suggest a prevalent sentiment among students that genuine reasons drive welfare farming practices beyond sheer commercial or novelty motives.

Table 3. Students' perceptions of animal welfare.

Item (Statement)	Mean	Standard Deviation	Reliability	Overall Reliability
Since farm animals will ultimately be slaughtered for consumption, their welfare does not matter.	2.374	0.965	0.812	
Human welfare has yet to be met, and it is not time to consider animal welfare.	2.634	1.089	0.785	0.850
The cost of welfare-oriented farming is too high and not suitable for our country's reality.	2.876	0.979	0.790	
Some welfare farming practices are merely due to farmers' curiosity and novelty, or for commercial selling points.	2.808	1.042	0.846	

2.4.3. Factors Influencing the Perception of Animal Welfare Milk

Building upon the foundational work of Wang and Gu (2014) [31], in our study, we meticulously examine university students' cognitive attitudes toward animal welfare milk. This exploration is bolstered by highlighting two interlinked dimensions: product quality and emotional resonance. Specifically, we sought to understand how students discern tangible attributes like taste, safety, and health benefits (product quality) in juxtaposition with intangible values, such as emotional well-being and ethical considerations (emotional resonance) when they consume animal welfare milk.

To enrich this understanding, an evaluative framework, inspired by Liang et al., (2022) [1], was employed. Notwithstanding their primary focus on meat products, we identified an alignment in attributes relevant to our study. Using a 5-point Likert scale, we solicited participants' sentiments and beliefs. As illustrated in Table 4, it is conspicuous that the ethical treatment of farm animals stands out as a prime consideration, with a mean score of 3.454. Additionally, the attribute linked to health also gains substantial attention, surpassing a mean score of 3.367. An overarching reliability score of 0.909 adds credence to the validity of our data.

Table 4. Cognition of farm animal welfare milk.

Item (Statement)	Mean	Standard Deviation	Reliability	Overall Reliability
The taste of animal welfare milk is better.	3.247	0.686	0.897	
Animal welfare milk is safer.	3.365	0.746	0.875	
Animal welfare milk is healthier.	3.396	0.769	0.874	0.909
Drinking animal welfare milk makes me feel better.	3.374	0.825	0.887	
Purchasing animal welfare milk expresses my concern for farm animals.	3.454	0.848	0.907	

Advancing from individual attributes to holistic orientations, the factors affecting the perception of animal welfare milk can be synthesized into two dominant sub-dimensions:

(1) Product Quality Orientation. This dimension encapsulates perceptions related to the taste, safety, and health benefits of animal welfare milk.
(2) Emotional Resonance. This primarily focuses on the intangible rewards that students experience when consuming animal welfare milk, coupled with their empathetic stance toward the well-being of farm animals.

Students' alignment with these dimensions was gauged using the mean scores from the product quality (comprising 3 items) and emotional resonance (comprising 2 items) sections. Respondents exhibiting a stronger affinity toward product quality were earmarked as "Quality–Oriented", while those leaning toward emotional considerations were dubbed "Emotionally Intuitive". Those straddling both dimensions equally were cataloged under the "Quality–Emotion Balanced" group.

As delineated in Figure 2, a significant cohort, nearly 48.77%, regarded both dimensions—quality and emotion—with equal emphasis. This cohort was followed by

the "Emotionally Intuitive" cluster (30.67%) and then the "Quality–Oriented" contingent (20.55%) (percentages may not sum to 100% due to rounding). This stratification suggests that university students navigate a delicate interplay between tangible product quality and intangible emotional considerations, albeit with a minor skew toward the latter.

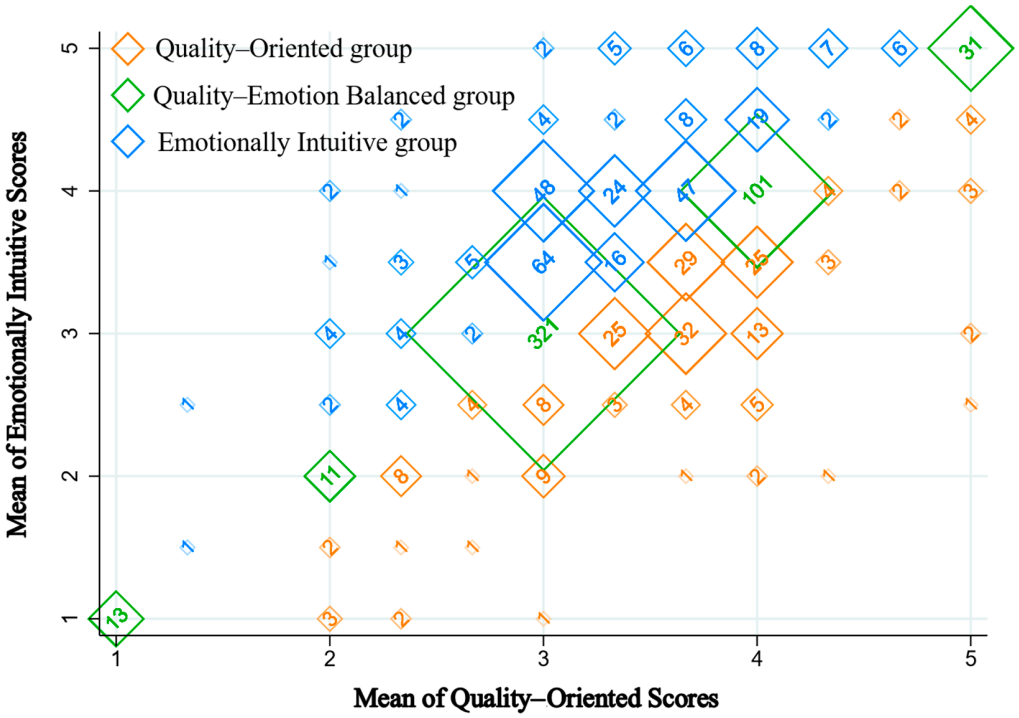


Figure 2. Students' preferences: quality vs. emotional considerations. The numerical values indicate the total number of university students within each category.

3. Empirical Results and Econometric Analysis

3.1. Preferences of University Students toward Animal Welfare Milk

Table 5 delineates the outcomes of the Mixed Logit regression, shedding light on Chinese university students' inclinations and preferences for specific attributes of animal welfare milk. At a holistic level, students manifest discernible preferences across factors such as brand affiliation, labeling, protein concentration, and product longevity. Notably, the "Organic" attribute emerges as the preeminent driver of value perception, exhibiting a coefficient (β) of 1.377. This is closely trailed by the "animal welfare" attribute, with a coefficient of 1.237. In stark contrast, attributes like protein content (β = 0.466) and shelf life (β = 0.024) seem to hold relatively subdued importance. Intriguingly, the "import" attribute did not achieve statistical significance, alluding to the inference that the origin—whether domestic or international—does not substantially sway students' predilections when navigating choices in the realm of animal welfare milk.

Further diving into the variance associated with each attribute, we find that, with the exception of "import" and "shelf life", attributes such as "organic", "animal welfare", and "protein content" are significant at the 1% level, reinforcing the validity of employing the Mixed Logit framework for this investigation. Furthermore, the trans-disciplinary perspective reveals a remarkable uniformity in the preferences of students hailing from diverse academic backgrounds like agriculture, science, engineering, and the humanities. This homogeneity suggests a unified stance and understanding among students when it comes to the ascribed value of the animal welfare attributes of milk.

Table 5. Regression results for preferences toward animal welfare milk.

Attributes	Full Sample	Agriculture	Science	Engineering	Humanities
Mean					
Price	−0.344 ***	−0.349 ***	−0.311 ***	−0.314 ***	−0.406 ***
	(0.013)	(0.028)	(0.027)	(0.025)	(0.030)
Import	−0.060	0.052	−0.117	0.001	−0.136
(Baseline: Domestic)	(0.044)	(0.084)	(0.088)	(0.091)	(0.094)
Organic	1.377 ***	1.277 ***	1.377 ***	1.298 ***	1.533 ***
(Baseline: No Label)	(0.062)	(0.131)	(0.126)	(0.120)	(0.139)
Animal Welfare	1.237 ***	1.185 ***	1.228 ***	1.059 ***	1.455 ***
(Baseline: No Label)	(0.061)	(0.129)	(0.124)	(0.112)	(0.138)
Protein	0.466 ***	0.385 **	0.381 ***	0.599 ***	0.262 *
	(0.072)	(0.153)	(0.145)	(0.143)	(0.156)
Shelf Life	0.024 *	0.013	0.008	0.029	0.044
	(0.013)	(0.027)	(0.027)	(0.025)	(0.029)
No Purchase	−1.963 ***	−2.471 ***	−1.672 ***	−1.415 **	−2.713 ***
	(0.291)	(0.625)	(0.568)	(0.562)	(0.633)
Standard Deviation					
Import	0.687 ***	−0.418 **	0.601 ***	0.863 ***	0.626 ***
(Baseline: Domestic)	(0.064)	(0.177)	(0.148)	(0.128)	(0.139)
Organic	0.705 ***	0.669 ***	0.738 ***	0.761 ***	0.677 ***
(Baseline: No Label)	(0.087)	(0.197)	(0.174)	(0.164)	(0.183)
Animal Welfare	0.536 ***	0.525 *	0.457 *	0.518 **	0.550 ***
(Baseline: No Label)	(0.106)	(0.302)	(0.262)	(0.219)	(0.212)
Protein	0.521 ***	0.751 ***	0.517 ***	0.605 ***	0.458 ***
	(0.040)	(0.086)	(0.069)	(0.092)	(0.117)
Shelf Life	−0.007	0.039	0.054	−0.005	0.101 *
	(0.027)	(0.044)	(0.050)	(0.051)	(0.054)
No Purchase	−1.438 ***	0.485	0.328	0.328	−1.058 *
	(0.172)	(0.527)	(0.343)	(0.811)	(0.552)
Model Fit					
LR chi2	792.23	240.74	142.83	234.47	104.55
Log likelihood	−4452.3548	−955.8887	−1062.6250	−1226.6594	−942.8218
AIC	8930.710	1937.777	2151.250	2479.319	1911.644
BIC	9031.796	2019.110	2233.118	2563.577	1993.037
Observations	17,604	3852	4014	4824	3870

Note: Levels of significance have been demarcated as ***, **, and * to represent the 1%, 5%, and 10% thresholds, respectively. Values in parentheses are standard errors.

3.2. Segmented Analysis of Consumer Motivations behind Animal Welfare Preferences

This study delves into the purchasing patterns of university students when selecting milk products endorsed with animal welfare labels. We concentrate on three distinct cognitive consumer drivers, namely "Quality–Oriented", "Emotionally Intuitive", and "Quality–Emotion Balanced". Our goal is to unravel the key influences shaping their preferences.

According to the regression results shown in Table 6, each consumer category demonstrates a significant predilection for the animal welfare attribute, though to varying degrees. The "Emotionally Intuitive" group exhibits the most pronounced preference for animal welfare (β = 1.646). This underscores a heightened ethical awareness regarding animal treatment within this cohort. Their behavior indicates a profound alignment of animal welfare-labeled milk products with their core emotional values. On the other hand, the "Quality–Oriented" group, while valuing animal welfare, assigns supreme significance to the protein content (β = 0.580), reflecting their intrinsic emphasis on the nutritional and health characteristics of the product. The "Quality–Emotion Balanced" group represents an equilibrium between the other two groups, appreciating both quality and ethical dimensions. Their purchasing behavior embodies a balanced interplay of rationality and emotion. Notably, a universal endorsement of the organic certification is evident across all consumer categories. This suggests a potential perception among students of a linkage between

organic standards and ethical production—a dimension meriting further exploration in subsequent research endeavors.

Table 6. Segmented analysis of preferences for animal welfare milk.

Attributes	Quality–Oriented	Quality–Emotion Balanced	Emotionally Intuitive
Mean			
Price	−0.347 ***	−0.315 ***	−0.414 ***
	(0.027)	(0.019)	(0.027)
Import (Baseline: Domestic)	−0.087	−0.043	−0.029
	(0.091)	(0.065)	(0.083)
Organic (Baseline: No Label)	1.484 ***	1.268 ***	1.607 ***
	(0.138)	(0.093)	(0.113)
Animal Welfare	1.283 ***	1.021 ***	1.646 ***
(Baseline: No Label)	(0.128)	(0.088)	(0.122)
Protein	0.580 ***	0.483 ***	0.355 ***
	(0.153)	(0.108)	(0.128)
Shelf Life	0.028	0.018	0.037
	(0.029)	(0.019)	(0.024)
No Purchase	−1.294 **	−2.237 ***	−1.966 ***
	(0.631)	(0.436)	(0.519)
Standard Deviation			
Import (Baseline: Domestic)	0.511 ***	0.757 ***	0.815 ***
	(0.145)	(0.095)	(0.117)
Organic (Baseline: No Label)	0.766 ***	0.870 ***	−0.365 *
	(0.176)	(0.130)	(0.188)
Animal Welfare	0.089	0.705 ***	0.645 ***
(Baseline: No Label)	(0.309)	(0.141)	(0.176)
Protein	0.346 ***	0.756 ***	0.089
	(0.118)	(0.060)	(0.094)
Shelf Life	0.007	0.004	0.023
	(0.097)	(0.037)	(0.042)
No Purchase	1.622 ***	0.361	−1.629 ***
	(0.396)	(0.287)	(0.214)
Model Fit			
LR chi2	151.15	545.07	129.25
Log likelihood	−917.788	−2171.489	−1323.818
AIC	1861.576	4368.978	2673.636
BIC	1942.094	4460.730	2759.360
Observations	3618	8586	5400

Note: Levels of significance have been demarcated as ***, **, and * to represent the 1%, 5%, and 10% thresholds, respectively. Values in parentheses are standard errors.

In summation, the motivations underpinning university students' inclination for animal welfare-labeled milk products are multifarious. For marketers, it is imperative to comprehend these subtle inclinations. Crafting marketing strategies that mirror these specific motivations will pave the way for more impactful and resonant campaigns tailored to the university student demographic.

3.3. Differential Willingness to Pay for Animal Welfare Milk Based on Consumer Motivations

To better understand the willingness-to-pay (WTP) dynamics for animal welfare-labeled milk among university students of different motivational categories, we evaluated the price premium they associated with such labeled products. Figure 3 reveals that the student cohort under investigation was willing, on average, to pay an extra CNY 3.40 for milk branded with an animal welfare label, though significant variations were evident among the three consumer motivation categories.

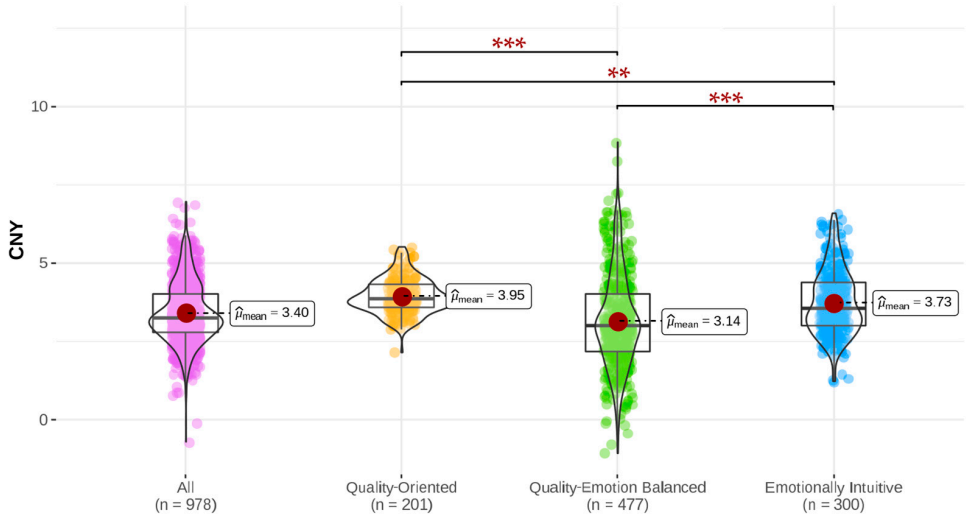


Figure 3. Differential willingness to pay based on consumer motivations. The symbols *** and ** denote significant discrepancies at the 0.1% and 1% confidence intervals, respectively.

Students with a quality-driven focus recorded the highest WTP, willing to part with an additional CNY 3.95. The narrowness of their standard deviation underscores a consistent belief in the intimate relationship between the quality of milk and the well-being of the animals. This pattern indicates that when consumers discern a tangible link between product excellence and humane animal treatment, their readiness to bear a higher cost strengthens.

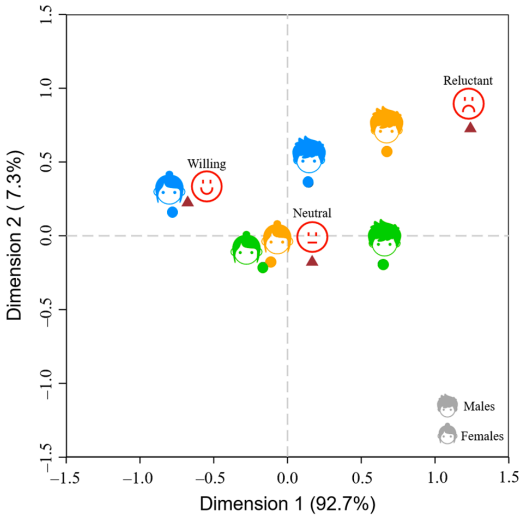
Those driven by emotional intuition presented a WTP premium of CNY 3.73, mirroring their ethos of ethically conscious consumption. These students, guided primarily by ethical values and emotional resonance, perceive animal welfare not merely as an added feature but as an intrinsic value. They firmly believe that purchasing such products is a direct reflection of their moral compass.

Interestingly, students who place an equivalent emphasis on both quality and emotion displayed the lowest WTP, with a figure of CNY 3.14, along with a broader standard deviation. This WTP does not neatly fit between the quality-centric and emotion-driven cohorts. One compelling explanation is their diminished price sensitivity ($\beta = -0.315$) relative to their counterparts. Such students are possibly influenced by a broader array of factors in their purchasing decisions, encompassing aspects like brand reputation and promotional tactics. These additional considerations may dilute their enthusiasm for directly supporting animal welfare when juxtaposed against the other two groups.

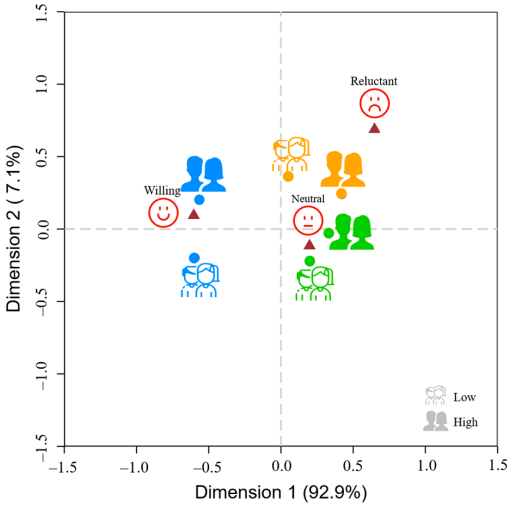
Advanced statistical scrutiny validated significant disparities in the premium WTP for animal welfare-labeled milk across the three student groups, with these differences being statistically significant at the 1% level. This revelation bears significant implications for market strategists seeking to finely calibrate their outreach to university students, tailored to their unique consumption propensities.

3.4. Sociodemographic Determinants of Purchase Intentions for Animal Welfare Milk

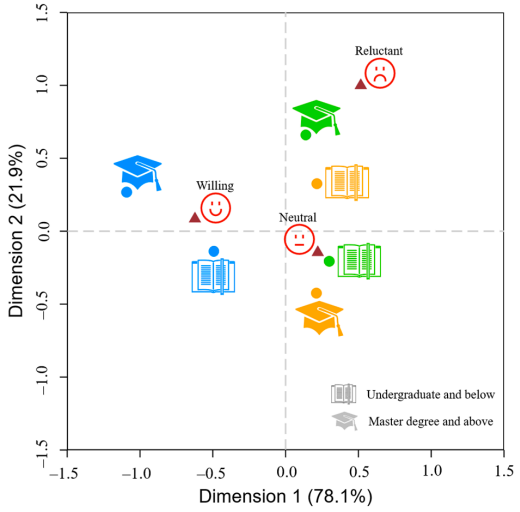
We used the correspondence analysis method to identify demographic variations in purchasing inclinations for animal welfare-certified milk and to pinpoint the ideal consumer segment. We assessed purchase intentions by posing the question, "Would you be inclined to purchase milk bearing an animal welfare certification if it were available?" Responses were gauged on a 5-point Likert scale, with "1" representing "Definitely not" and "5" signifying "Definitely yes". We stratified purchase intentions into three distinct tiers: "Reluctant to Buy" (scores 1–2), "Neutral" (score 3), and "Willing to Buy " (scores 4–5). Data considered for visualization in Figure 4 met the criteria of independence at the 1% significance level. Importantly, closer point distances indicate a stronger association, reflecting characteristic agreement.



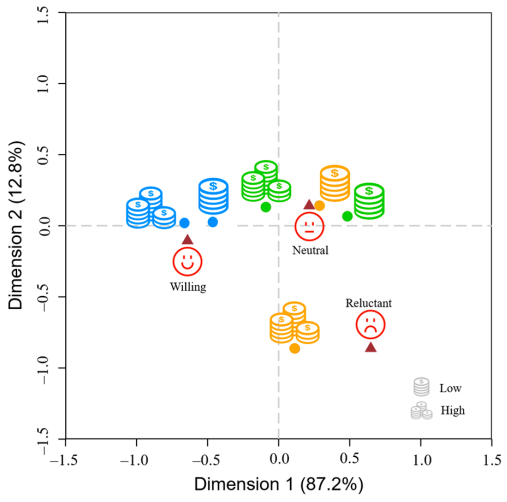
(**a**) Gender



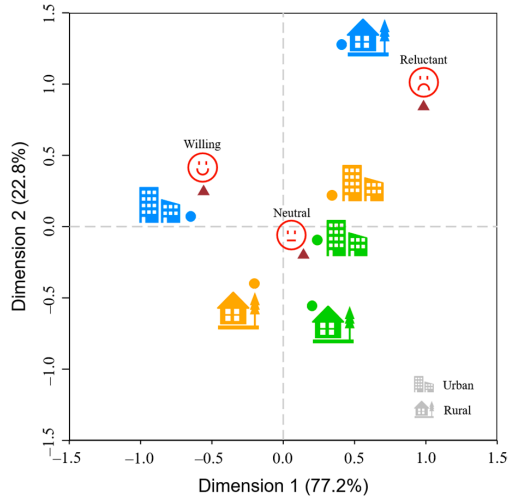
(**b**) Age



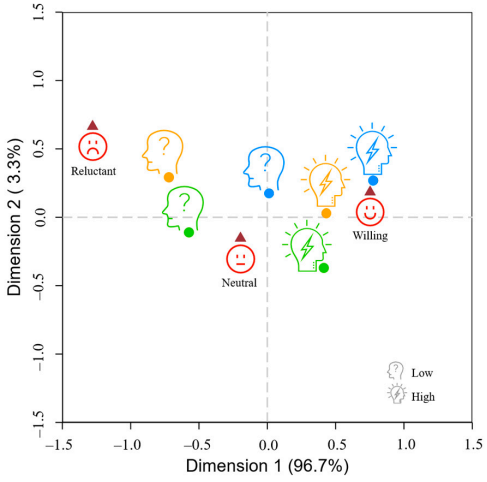
(**c**) Education



(**d**) Monthly Living Expenses



(**e**) Place of Residence



(**f**) Animal Welfare Perception

Figure 4. Interplay between sociodemographic traits and purchase intentions for animal welfare milk; ● symbolizes the Quality–Oriented group, ● denotes the Quality–Emotion Balanced group, and ● indicates the Emotionally Intuitive group.

From the data, university students demonstrating a heightened purchase intent are predominantly female, older in age, hold an undergraduate degree or lower, have a superior monthly expenditure, are long-term urban dwellers, and exhibit robust animal welfare cognizance. Probing further, the "Willing to Buy" cohort can be more narrowly defined, whereas the "Reluctant to Buy" cluster appeared more amorphous. Interestingly, the "Emotionally Intuitive" segment, showing a strong preference for animal welfare certification, was closely tied to the "Willing to Buy" stance. Conversely, the "Quality–Oriented" demographic, exhibiting tepid enthusiasm for animal welfare milk, frequently aligned with the "Reluctant to Buy" category. These observations suggest that campaigns promoting animal welfare milk in the university marketplace should prioritize emotionally attuned consumers. In contrast, those prioritizing quality might remain more reticent. Consequently, emotive elements are paramount in shaping university students' valuation of animal welfare-certified milk.

4. Discussion and Implications

4.1. Discussion

As highlighted in our introduction, the emphasis on animal welfare has grown substantially in recent years, both globally and in China. Our study aims to highlight its importance in the advancement of the livestock sector. Given the increasing focus on sustainability and animal rights, there is a growing demand for products that prioritize animal welfare [11,12,32]. Given the omnipresence of milk in everyday consumption, its intersection with animal welfare becomes a prescient issue. Building on the significance of milk as a symbol of nutrition for the younger generation, we sought to understand the consumption inclinations of university students, who are likely to become key supporters and promoters of animal welfare [5,15]. This study focuses on university students from Guangdong Province, China, using choice experiments to understand their preferences for milk associated with animal welfare and the reasons behind those preferences.

Our findings resonate with those of Cornish et al., (2020) [8] in their study on young Australian consumers, particularly in highlighting the pronounced inclination and awareness of animal welfare within the 18–29 age group. However, unlike the broader Australian demographic, our research specifically zooms in on Chinese university students, offering unique insights into this specific demographic. This positive inclination might stem from their enriched academic exposures, receptiveness to modern paradigms, and their active immersion in the digital sphere and social media landscapes. Broader consumer studies (spanning ages 18–65 and beyond) have corroborated the conclusion that females and individuals with augmented incomes exhibit an amplified willingness to shell out a premium for enhanced animal welfare [8,33], an observation resonating with our data from the student segment. Intriguingly, a significant portion of our student sample (35.58%) disclosed monthly expenditures of CNY 1500, with 25.66% reporting CNY 2000, suggesting a relatively comfortable financial milieu. This suggests that the evolving socioeconomic status in China is influencing these spending patterns, empowering the younger generation to make informed purchasing decisions based on ethics and values. Those with steeper outlays exhibit a heightened predisposition toward welfare-endorsed milk.

Additionally, our research reveals a range of preferences among students regarding animal welfare. While Wang and Gu (2014) [31] proposed that consumers' rationale for championing animal welfare oscillates between product quality [34,35] and emotional alignment [36,37], our findings among university students shed light on the emerging importance of ethical consumption in China. Such importance is, to some extent, influenced by global trends, but is also inherently rooted in local dynamics [5]. This correlation between quality and emotion, as highlighted in our study, further finds empirical affirmation in the broader context of ethical consumer behavior. Furthermore, our research bolsters the assertions by Zingon et al. (2017) [3] and Vargas-Bello-Pérez et al. (2021) [15] that consumer judgments on animal welfare strike a nuanced equilibrium between quality and emotional dimensions. Segmenting students based on their orientations, we discerned

three typologies: "Quality–Oriented", "Emotionally Intuitive", and "Quality–Emotion Balanced". Collectively, these segments conveyed a shared endorsement of animal welfare, albeit with distinct willingness-to-pay and motivational contours.

Our study underscores the strong commitment of university students to animal welfare and offers valuable insights into future trends. While global narratives, such as those presented by Thorslund et al., (2016) [38] and Henriksen et al., (2022) [39], highlight an increased alignment with animal welfare among consumers—particularly in the European context—China faces its own unique challenges as an evolving market. One such pronounced challenge, which may be hinted at in global studies but is distinctly evident in our research, is the disparity between consumers' perceptions and the actual living conditions of livestock in China. Only a mere 6.85% of our student cohort perceived suboptimal living conditions for dairy cows. However, research like that of Ding et al., (2022) [40] suggests a more concerning reality, emphasizing the gap due to informational shortcomings. This points to the pressing need for comprehensive, targeted educational interventions, tailored to enhancing students' understanding of animal welfare.

Our study fills a significant gap by examining the perceptions of Chinese university students. Their attitudes set the stage for future inquiries and strategies in the context of a growing emphasis on ethically sourced products in the global market. However, certain caveats merit acknowledgment. The cultural and economic heterogeneity across China mandates a judicious extrapolation of insights gleaned from Guangdong Province students. Methodologically, while choice experiments furnish in-depth revelations on student predilections, the experimental configurations could subtly modulate the responses. However, we believe that our approach accurately captures genuine consumer orientations and sheds light on their decision-making processes. From a temporal vantage, given the dynamic landscape of animal welfare perceptions in China, our study offers a contemporaneous "capture" of prevailing attitudes—a valuable touchstone for subsequent inquiries. Future research endeavors might involve amplifying the sampling purview, finetuning the experimental paradigms, and chronicling the evolving narratives of animal welfare, thereby ensuring richer, more holistic insights.

4.2. Implications

University students, recognized as future societal leaders, are instrumental in shaping the direction of animal welfare perceptions. Their perspectives provide not only a glimpse into potential societal shifts but also a basis for offering actionable guidance for both governmental and corporate entities.

Firstly, we consider the cultivation of animal welfare awareness through education. Recognizing the influential position that university students will soon occupy in society, it becomes vital to nurture a profound understanding of animal welfare within them. This can be achieved through the introduction of animal welfare-centric courses and by forging collaborations with international bodies to ensure an alignment with global best practices. Immersive experiences, like engagements with animal protection agencies or gaining insights into the livestock industry, can further solidify their understanding. On campuses, the establishment of animal welfare societies and the hosting of related events can offer students platforms to express, share, and implement their insights. Furthermore, integrating cultural initiatives, such as art exhibitions themed around animal welfare, can cultivate a more compassionate academic environment.

Secondly, we consider shaping an animal welfare-aligned market. It is crucial to establish a marketplace that genuinely emphasizes animal welfare. This entails prioritizing both product research and ethically driven innovation. Businesses should look beyond mere profitability, focusing also on ethical considerations in product development. Transparent product labeling indicating a commitment to animal welfare standards is paramount. This dedication should extend beyond the product itself, encompassing the entire supply chain, from sourcing raw materials to the final processing stages. Through periodic market

assessments, companies can better align their offerings with the evolving expectations and preferences of consumers.

Lastly, we consider fostering an animal welfare-conscious society. Building a societal atmosphere that resonates with the principles of animal welfare demands a comprehensive approach. Efforts from governmental and institutional bodies should prioritize public outreach and education, aiming to deepen understanding and elicit widespread support for animal welfare. From a legislative perspective, the enactment of robust laws and policies that champion these values is essential. Collaborative initiatives with NGOs, especially those specializing in animal welfare, can play a pivotal role in driving awareness and engagement across the broader public. In the corporate realm, brands need to ensure that their commitment to animal welfare is both genuine and visible. Moreover, incorporating animal welfare education across all educational tiers, from primary to tertiary levels, will ensure these values are instilled early and reinforced consistently.

5. Conclusions

In contemporary consumer markets, a simple bottle of milk transcends its basic nutritional value, reflecting broader concerns about animal welfare. In this light, our research directed its lens toward Chinese university students, aiming to understand their consumption dispositions and preferences for milk products adorned with animal welfare certifications. Using the discrete choice experiment approach, we discerned a marked preference among this demographic for milk products with animal welfare certification. When unpacking the consumption determinants, 48.77% of students emerged as the "Quality–Emotion Balanced" segment, followed by the "Emotionally Intuitive" segment at 30.67%, and the "Quality–Oriented" segment encompassing 20.55%. Across the board, these segments demonstrated a favorable bias toward animal welfare, with the "Emotionally Intuitive" segment standing out prominently. These findings underscore that while considerations of quality and ethical alignment shape students' dairy choices, personal consumption motivations wield significant influence. Further, our empirical assessment underscored variations in the premium that different segments were prepared to offer.

Our inquiry offers insights into Chinese university students' dispositions and preferences toward dairy products associated with animal welfare, concurrently casting a light on overarching market dynamics and strategies. The consumer ethos exhibited by university students, to a significant degree, promises to sculpt the trajectory of the broader market landscape. Consequently, understanding their preferences is not only pivotal for China's animal welfare market but could also offer valuable strategic perspectives for international markets. It is crucial to recognize the study's inherent scope limitations, primarily its circumscribed focus on Chinese university students, which might temper the universality of the insights. With global interconnectivity intensifying, subsequent research could embrace broader student cohorts across diverse global regions, helping to compare consumption behaviors and market details. Such comparative endeavors would not only render a richer global panorama but would also accentuate the central role that university students inhabit in steering consumer trends. Beyond this, future investigations could venture beyond the university student demographic, expanding the investigative ambit to incorporate a wider consumer spectrum, thereby offering a more nuanced market perspective. Our work presents invaluable reflections for academics, policymakers, and industry stakeholders, underscoring its transnational pertinence. We hope that our contributions catalyze further advancements and innovation in the animal welfare marketplace.

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animals

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Article

Pet Ownership and Its Influence on Animal Welfare Attitudes and Consumption Intentions Among Chinese University Students

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Simple Summary: This study explores how having pets influences Chinese university students' attitudes and willingness to buy animal welfare certified products. It finds that students from households with pets are more empathetic toward animals and show a greater willingness to support animal welfare certified products, even if it means paying a premium. The research highlights the important role of pet ownership in shaping ethical attitudes toward animals and suggests that this background could be valuable for promoting animal welfare more broadly across society. Additionally, the study emphasizes that policies, businesses, and education should work together to raise awareness about animal welfare and encourage ethical consumption.

Abstract: As global awareness of animal welfare continues to rise, it has become essential to understand the factors that shape individual attitudes and consumption behaviors related to animal welfare. This study empirically investigates how pet ownership influences attitudes towards animal welfare and related consumption intentions among Chinese university students. Findings demonstrate that students from pet-owning households exhibit significantly more favorable attitudes and behaviors concerning animal empathy, awareness of animal welfare, willingness to purchase animal welfare certified products, and the willingness to pay a premium for animal welfare labels. Pet ownership fosters emotional resonance, enhancing empathy and perceptions regarding animal welfare, and influences preferences for animal welfare certified products through simulated consumer choices. By applying propensity score matching (PSM) to mitigate endogeneity concerns, this research advances theoretical discussions surrounding animal welfare attitudes and consumption behaviors. Looking ahead, the promotion of animal welfare should involve coordinated efforts across educational institutions, policy frameworks, and market mechanisms to cultivate a broader understanding and adoption of animal welfare principles.

Keywords: pet ownership; animal welfare attitudes; consumption intentions; propensity score matching (PSM); Chinese university students

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1. Introduction

In recent years, animal welfare has increasingly emerged as a critical indicator of social progress and sustainable development [1,2]. In 2022, the United Nations Environment Assembly adopted a landmark resolution recognizing the relationship between animal welfare and environmental sustainability, marking the first time that animal welfare was formally integrated into the global environmental agenda. This development underscores

the growing international consensus on the strategic importance of animal welfare, positioning it as a vital measure of national modernization [2]. Beyond its direct benefits in production systems, animal welfare also delivers broader societal advantages, including improved workforce well-being, competitive business gains, and reduced health risks for both humans and animals [3–5]. Furthermore, it plays a pivotal role in mitigating the impacts of climate change [6]. Within this global context, animal welfare has ignited extensive ethical and social discourse, particularly in relation to consumer behavior. As markets expand, consumer attitudes and purchasing behaviors have become significant drivers in the promotion of animal welfare certified products [7,8]. Understanding the factors that shape consumer attitudes and behaviors towards these products is crucial for advancing animal welfare policies and promoting ethical consumption practices.

Despite the increasing global emphasis on animal welfare certified products, much of the existing research has predominantly focused on developed Western countries, particularly within their established market environments. International studies consistently highlight the crucial role that moral awareness and societal values play in shaping consumer attitudes and behaviors related to animal welfare [9–13]. In these developed nations, markets for animal welfare certified products are relatively mature, and consumer awareness is well-formed, with many individuals aligning their ethical beliefs with purchasing behaviors. However, in China—where the market for animal welfare certified products is still in its infancy—consumer awareness of and attitudes toward animal welfare are less developed, and the concept itself remains relatively novel [1]. While a substantial body of literature has examined the correlation between animal welfare attitudes and consumption behaviors, there remains a gap in understanding the specific factors influencing these attitudes and behaviors within China's unique cultural context. Investigating the external influences on consumer attitudes toward animal welfare in China, particularly among younger consumers, presents an important research avenue.

University students, as a key demographic in the future consumer market, hold a pivotal role in shaping emerging trends, particularly in sectors such as animal welfare certified products [14–16]. Their consumption patterns not only mirror evolving societal values but also have the potential to guide broader market directions. With their higher education levels and better access to information, university students are often at the forefront of adopting new ideas, including ethical consumption. Understanding their attitudes and intentions toward animal welfare offers critical insights for predicting shifts in consumer behavior, making them a valuable group for studying the future trajectory of animal welfare in China.

Pet ownership has emerged as one such influencing factor, which has garnered increased attention in recent years. Interactions with pets can strengthen an individual's emotional connection with animals and enhance their awareness of animal welfare [17–21]. This combined effect on both emotional and perceptual dimensions not only manifests in the care of pets but may also extend to attitudes toward other animals, influencing moral inclinations and consumer behavior [22,23]. Research indicates that pet owners are generally more attuned to animal welfare concerns [21,24], exhibit a greater sensitivity to ethical considerations and social responsibilities, and show an increased willingness to purchase products that support animal welfare [25,26]. While previous research has explored the correlation between pet ownership and animal welfare attitudes, causal relationships remain underexplored, especially in China. This study aims to fill this gap by employing propensity score matching (PSM) to examine the impact of pet ownership on attitudes toward animal welfare and consumption intentions within the Chinese cultural context.

Following this context, the central objective of this study is to examine the extent to which pet ownership influences individual attitudes toward animal welfare and consumption intentions. In particular, this research focuses on university students' attitudes, exploring the dual dimensions of empathy (emotional) and perceptions of animal welfare (perceptual). With the rise of animal welfare awareness in China, understanding the factors influencing the consumption of animal welfare certified products is essential. As university

students are poised to become the future drivers of the animal welfare market, their perspectives provide unique insights into future trends [14–16]. By utilizing survey data from university students and applying PSM to reduce selection bias, this study provides a more robust analysis of how pet ownership influences attitudes and consumption intentions, offering empirical insights into the relationship between these variables within China's unique social and economic environment.

The contributions of this paper are threefold: First, it systematically investigates the influence of pet ownership on attitudes toward animal welfare and consumption intentions within the Chinese context, thereby expanding the geographical and cultural scope of existing research. Second, by utilizing PSM, the study addresses the issue of self-selection bias, improving the causal interpretability of the findings. Finally, the research explores not only the effect of pet ownership on attitudes but also its influence on actual consumer behaviors, such as purchase intentions and willingness to pay a premium, thereby offering a more holistic perspective on the topic.

The structure of this paper is as follows: Section 2 reviews the literature on animal welfare and presents the research hypotheses; Section 3 describes the data sources, variable definitions, and research methodology; Section 4 presents the empirical analysis results; Section 5 discusses the findings and provides recommendations; and Section 6 concludes with the study's key findings.

2. Literature Review and Research Hypotheses

2.1. Pet Ownership and Attitudes Toward Animal Welfare

Attitudes toward animal welfare are shaped by a range of factors, including cultural values, education, and personal experiences with animals, such as pet ownership. Among these factors, pet ownership has been found to significantly influence both the emotional and perceptual dimensions of individuals' attitudes toward animal welfare [27,28]. While this study focuses on pet ownership, it is important to recognize that other factors also contribute to shaping these attitudes [29–31]. The goal here is to examine pet ownership as one potential influencing factor within the broader context of animal welfare attitudes.

The "pets as ambassadors hypothesis" suggests that daily interactions with pets not only deepen emotional attachments but also foster moral concern for other animal species, enhancing awareness of animal welfare more broadly [22,23]. These interactions cultivate empathy, defined as the ability to perceive and respond to the emotional states of others. Research shows that pet owners are more likely to demonstrate empathy toward animals, as pet ownership fosters sensitivity to animal suffering and well-being [17,23,32]. This increased empathy often leads to greater awareness of animal welfare issues, motivating consumers to make ethically conscious decisions regarding their product choices, particularly those related to animal welfare [33].

From a perceptual perspective, pet ownership influences individuals' attitudes by shaping their interpretations and views of animal welfare issues. Specifically, perceptions of animal welfare encompass individuals' subjective views on the ethical and practical considerations surrounding the treatment and welfare of animals. Pet owners may be more likely to perceive animal welfare as an important societal concern [34,35], which informs their broader attitudes toward ethical consumption and animal welfare practices. These perceptions, shaped by personal experiences and societal influences, may affect how individuals assess the importance of supporting animal welfare through their everyday decisions [36].

In addition to emotional and perceptual influences, socioeconomic characteristics also play a role in shaping the relationship between pet ownership and attitudes toward animal welfare. Research suggests that younger, urban, and better-educated individuals are more likely to own pets and be attuned to animal welfare concerns [28,37]. As such, while pet ownership may enhance both emotional and perceptual pathways, the strength of this influence may vary across different demographic groups.

Based on this review, the following hypotheses are proposed. H1a and H1b represent two key dimensions of attitudes toward animal welfare. While H1a focuses on the emotional response (empathy) to animal suffering, H1b addresses the perceptual understanding of animal welfare issues. Together, these two dimensions provide a comprehensive view of how pet ownership influences both the emotional and perceptual aspects of attitudes toward animal welfare:

H1. *Pet ownership has a significant positive impact on attitudes toward animal welfare.*

H1a. *Pet ownership positively influences animal empathy.*

H1b. *Pet ownership positively influences perceptions of animal welfare.*

2.2. Pet Ownership and Animal Welfare Consumption Intentions

Consumer behavior regarding animal welfare certified products has garnered significant attention in recent years [13], particularly as younger consumers increasingly seek products aligned with ethical practices and animal welfare standards [16]. Research suggests that pet ownership strengthens emotional connections with animals [23,24], and that these bonds may directly shape consumer preferences and behaviors toward animal welfare certified products [16,38]. Through their experience with pets, individuals may develop a heightened awareness of animal welfare, which could influence their purchasing decisions, particularly when evaluating animal welfare certified products [1].

Purchase intention refers to a consumer's likelihood of choosing to buy products that align with animal welfare standards [1]. Studies have consistently shown that pet owners are more inclined to purchase products with animal welfare certifications due to the stronger emotional bonds they develop with animals [25,26,35]. This suggests that pet ownership fosters an increased likelihood of supporting animal welfare products, indicating that pet owners are more likely to integrate animal welfare considerations into their purchasing decisions [39]. While purchase intention reflects a positive behavioral inclination, it also indicates how closely animal welfare values are integrated into the consumer's broader value system.

Similarly, willingness to pay a premium reflects consumers' recognition of the ethical value embedded in animal welfare certified products and their readiness to pay more for such goods [13,16]. Pet ownership has been shown to significantly enhance this willingness, as pet owners are generally more attuned to the ethical dimensions of product choices. Although practical factors such as financial capacity and product availability may influence actual purchasing behavior, willingness to pay a premium reflects a deeper ethical commitment to animal welfare values, which often results in a higher likelihood of paying more for ethically certified products [13,40].

Additionally, socioeconomic factors such as education, age, and urban living further moderate the relationship between pet ownership and consumer behavior. Younger, better-educated, and urban-dwelling individuals not only tend to be more attuned to animal welfare issues but also often have greater access to welfare-certified products and the resources to purchase them, which may further support their willingness to pay a premium for these products [16,39,41,42]. These factors suggest that pet ownership enhances both purchase intention and willingness to pay a premium across different consumer demographics, albeit with varying levels of influence depending on socioeconomic characteristics.

Based on the literature and the factors discussed, we propose the following hypotheses to explore the relationship between pet ownership and animal welfare consumption intentions. Purchase intention and willingness to pay a premium reflect complementary aspects of consumer behavior. Purchase intention refers to a general willingness to buy animal welfare products, whereas willingness to pay a premium indicates a deeper commitment, where consumers are ready to invest financially in products certified for animal welfare.

By considering both dimensions, we aim to capture the full range of consumer intentions, from general ethical support to specific financial commitments:

H2. *Pet ownership has a significant positive impact on animal welfare consumption intentions.*

H2a. *Pet ownership positively influences the willingness to purchase animal welfare certified products.*

H2b. *Pet ownership positively influences the willingness to pay a premium for animal welfare certified products.*

3. Data, Variables, and Methods

3.1. Data

Data were collected using an online questionnaire, distributed via the "Wenjuanxing" platform, a leading survey platform in China. The questionnaire captured key variables such as demographic characteristics, family background, pet ownership, and attitudes toward animal welfare and consumption intentions. It underwent several rounds of expert review and revisions to ensure scientific validity and clarity. A pilot test with 30 university students in March 2023 helped refine the questionnaire's wording, structure, and logic.

The formal survey was conducted between July and August 2023, targeting university students in Guangdong Province, a region known for its economic development and openness to global ideas. These students represent a forward-looking demographic, particularly in emerging sectors like animal welfare products. A total of 1409 responses were collected, incentivized by a random red packet reward ranging from CNY 1 to 3. After data cleaning, which involved excluding incomplete or inconsistent responses, 1140 valid questionnaires were retained, yielding an effective response rate of 80.91%.

3.2. Variable Description

3.2.1. Dependent Variables

This study employs four specific indicators to measure university students' attitudes toward animal welfare and their behavioral intentions. Attitudes are assessed through two dimensions: animal empathy and perceptions of animal welfare; behavioral intentions are captured using two indicators: willingness to purchase animal welfare certified products and willingness to pay a premium for animal welfare labels.

(1) Animal Empathy

Animal empathy reflects the respondent's emotional reaction to animal suffering. The questionnaire included the following statement: "Please evaluate the following statement: 'I feel upset every time I see animals being abused or in pain'". Responses were measured on a 5-point Likert scale, ranging from "1 = Strongly Disagree" to "5 = Strongly Agree". Based on the survey results, the average score for animal empathy was 4.061 (with a standard deviation of 0.952).

Given the distribution of responses, where the majority of students scored either 4 or 5, we classified animal empathy into three distinct categories to better capture the variability in empathy levels. Respondents scoring 1 to 3 were classified as having low empathy, those scoring 4 as having moderate empathy, and those scoring 5 as having high empathy. This three-category classification allows for a more nuanced analysis of empathy levels, ensuring that subtle differences between moderate and high empathy are preserved. The following analysis uses these three categories to examine the relationship between pet ownership and animal empathy.

(2) Perceptions of Animal Welfare

Perceptions of animal welfare reflect respondents' subjective views and interpretations regarding key animal welfare issues. Four statements were used to assess these perceptions, each capturing distinct dimensions of ongoing debates about animal welfare in Chinese society: "Farm animal welfare does not need to be considered since they are eventually slaughtered for food", "Human welfare has not yet been fully met, so it's not time to

consider animal welfare", "The cost of welfare farming is too high and unsuitable for our country's reality", and "Some welfare farming measures are merely commercial gimmicks or a result of curiosity from farmers".

These statements were selected based on prevailing discussions and misconceptions about animal welfare that we have frequently observed in our broader research on the topic. In their study, Liang et al. [16] identified similar themes when investigating perceptions of animal welfare among Chinese university students. These statements were designed to capture key areas of debate, including the ethical trade-offs between human and animal welfare, economic considerations, and skepticism toward commercialized welfare practices. This reflects a range of attitudes commonly encountered in Chinese society, where animal welfare is still an emerging concept.

Each statement was evaluated on a 5-point Likert scale, ranging from "1 = Strongly Disagree" to "5 = Strongly Agree". The Cronbach's α coefficient for each statement exceeded 0.75, with an overall reliability of 0.848, indicating strong internal consistency for the scale. The average total score across these statements was 2.680 (with a standard deviation of 0.842). For analytical purposes, we classified respondents' perceptions of animal welfare into two levels: high and low. A "high" perception reflects a more favorable and supportive attitude toward animal welfare, indicating a belief that animals merit ethical consideration and humane treatment, despite potential practical challenges. Conversely, a "low" perception suggests a more utilitarian or pragmatic outlook, with respondents potentially prioritizing human needs over animal welfare concerns. Respondents scoring below the mean were classified as having high perceptions of animal welfare (assigned a value of 1), while those scoring above the mean were classified as having low perceptions (assigned a value of 0). This classification enables an examination of how variations in perceptions align with differing ethical perspectives on animal welfare within the study's framework.

(3) Willingness to Purchase Animal Welfare Certified Products

Willingness to purchase animal welfare certified products measures respondents' intentions toward consuming specific animal welfare certified products. To ensure representativeness and prompt respondents to make concrete consumption decisions, this study selected "milk" as the target product, given its status as a common, affordable item frequently consumed by university students. The survey posed the question: "If animal welfare-certified milk were available on the market, would you be willing to buy it?" Responses were measured on a 5-point Likert scale, ranging from "1 = Definitely Not" to "5 = Definitely Yes". The statistical results indicated an average score of 3.250 (with a standard deviation of 0.650). For analytical purposes, respondents with scores above the mean were classified as having high willingness to purchase and assigned a value of 1, while those scoring below the mean were classified as having low willingness to purchase and assigned a value of 0.

(4) Willingness to Pay a Premium for Animal Welfare Labels

To measure respondents' willingness to pay a premium for animal welfare certified products, this study employed a discrete choice experiment (DCE) focused on milk consumption. Several attribute variables were included, such as brand, animal welfare label, protein content, shelf life, and price. The experiment presented different product combinations, prompting respondents to select their preferred option, allowing for the derivation of their willingness to pay a premium for animal welfare certified products. A mixed logit model was used to analyze the data and estimate the willingness to pay (WTP) for animal welfare labels among the university students surveyed. Following the approach by Liu and Wang [43], individual-level coefficients for the animal welfare label premium were extracted. The statistical results showed that the average willingness to pay a premium for animal welfare labels among university students was CNY 3.617 (with a standard deviation of 0.960). Further details on the experimental design and statistical methods are elaborated in a related study [16].

3.2.2. Core Independent Variable

The core independent variable in this study is "pet ownership", which broadly refers to the presence of pets in the household. It was measured through a specific survey question, "Does your family keep pets?", with response options of "1 = Yes" and "0 = No". While this question does not capture detailed aspects of pet ownership, such as the respondent's caretaking responsibilities, the type of pet, or the duration of pet ownership, it serves as a proxy for pet-related experiences that may influence respondents' attitudes toward animal welfare and their consumption intentions. Previous research indicates that simply growing up in a household with pets can positively affect individuals' empathy towards animals and enhance their understanding of animal welfare issues [1,19,44]. Given the scope of our study, this measure provides a useful indicator for exploring the potential relationship between pet ownership and ethical attitudes and behaviors related to animal welfare.

3.2.3. Control Variables

To minimize the influence of extraneous factors on the research outcomes, a series of individual- and family-level control variables were selected. These control variables include gender, age, BMI (body mass index), academic major, monthly living expenses, and the number of permanent family members. The selection of these variables is grounded in theoretical considerations, as previous studies suggest they may affect respondents' attitudes and consumption behaviors related to animal welfare [1,4,16,45,46]. The specific definitions and operationalization of each variable are detailed in Table 1.

Table 1. Definitions and measurement of control variables.

Variable Name	Definition and Measurement
Gender	Female = 1, Male = 0
Age	Above average age = 1, Below average age = 0
BMI	$\geq$24.00 = 2, 18.50–23.99 = 1, $\leq$18.50 = 0
Agricultural Major	Yes = 1, No = 0
Engineering Major	Yes = 1, No = 0
Humanities/Social Sciences Major	Yes = 1, No = 0
Monthly Living Expenses	Above average living expenses = 1, Below average = 0
Permanent Family Members	Above average number of family members = 1, Below average = 0

3.3. Analytical Methods and Steps

The core objective of this study is to determine whether "pet ownership" significantly influences Chinese university students' attitudes toward animal welfare and their consumption intentions. Since the distribution of "pet ownership" is not random and may be influenced by factors such as gender, economic conditions, and academic background, there is potential for selection bias within the sample. This selection bias could lead to systematic differences between the treatment group (students from households with pets) and the control group (students from households without pets), thus compromising the accuracy of causal inferences.

To address this issue, the study employs the PSM method. PSM, grounded in the counterfactual framework, aims to construct a treatment group and a control group that are comparable in terms of covariates, thereby mitigating systematic differences between samples and enabling a more accurate estimation of the causal effects of "pet ownership" on attitudes toward animal welfare and consumption intentions. Specifically, this study matches students from households with pets to those from households without pets based on individual characteristics such as gender, age, BMI, academic major, monthly living expenses, and the number of permanent family members.

The matching process involves the following steps:

(1) Estimating Propensity Scores: First, a logistic regression model is used to estimate the probability of each sample individual coming from a household with pets, which generates the propensity score $P(x) = Pr(T = 1|X)$, where T indicates whether the individual

comes from a household with pets and X represents the matrix of covariates. Assuming no unobserved confounding and that the common support condition holds, PSM can achieve effects similar to covariate matching.

(2) Selecting Matching Methods: To ensure the robustness of the results, this study employs three mainstream matching methods: ① Kernel Matching: This method utilizes all control group samples for weighted matching, with weights assigned based on the differences in propensity scores between treatment and control samples. The default kernel function and bandwidth parameters are used in this study. ② Radius Matching: Also known as caliper matching, this method restricts the absolute distance between propensity scores to control the precision of sample matching. The caliper range is set to 0.01. ③ Nearest Neighbor Matching: For each treatment group sample, the control group sample with the closest propensity score is matched. A caliper range of 0.01 is adopted and k = 4 is set, meaning each treatment group sample is matched with four control group samples to minimize the mean squared error.

(3) Estimating Causal Effects: After matching, the Average Treatment Effect on the Treated (ATT) is calculated using the matched samples, which reflects the impact of pet ownership on attitudes toward animal welfare and consumption intentions. The estimation formula for ATT is:

$$ATT = E\{Y_{1i} - Y_{0i} \mid D_i = 1\} = E[E\{Y_{1i} - Y_{0i} \mid D_i = 1, p(X)_i\}] = E[E\{Y_{1i} \mid D_i = 1, p(X)_i\} - E\{Y_{0i} \mid D_i = 0, p(X)_i\} \mid D_i = 1]$$

where Y_1 and Y_0 represent the outcome differences on the dependent variables (attitudes toward animal welfare and behavioral intentions) for individuals from households with and without pets, respectively.

All statistical analyses were conducted using Stata 17.0 software. A significance level of 0.1 was used, which allows for detecting marginally significant effects, common in social science research where subtle effects may be important. After matching the samples using PSM, paired sample *t*-tests were employed to compare the mean differences between the treatment and control groups on the dependent variables (attitudes toward animal welfare and consumption intentions). The *t*-tests assess whether significant differences exist between pet-owning and non-pet-owning students while accounting for covariates. Robust standard errors were applied to account for potential heteroscedasticity, ensuring the reliability of the results. The statistical tests and significance levels are explicitly reported in the results section and referenced in Table 2.

Table 2. Descriptive comparison of pet ownership on university students' animal welfare attitudes and consumption intentions.

Variable	Full Sample	Households With Pets	Households Without Pets	Difference
Animal Empathy	1.152 (0.747)	1.304 (0.737)	1.118 (0.745)	0.186 ***
Perceptions of Animal Welfare	0.444 (0.497)	0.527 (0.501)	0.426 (0.495)	0.101 ***
Willingness to Purchase Animal Welfare Certified Products	0.290 (0.454)	0.357 (0.480)	0.275 (0.447)	0.082 **
Willingness to Pay a Premium for Animal Welfare Labels	3.617 (0.960)	3.730 (0.963)	3.592 (0.959)	0.137 *

Note. The values represent the means for each group, with standard deviations shown in parentheses. The "Difference" column reports the mean difference between students from households with pets and those from households without pets. Positive values indicate higher mean scores for students from households with pets. Statistical significance of the differences was assessed using t-tests: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Empirical Results and Econometric Analysis

4.1. Descriptive Findings

Table 2 presents a descriptive analysis comparing differences in animal welfare attitudes and consumption intentions between university students from households with pets and those from households without pets. The results indicate that students from households with pets exhibit significantly higher levels of animal empathy, perceptions

of animal welfare, willingness to purchase animal welfare certified products, and willingness to pay a premium for animal welfare labels. Specifically, the mean animal empathy scores for students from pet-owning households were 0.186 points higher than those from non-pet-owning households, indicating a greater likelihood of moderate to high empathy levels among pet owners ($p < 0.01$). Regarding perceptions of animal welfare, the proportion of students with high perceptions is 10.1% higher for those from pet-owning households ($p < 0.01$), suggesting that pet ownership may enhance students' sensitivity to and understanding of animal welfare issues.

In terms of consumption intentions, pet ownership also plays a significant role. The proportion of students with a high willingness to purchase animal welfare certified products is 8.2% higher among those from households with pets ($p < 0.05$), indicating that pet ownership not only influences attitudinal factors but also has a tangible impact on consumption behaviors. Additionally, students from pet-owning households are willing to pay an average of CNY 0.137 more per bottle ($p < 0.1$) for animal welfare certified products compared to those from households without pets, further demonstrating the influence of pet ownership on consumption choices. Overall, these findings suggest that pet ownership significantly affects university students' attitudes toward animal welfare and their consumption intentions, with all differences being statistically significant.

4.2. Results of Average Treatment Effect on the Treated (ATT)

Table 3 presents the Average Treatment Effect on the Treated (ATT) of pet ownership on Chinese university students' attitudes toward animal welfare and their consumption intentions. The results from kernel matching show that students from households with pets exhibit significantly more positive attitudes and behavioral intentions related to animal welfare across all variables. Specifically, the animal empathy scores for students from pet-owning households were 0.178 points higher than those from non-pet-owning households ($p < 0.01$). Additionally, the proportion of students with high perceptions of animal welfare is 9.5% higher ($p < 0.01$), while the proportion of those with a strong willingness to purchase animal welfare certified products is 8.2% higher ($p < 0.05$). Regarding the willingness to pay a premium for animal welfare labels, students from pet-owning households are willing to pay an additional CNY 0.139 per bottle of milk with an animal welfare label ($p < 0.1$).

Table 3. Average treatment effect of pet ownership on university students.

Variable	Kernel Matching		Radius Matching		Nearest Neighbor Matching	
	ATT	Std. Error	ATT	Std. Error	ATT	Std. Error
Animal Empathy	0.178 ***	0.050	0.169 ***	0.061	0.178 ***	0.062
Perceptions of Animal Welfare	0.095 ***	0.037	0.085 **	0.040	0.112 **	0.047
Willingness to Purchase Animal Welfare Certified Products	0.082 **	0.037	0.083 **	0.040	0.106 **	0.050
Willingness to Pay a Premium for Animal Welfare Labels	0.139 *	0.075	0.148 **	0.075	0.152 *	0.088

Note. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

To ensure the robustness of the results, we also conducted analyses using radius matching and nearest neighbor matching. While there are slight variations in the absolute values of the average treatment effects, the direction, magnitude, and significance levels of the coefficients remain consistent across all methods. This consistency further supports the positive impact of pet ownership on students' attitudes and consumption intentions regarding animal welfare. These findings demonstrate that the positive effect of pet ownership is robust, regardless of the matching method employed.

4.3. Matching Effectiveness Test

A key assumption of the PSM method is that there should be significant differences in propensity scores between the treatment and control groups before matching, and these

differences should be substantially reduced or eliminated after matching. To assess the effectiveness of the matching process, kernel matching is used as an illustrative example. As shown in Figure A1, most observations fall within the common range of propensity scores, indicating minimal sample loss during the matching process. Figure A2 presents the kernel density comparison before and after matching, where the two curves are notably more aligned post-matching. Specifically, there is a visible reduction in the peak and a shrinking tail in the control group, demonstrating that the differences in propensity scores between the treatment group (students with pet ownership) and the control group (students without pet ownership) have significantly decreased.

Table A1 provides a detailed comparison of the differences in covariates between the treatment and control groups before and after matching. Prior to matching, significant differences were observed between the two groups in variables such as age, BMI, agricultural major, living expenses, and the number of permanent family members. However, after matching, these significant differences were eliminated, and variables that originally showed no significant differences became even less significant post-matching. Figure A3 visually illustrates the changes in standardized biases of the control variables before and after matching, demonstrating a substantial reduction in bias following the matching process. Overall, the matching process was effective, enhancing the credibility and robustness of the study's findings.

Table A2 further tests the reliability of the PSM results. The average standardized bias of the control variables before matching was 46.4%, while after matching, this value dropped to between 5.4% and 8.6%, well below the 20% threshold typically used for balance testing. Additionally, the pseudo R^2 decreased from 0.033 before matching to 0.001 after matching, and the LR statistic dropped significantly from 35.98 before matching to a range of 0.30 to 0.76 after matching. These results demonstrate that the application of PSM effectively reduced the differences in control variables between the treatment and control groups, thereby mitigating estimation bias caused by sample self-selection.

5. Discussion

As global attention to animal welfare issues intensifies, consumer attitudes and behavioral intentions have emerged as key drivers in the development of the animal welfare certified product market [42]. Within this context, the present study investigates how pet ownership influences Chinese university students' attitudes toward animal welfare and their consumption intentions. Using the PSM method, the empirical results reveal that living in a household with pets significantly enhances students' animal empathy, perceptions of animal welfare, and their willingness to purchase animal welfare certified products and pay a premium for them. These findings offer empirical support for understanding animal welfare awareness in the Chinese context and highlight the role of pet ownership in promoting ethically driven consumer behavior.

Regarding the impact of pet ownership on attitudes toward animal welfare, our findings align with the conclusions of Auger and Amiot [23], who suggested that living in a household with pets can enhance individuals' emotional resonance and increase their attention to animal welfare. Among the specific group of Chinese university students, we found that those from pet-owning households are more likely to exhibit higher levels of animal empathy. This suggests that the emotional bond between pets and their owners is effective not only in Western cultural contexts but also in a cultural context like China. This finding further extends Serpell and Paul's [22] "pets as ambassadors" hypothesis, indicating that pet ownership can influence individuals' perceptions and attitudes toward other animals. Additionally, the connection between pet ownership and animal welfare perceptions proposed by McKendree et al. [34] was confirmed in our study. University students from pet-owning households demonstrate not only heightened emotional resonance but also a deeper perceptual understanding of animal welfare issues, reflecting a more comprehensive awareness of animal rights and welfare.

The impact of pet ownership on consumption intentions related to animal welfare is another key finding of this study. To assess willingness to pay a premium for animal welfare certified products, we used milk as an example due to its familiarity and accessibility. Students from pet-owning households exhibit significantly higher willingness to purchase animal welfare certified products than those without pets. This aligns with the findings of Pirsich et al. [25] and Pearce et al. [26], which suggest that pet ownership can shape ethical consumption behavior. Additionally, our results further support previous research [1], showing pet ownership positively influences both purchase intentions and willingness to recommend animal welfare products. In our study, the increased willingness to pay a premium for products like animal welfare labeled milk highlights the role of pet ownership in enhancing consumer behavior. This aligns with Pettersson et al. [47], who demonstrated that animal welfare labels can significantly influence consumer decisions. Our findings extend this by showing that pet ownership amplifies the effect, suggesting that it motivates consumers to support animal welfare certified products.

Building on the existing literature on animal welfare, this study is the first to empirically examine the impact of pet ownership on university students' attitudes and consumption intentions toward animal welfare within the Chinese cultural context. Platto et al. [28] previously highlighted that the influence of pet ownership on attitudes toward animal welfare may vary across different social and cultural settings. While awareness of animal welfare is more established in Western societies, it is still emerging in China. In Guangdong Province—a region known for its economic development and openness to global ideas—university students exhibit attitudes and behaviors that align with international trends. Our empirical data demonstrate that pet ownership significantly enhances students' emotional engagement and shapes their consumption behavior. Guangdong's socio-economic characteristics, including its exposure to global trends, may partly explain the strong openness toward animal welfare observed among students. This finding suggests that as animal welfare continues to gain prominence in China, pet ownership could play a crucial role in shifting consumer behavior and fostering ethical consumption.

While this study focuses on the relationship between pet ownership and individual attitudes and consumption behavior, the implications extend beyond pet-owning households. The connection between pet ownership and ethical values highlights the need for coordinated efforts across education, business, and government sectors to promote animal welfare and sustainable consumption. Achieving widespread animal welfare awareness requires a multi-sectoral approach. Based on these insights, we propose the following recommendations to enhance the impact of animal welfare awareness and foster a culture of ethical consumption and responsibility. First, educational institutions should integrate animal ethics and social responsibility into their curricula, helping students build a comprehensive set of moral values. Second, businesses should leverage the growing trend of ethical consumption, particularly among younger consumers, by promoting products that meet animal welfare standards and increasing the visibility of animal welfare certifications. Lastly, policymakers should institutionalize animal welfare by implementing certification systems and offering incentives for companies that adopt higher welfare standards. These combined efforts will elevate societal awareness of animal welfare, promote responsible consumption, and support sustainable development.

Despite the valuable insights offered, this study has certain limitations. First, the data for this study are drawn exclusively from university students in Guangdong Province. While Guangdong reflects a degree of economic development and openness to ideas, the external validity of the results may be limited when applied to other regions or demographic groups. Future research could expand to additional regions to assess whether these findings have broader applicability. Second, while university students play a significant role in social change, their behaviors and attitudes may not fully capture the perspectives of other social groups regarding animal welfare issues. Thus, future studies should consider incorporating a more diverse population to enhance the generalizability of the research. Third, this study utilizes cross-sectional data. Although the PSM method helps address

endogeneity concerns, it does not account for the long-term effects of pet ownership on individual attitudes and behavioral intentions from a dynamic perspective. Future research could employ longitudinal data to further improve the accuracy of causal inferences. Lastly, this study did not collect detailed information about the nature of the relationship between respondents and their household pets, such as the extent of their involvement in pet care, the type of pet, or the emotional bond between the respondents and the pets. Future studies could investigate the quality of pet ownership, including emotional commitment, attachment, and the depth of interaction with pets, to gain deeper insights into how these factors influence attitudes toward animal welfare and consumption behaviors.

6. Conclusions

As animal welfare gains increasing global importance, understanding the factors that influence individual attitudes and consumption intentions in this area is crucial for promoting greater awareness and practice. Using the PSM method, this study empirically examined the impact of pet ownership on the animal welfare attitudes and consumption intentions of Chinese university students. The findings demonstrate that pet ownership significantly enhances students' animal empathy, perceptions of animal welfare, willingness to purchase animal welfare certified products, and willingness to pay a premium for such products. Specifically, university students from households with pets exhibit more positive attitudes and behaviors, including greater emotional resonance with animals, a deeper understanding of animal welfare, and more favorable consumption behaviors. Compared to students from households without pets, they are more likely to endorse the concept of animal welfare and are willing to pay a higher premium for animal welfare certified products. It is evident that pet ownership is not simply a routine activity, but one that has a meaningful impact on individuals' views of animal welfare across emotional, perceptual, and consumption-related dimensions.

This finding provides new empirical evidence for related theoretical research and offers valuable insights for policymakers and businesses. Based on these results, future education and advocacy efforts should focus on promoting concepts such as animal ethics, social responsibility, and sustainable development to achieve broader societal recognition and practice of animal welfare. This study not only highlights the significant impact of pet ownership on various dimensions of animal welfare views through empirical analysis, but also addresses endogeneity issues, to some extent, by using the PSM method, thereby strengthening the study's causal inference capabilities. This approach improves upon the limitations of previous studies, which often explored only simple correlations, and provides more robust empirical support for theoretical research. However, this study is limited by the lack of detailed data on the depth of interaction between respondents and their household pets, as well as the regional and demographic scope of the sample. Future research could expand to include a broader range of social groups and regions, incorporate longitudinal data, and conduct mechanism analyses to further investigate the long-term impact of pet ownership and the quality of interaction on animal welfare attitudes and consumption behavior. By broadening the scope and deepening the analysis, future research can offer richer theoretical and practical guidance for advancing animal welfare in China and beyond.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Conflicts of Interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

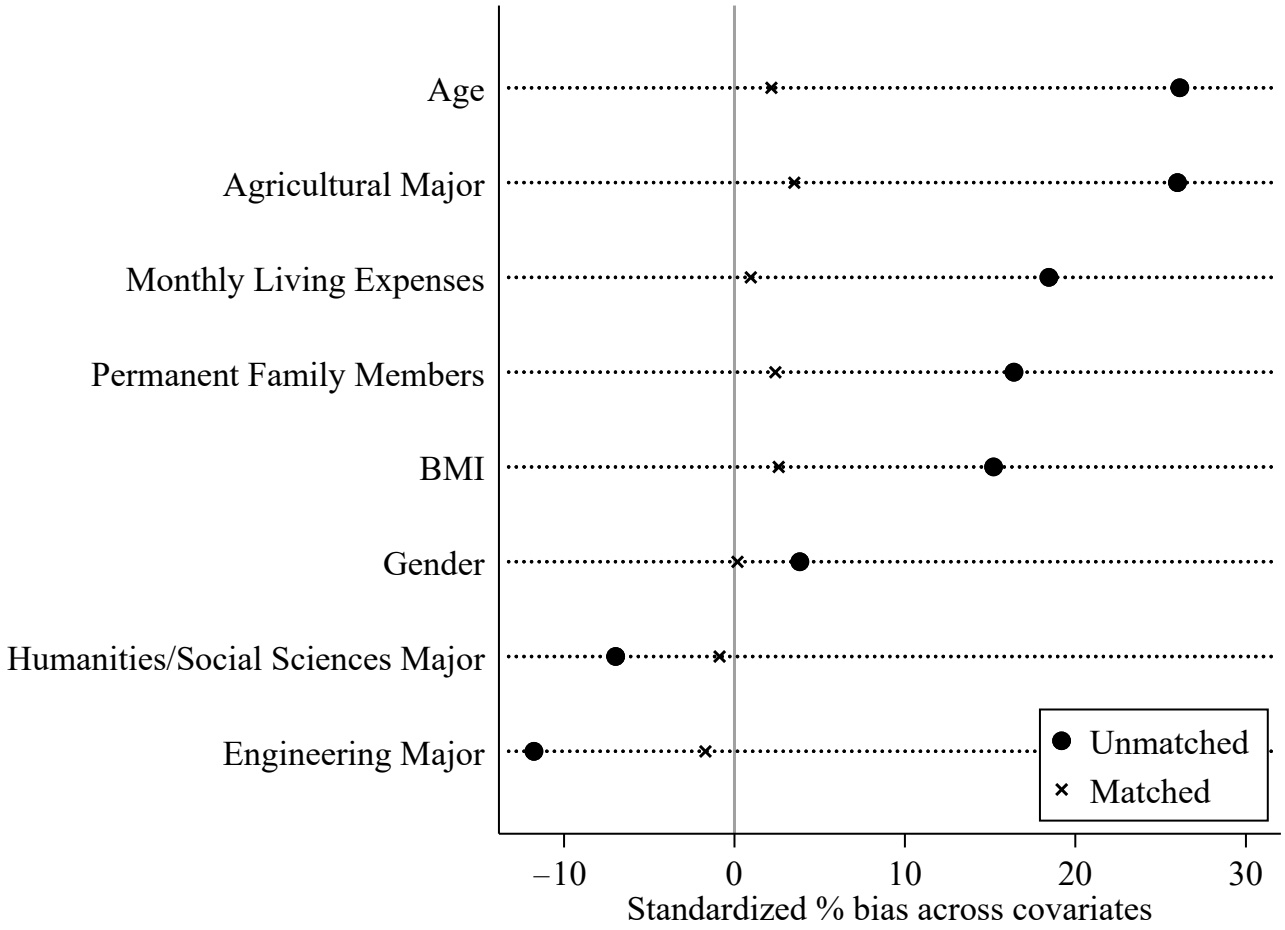


Figure A1. Common range of propensity scores.

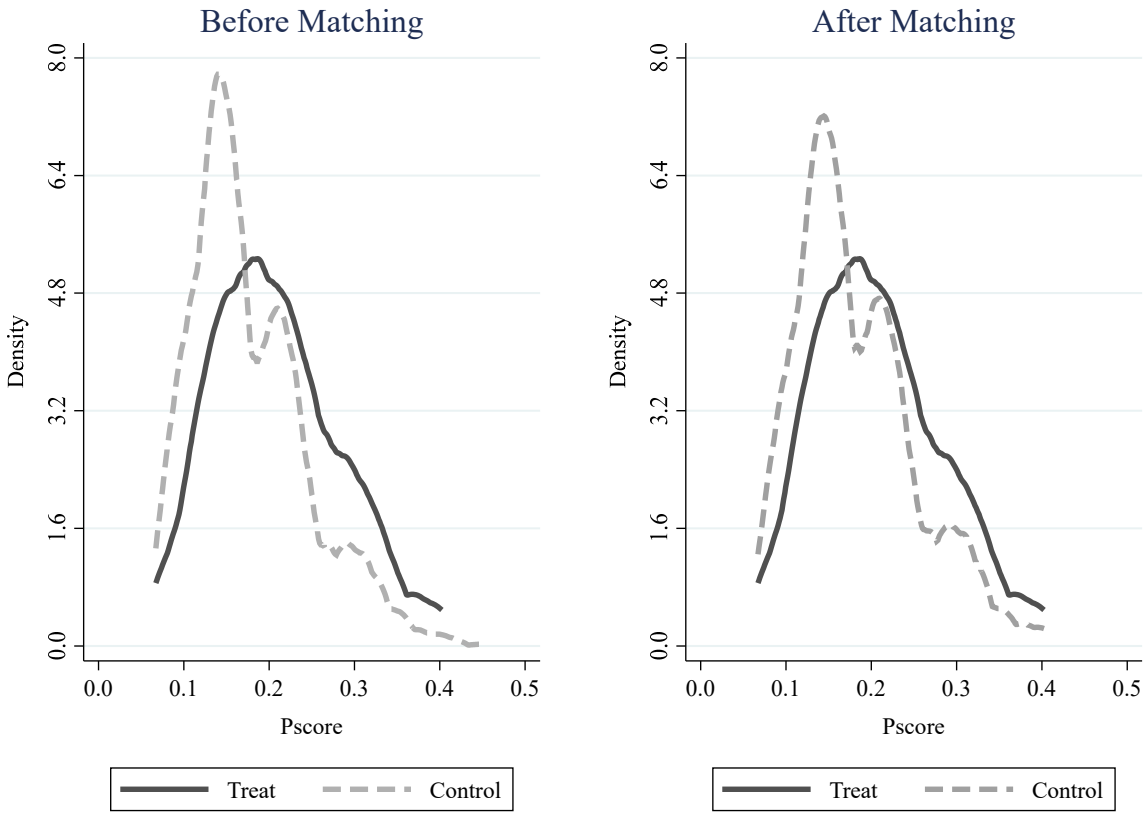


Figure A2. Kernel density comparison before and after matching.

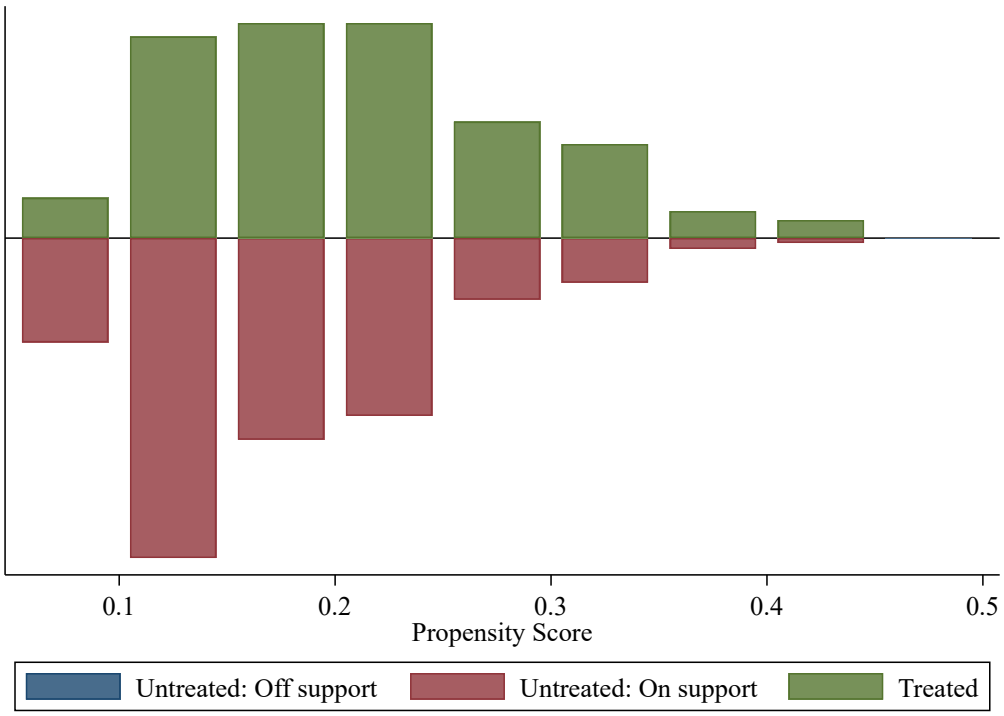


Figure A3. Common range of values for the propensity score. Group assignment after matching: Untreated: Off support (blue), N = 1; Untreated: On support (red), N = 932; Treated (all on support, green), N = 207. The "Untreated: Off support" group is not visible due to its minimal size. Excluding such small groups in PSM is standard practice to ensure representativeness and comparability, minimizing potential bias from sample imbalance or matching issues.

Table A1. Balance test results for covariates before and after matching.

Variable	Umatched	Mean		%Bias	%Reduct |Bias|	*t*-Test	
	Matched	Treated	Control			*t*	$p > \|t\|$
Gender	U	0.623	0.605	3.8	95.6	0.50	0.619
	M	0.623	0.622	0.2		0.02	0.986
Age	U	0.589	0.460	26.1	91.7	3.39	0.001
	M	0.589	0.576	2.2		0.22	0.825
BMI	U	1.053	0.964	15.2	82.9	1.97	0.049
	M	1.053	1.042	2.6		0.26	0.792
Agricultural Major	U	0.300	0.189	26.0	86.5	3.57	0.000
	M	0.300	0.285	3.5		0.33	0.739
Engineering Major	U	0.213	0.263	−11.8	85.5	−1.50	0.135
	M	0.213	0.221	−1.7		−0.18	0.858
Humanities/Social Sciences Major	U	0.222	0.252	−7.0	87.5	−0.90	0.371
	M	0.222	0.227	-0.9		−0.09	0.928
Living Expenses	U	0.488	0.397	18.4	94.9	2.42	0.016
	M	0.488	0.485	0.9		0.10	0.924
Permanent Family Members	U	0.420	0.341	16.4	85.4	2.16	0.031
	M	0.420	0.407	2.4		0.24	0.811

Table A2. Balance test results for control variables before and after matching using different matching methods.

Matching Method	Pseudo R^2	LR Statistic	Standardized Bias (%)
Before Matching	0.033	35.98	46.4
Kernel Matching	0.001	0.30	5.4
Radius Matching	0.001	0.68	8.1
Nearest Neighbor Matching	0.001	0.76	8.6

Appendix B

Preliminary Question

Do you regularly purchase milk?

○ Yes
○ No (End of the survey)

I. Basic Information

What is your gender?

○ Male
○ Female

How old are you? _____ years old
Where do you live?

○ Urban
○ Rural

What is your educational background?

○ Primary school or below
○ Junior high school
○ Senior high school/Vocational school
○ College
○ Bachelor's degree
○ Master's degree or higher

What is your occupation?

- ○ Government/Institution/Public Servant
- ○ Company/Corporate Employee
- ○ Professional (e.g., Education, Healthcare)
- ○ Self-employed/Freelancer
- ○ Farmer/Rural laborer
- ○ Student
- ○ Unemployed or Retired
- ○ Other (please specify)

What is your major?

- ○ Agricultural
- ○ Engineering
- ○ Humanities/Social Sciences
- ○ Other

What is your monthly living expense? _____ CNY
What is your height? _____ cm
What is your weight? _____ kg
How many people are there in your household? _____ persons
Does your household keep pets?

- ○ Yes
- ○ No

II. Attitudes Toward Animal Welfare and Consumption Intentions

How do you evaluate the following statement: "I feel upset every time I see animals being abused or in pain"?

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly agree

Please evaluate the following statements based on your personal experience.

Item (Statement)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Since farm animals will ultimately be slaughtered for consumption, their welfare doesn't matter.					
Human welfare has yet to be met, and it's not time to consider animal welfare.					
The cost of welfare-oriented farming is too high and not suitable for our country's reality.					
Some welfare farming practices are merely due to farmers' curiosity and novelty, or for commercial selling points.					

If there is animal welfare-certified milk available on the market, would you be willing to purchase it?

- ○ Definitely not
- ○ Probably not
- ○ Might consider
- ○ Probably will
- ○ Definitely will

III. Choice Experiment

People's purchasing decisions in hypothetical scenarios may differ from their real-life behavior. This difference is called hypothetical bias. In hypothetical scenarios, people often overestimate their willingness to pay for products, whereas in real-life situations, they may reconsider based on affordability.

In this section, you will be presented with six sets of milk with different qualities. These types of milk are available in supermarkets where you usually shop, with prices ranging from 2.8 to 8.8 CNY per bottle. For each set, you can choose one of the two options or neither. It is important that you make your choices as if you were selecting milk in your usual shopping scenario.

Below is some additional information about the milk:

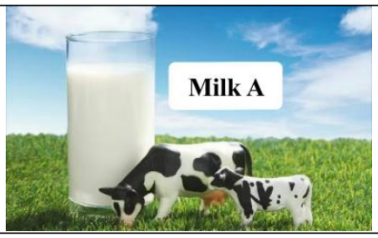
- Brand: Refers to the domestic or international brand.
- Shelf Life: The period during which the pre-packaged milk maintains its quality under the specified storage conditions.
- Protein Content: The amount of protein per 100 mL of milk.
- Label: Indicates whether the milk is produced following animal welfare or organic certification standards.
- Price: The price per 250 mL bottle.

Before starting, please provide your birth month:

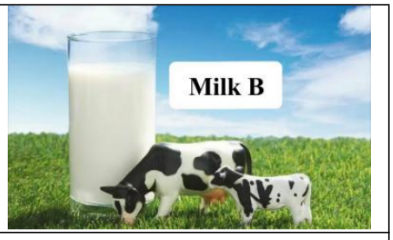
- ○ January or July
- ○ February or August
- ○ March or September
- ○ April or October
- ○ May or November
- ○ June or December

Due to space constraints, only the first block of the experiment (for respondents born in January and July) is presented below:

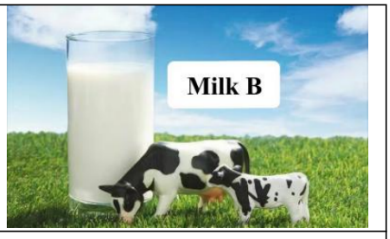
1/10/36

Attributes		
Brand	International	Domestic
Label	Animal welfare	No label
Protein	3.2g/100ml	3.6g/100ml
Shelf Life	One month	Trimester
Price	8.8 CNY/bottle	2.8 CNY/bottle
I will buy:		
A. Milk A	B. Milk B	C. None of these milk

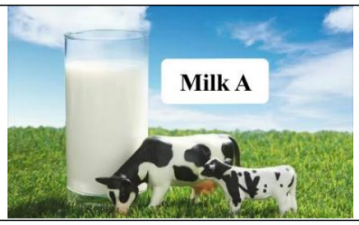
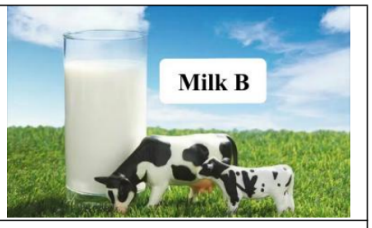
1/12/36

Attributes		
Brand	International	Domestic
Label	No label	Organic
Protein	4.0g/100ml	3.2g/100ml
Shelf Life	Five months	One month
Price	6.8 CNY/bottle	8.8 CNY/bottle
I will buy:		
B. Milk A	B. Milk B	C. None of these milk

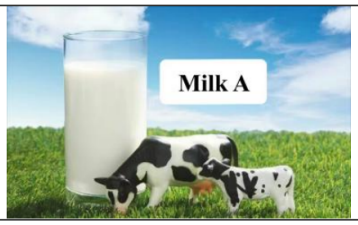
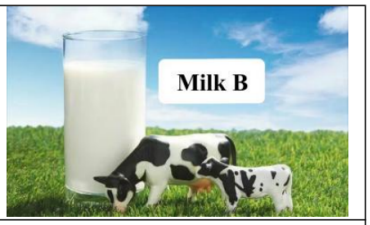
1/16/36

Attributes		
Brand	International	Domestic
Label	Animal welfare	No label
Protein	4.0g/100ml	3.2g/100ml
Shelf Life	One month	Trimester
Price	4.8 CNY/bottle	6.8 CNY/bottle
I will buy:		
C. Milk A	B. Milk B	C. None of these milk

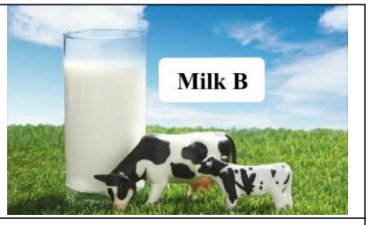
1/17/36

Attributes		
Brand	Domestic	International
Label	Animal welfare	No label
Protein	3.6g/100ml	4.0g/100ml
Shelf Life	Five months	One month
Price	8.8 CNY/bottle	2.8 CNY/bottle
I will buy:		
D. Milk A	B. Milk B	C. None of these milk

1/23/36

Attributes		
Brand	International	Domestic
Label	No label	Organic
Protein	3.6g/100ml	4.0g/100ml
Shelf Life	Trimester	Five months
Price	6.8 CNY/bottle	8.8 CNY/bottle
I will buy:		
E. Milk A	B. Milk B	C. None of these milk

1/25/36

Attributes		
Brand	International	Domestic
Label	No label	Organic
Protein	3.2g/100ml	3.6g/100ml
Shelf Life	Trimester	Five months
Price	2.8 CNY/bottle	4.8 CNY/bottle
I will buy:		
F. Milk A	B. Milk B	C. None of these milk

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Emerging market for pork with animal welfare attribute in China: An ethical perspective

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ABSTRACT

There is growing public concern about the welfare of farm animals, and farm animal welfare can be considered an ethical attribute of product quality. This paper elicits consumers' willingness to pay (WTP) for animal welfare attributes in pork products using a choice experiment (CE) in China. Consumers are willing to pay a premium of 13.923 to 18.493 CNY/500 g for more desirable product attributes in terms of animal welfare, branding, humane slaughter, and environmental friendliness. There is a complementary relationship between ethical morality in public policy and animal welfare farming. The findings of the study contribute to an increasing understanding of consumer preferences for animal-friendly products in emerging countries. A wide range of relevant, practical initiatives to help promote animal welfare development are needed in China, by strengthening the education of ecological ethics and animal welfare ideology, establishing an animal welfare security system by global standards, and optimising contractual arrangements for the value chain of animal-friendly products.

1. Introduction

The coronavirus (COVID−19) outbreak has triggered reflections on their relationship between humans and nature (Zhang & Xu, 2022). Societal attitudes towards animals are changing and a very high proportion of the people believe that welfare is important for both animals and humans (María, 2006). As a matter of fact, the public are showing more concern for the animal welfare, particularly in the domain of food production (de Queiroz et al., 2018; Schuck-Paim, Negro-Calduch, & Alonso, 2021). Farm animals, which are raised for the purpose of human consumption, provide proteins and other essential nutrients for human diets and deserve humane treatment, including respect, care, and humane slaughter (Phillips et al., 2010). For example, farm animals should be treated with animal welfare in mind and entitled to their five freedoms along the supply chain including the logistics and production processes, and this involves much more than good feeding. Many consumers hold that animal welfare and other social and moral attributes should be taken into account (Boogaard, Oosting, & Bock, 2006; Tonsor, Olynk, & Wolf, 2009; Van Loo, Caputo, Nayga, & Verbeke, 2014).

Animal welfare is recognised as an important attribute of high-end and high-quality food in the evolving livestock industry. Numerous studies in animal science have revealed a direct relationship between better animal welfare and higher-quality meat. For example, high welfare animals with less stress produce more palatable meat, and they also produce better milk, eggs, or wool, etc. Anderson and Barrett (2016) found that meat paired with factory farm descriptions looked, smelled, and tasted less pleasant than meat paired with humane farm descriptions. It implies that individual beliefs or values about how animals are raised can influence the consumers' eating experience. In fact, animal welfare is not only an important quality attribute of food products (Ortega, Hong, Wang, & Wu, 2016), but it is also indicative of human conscience and ethical norms (Bodur, Gao, & Grohmann, 2013). Wang and Gu (2014) argued that animal welfare products possess the characteristics of both private goods and public goods, which constitute the underlying economic attributes of farm animal welfare; the same authors also noted that consumers' willingness-to-pay (WTP) for animal

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welfare products may in essence originate not only from their self-interest tendencies, but also from their altruistic tendencies of consumers, or a combination of both. Hence, the willingness to pay a premium for animal welfare products may indicate consumers' altruistic tendencies, showing their humanitarian concern for animals.

Higher animal welfare products normally mean higher production costs, as animals require better feeding, care, housing and transport conditions, among other things. The additional costs are passed on to the consumers. A meta-analysis concluded that WTP for animal welfare could be viewed as relatively non-species specific (Lagerkvist & Hess, 2011), or consumer preference for animal welfare are product- rather than animal-specific (Olynk & Ortega, 2013). It is expected that consumers will pay more attention to food safety and environmental risks arising from meat production processes, and are willing to pay extra for meat products with such attributes as animal welfare, health, and environment-friendliness from the intensive production systems (de Passille & Rushen, 2005; Lai, Wang, Ortega, & Olynk Widmar, 2018; Liljenstolpe, 2008). A survey found that 34% of Australian respondents were willing to pay an additional 5% to 10% for animal products in conformity with the Five Freedoms of Animal Welfare (Taylor & Signal, 2009). A US study reported that the average consumer was willing to pay about 20% higher for pork and egg labelled as products without the use of gestation crates for pigs or cages for laying hens (Tonsor & Wolf, 2011).

Hog farming has been an important sector and the cornerstone of the animal husbandry industry in China. Topics related to pig welfare will likely gain traction among researchers and decision-makers alike. Since the 1980s, meat production in the country has been gaining strong momentum, with pork accounting for the biggest proportion (see Fig. 1). Despite the African swine fever in 2018 causing public panic and a drop in pork production, the output of pork in 2020 still reached 41.13 million tons, making up about 53.08% of total meat production.[1] It can be seen that the pig industry provides an important source of protein for Chinese residents. In 2014, China introduced the first set of farm animal welfare standards, Farm Animal Welfare Requirements: Pigs. Soon, a widening range of animal-friendly products will be available to meet the consumers' demand in China.

Previous research has confirmed consumers' willingness to pay price premium for farm animal welfare products in China. Although over 60% of respondents had never heard of the concept of animal welfare in mainland China (You, Li, Zhang, Yan, & Zhao, 2014), Wang and Gu (2014) found that respondents were willing to pay 16.2% higher for animal-friendly products without being informed of the link between animal welfare and meat quality and to pay 21.3% higher when given with the related information based on a survey in Jiangsu province. Ortega, Wang, Wu, and Hong (2015) compared the differences in consumer preference for animal welfare products from various retail channels in Beijing. Their study found that consumers were willing to pay a premium of 3.68 CNY per kilogram for pork with animal welfare attributes at domestic supermarkets. Most of these studies focus on Chinese consumers' attitudes towards and willingness to pay for animal welfare products. There is a lack of empirical research on consumers' motivation behind their preferences for animal welfare attributes in products available in China.

Studies have shown that most values are often associated with the direction of food choice motivation (De Boer, Hoogland, & Boersema, 2007) and that individuals' values can be used as a good predictor of animal welfare consumption preference (Sonoda, Oishi, Chomei, & Hirooka, 2018). In fact, many concepts, phrases, proverbs and sayings in the Chinese culture have been widely recognised to be full of ecological wisdom and passed on for generations, or even for centuries. "Unity of heaven and human" "inherent value" and "natural order of things under the heaven"[2] are just a few examples of such longstanding concepts. Therefore, the objective of this paper is to shed a new light – from an ethical perspective – on consumers' motivations to purchase welfare-friendly pork.

The main contributions of the present study cover the following aspects. Firstly, this study adds to a limited CE literature examining preferences for animal welfare and provides an estimation of Chinese consumers' willingness to pay (WTP), which extends the understanding of how consumers in emerging countries value the attributes associated with animal welfare. Secondly, consumer preference for pork with animal welfare attribute is explored from the ethical perspective using Random Parameter Logit (RPL) models. It helps stakeholders to better understand the basis of payment premium and consumption of pork products with animal welfare attribute. And finally, the findings of this study can also provide theoretical support for cultivating the high-end animal product market and provide guidelines for upgrading the production structure of the animal husbandry industry in emerging countries like China.

2. Material and methods

2.1. Research design

2.1.1. Choice experiment design

Considering that fresh lean pork is widely accepted by the vast majority of consumers, we chose it as an option for respondents in the shopping scenario. The quality of pork depends on many factors, including not only intrinsic characteristics such as colour, smell, tenderness, and nutrition, safety, appearance, convenience (Lebret & Čandek-Potokar, 2022; Wu, Wang, Zhu, Hu, & Wang, 2015), but also attributes based on eco-ethical standards such as animal welfare and environmental protection (Edwards, 2005; Gaviglio & Pirani, 2015).

Animal welfare should be conceived as an element of the agro-ecosystem that encompasses the entire logistical process from the farm of origin to the final product as well as the entire process of on-farm rearing, transport of the animals and slaughter at the abattoir. As the standards of animal welfare vary greatly from process to process, we focused our study on the welfare of animal farming like other researchers such as Li et al. (2017) and Denver, Sandøe, and Christensen (2017). Humane slaughter is an important aspect for the public to show their tenderness to animals. Many western developed countries, such as the US and the UK, have enacted laws that mandate more humane slaughtering of animals for human consumption. Protection of the natural ecological environment has been highly valued in recent years and the Chinese market has a high perception of environmental impact. Consumers can become an important positive contributor to a sustainable society by choosing healthy foods that meet environmental and social ethical standards (Ghvanidze, Velikova, Dodd, & Oldewage-Theron, 2016). Therefore, drawing on previous studies, animal welfare farming, humane slaughter, and environmental friendliness were chosen as the eco-ethical attributes in the present study.

Due to the limited information about pork production available at domestic supermarkets or wet markets, brand is an important consideration for consumers. In order to make the CE closer to reality, brand was included as one of the product characteristics. The price attribute consisted of three levels, using the average prices of lean pork in Guangzhou's large, medium and small-sized supermarkets, wet markets, and three major online fresh markets in China (*JD Fresh*, *Suning Commerce*, *Fresh Hema*) in February 2020. In the design, marketing pricing strategies were also taken into consideration. For example, while pricing at 49.9 or 50 CNY may have little impact on the sellers, 49.9 CNY would be perceived by the consumers as much cheaper than 50 CNY which is a round number. The characteristic attributes and levels of pork

[1] Source: 2020 China Statistical Yearbook.

[2] "天人合一" "天赋价值" "天道生生" in Chinese.

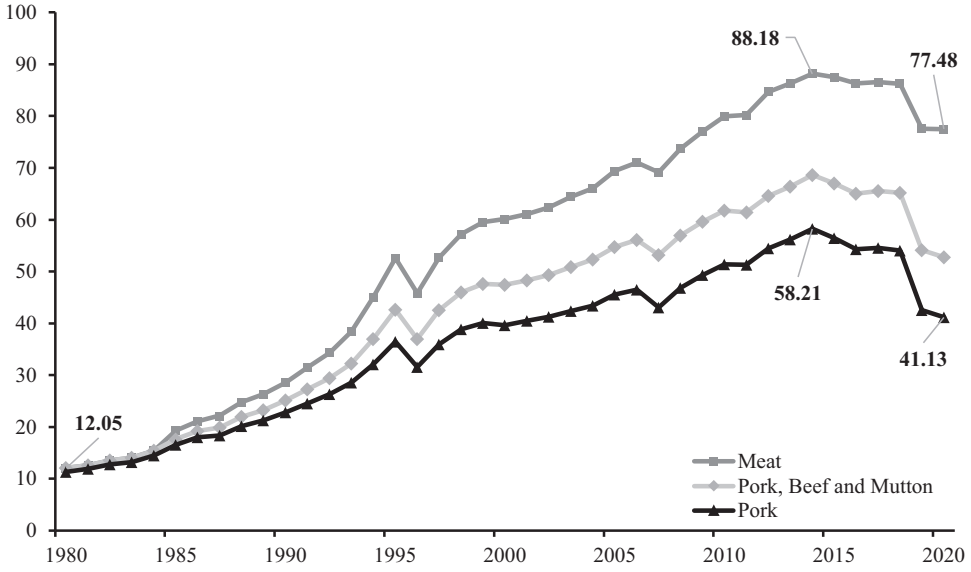

Fig. 1. China's meat production (in million tons).
Source: National Bureau of Statistics, China.

are shown in Table 1.

The choice experiment (CE) is a survey-based method designed with questions to elicit information on consumers' product preferences at the attribute level. These questions, called choice tasks, comprise two or more alternatives described by combinations of different product attributes. Respondents were presented with a series of choice tasks, which differ by the attribute's levels, and then asked to select an alternative. In this study, we selected five attributes as pork quality characteristics. A total of $2 \times 2 \times 2 \times 2 \times 3 = 48$ possible product options were available based on the above product attributes and their levels. Accordingly, $48 \times 47 = 2256$ product combinations or choice sets would be generated. Having three or more factors involved in the experiment might result in interactions between factors and increase the workload or complexity, making the experiment too difficult to implement. Accordingly, 12 choice sets were designed to estimate consumers' utility of pork attributes based on a D-optimal fractional causal analysis experimental design by using the Ngene 1.2.1 software package.[3] The choice sets were divided into two groups, each with six choice tasks in order to reduce the probability of selection fatigue.

Table 1
Pork attributes and levels used in discrete choice experiment.

Attribute	Description	Level
Welfare Farming	Farming practices that provide farm animals with comprehensive physical and mental care during the breeding process, including good feeding, good housing, good health and appropriate behaviour.	Yes, no.
Brand	The brand name that distinguishes one supplier's pork products from those of others.	Yes, no.
Humane Slaughter	Gentle care given to pigs prior to slaughter and techniques to make the process of slaughter (including transportation, slaughtering facilities, etc.) more humane, and thereby reduce the excessive stimulation and pain of pigs.	Yes, no.
Environmental Friendliness	The process of pork production causing minimal or no pollution to the surrounding environments such as air, water and soil.	Yes, no.
Price	Prices at which people usually buy fresh lean meat in supermarkets or wet markets (CNY/500 g).	49.9, 59.9, 69.9.

In the choice experiment, each choice set included two hypothetical alternatives and an opt-out or "no purchase" option, which made the experiment closer to reality. The purchase scenarios were randomly assigned to respondents based on the parity (singular or double) of the last digit of their mobile phone number. Furthermore, the order in which the choice tasks were presented was randomised to mitigate any ordering effects. In order to avoid the interference of different choice scenarios on the respondents and to ensure data quality within an acceptable range, the respondents were presented with only one choice scenario each time and made to stay in each choice scenario for no <12 s during the experiment. Meanwhile, in order to reduce the impact of hypothetical bias, a cheap talk strategy was used to inform respondents of the hypothetical bias prior to completion of the selection task (Cummings & Taylor, 1999). Fig. 2 shows a sample of the choice sets.

2.1.2. Survey design

The consideration of animal welfare is highly dependent on regional levels of economic and social development. Animal welfare may be more appealing in economically developed regions. Guangdong province (see Fig. 3) was selected as the survey area for the following reasons. Firstly, Guangdong is at higher levels of economic and social development, and has retained its place as the top province with the highest GDP in China for 33 consecutive years, with its GDP reaching approximately 1.92 trillion USD[4] in 2021. Guangdong's per capita disposable household income was 50,257 CNY or 7678 USD[5] in 2020, higher than the national average (32,189 CNY). The Engel coefficient[6] of Guangdong stood at 33.21%, close to the UN well-off line, better than that of Beijing (20.97%) and Shanghai (25.68%). With better performance than the national average in terms of various economic and social indicators, Guangdong stands out as more representative of the developed regions in China. Secondly, Guangdong, adjacent to Hong Kong and Macao, is

[3] Retrieved January 1, 2021, from http://www.choice-metrics.com.
[4] Exchange rate: 1 USD/CNY 6.1798, December 31, 2021 (CFETS).
[5] Exchange rate: 1 USD/CNY 6.5458, December 31, 2020 (CFETS).
[6] Engel coefficient = Per Capita Food Consumption Expenditure (in CNY) / Per Capita Consumption Expenditure (in CNY).

Attributes	Pork A	Pork B
		
Welfare Farming	×	√
Brand	√	×
Humane Slaughter	×	√
Environmental Friendliness	√	×
Price	49.9 CNY/500 g	59.9 CNY/500 g
I will buy:	A. Pork A	B. Pork B	C. None of these pork

Fig. 2. A sample of the choice sets.

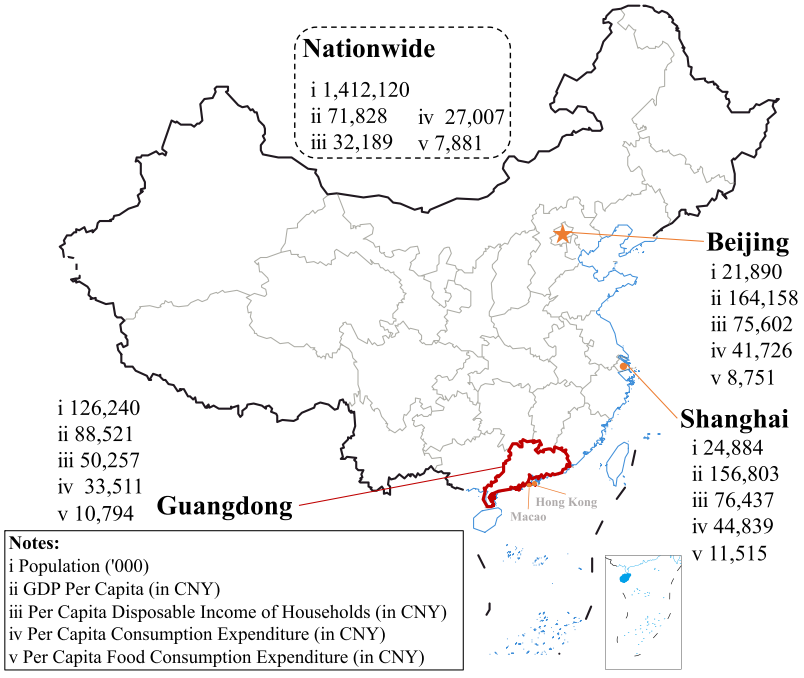

Fig. 3. Location of Guangdong province in mainland China.
Map Source: Amap.com. Data Source: National Bureau of Statistics of China. National data do not include data of Hong Kong, Macao and Taiwan. Data shown in the figure are for 2020.

the most vibrant province in opening up to the outside world, and apt to understand, discuss, and embrace new ideas and concepts like animal welfare. This receptive attitude can better predict China's future focus on animal welfare. Thirdly, Guangdong people (also known as "Cantonese people") are widely recognised as "truly discerning gastronomes" in the country, with Guangdong cuisine (better known as "Cantonese cuisine") being among the Eight Great Cuisines of China. This good reputation, in turn, means that Cantonese people may pay more attention to pork consumption. All of the above-mentioned facts and observations helped to control unobserved factors that were not clearly controlled, such as household food supplies, regional tastes, diet and other cultural factors.

Face-to-face surveys may significantly increase investigation costs and lead to the deviation caused by interviewees' limited cognitive resources including time and energy during the survey. Due to the COVID−19 quarantine and isolation rules, the questionnaires were

conducted online through *Wenjuanxing*,[7] the largest online survey platform in China. The platform recruits and maintains a group of consumers who participate in surveys from time to time with small incentives. Participants will randomly receive email invitations and URLs of the survey, and subsequently receive their rewards in the form of credits that can be converted to vouchers for shopping. Participation in each investigation is voluntary. A standardised set of instructions are compiled by the researchers, including the purpose and significance of their study.

This survey was anonymous and ethical approval had been granted by College of Economics & Management, South China Agricultural University. The following criteria were used to target the qualified respondents: They are in charge of purchasing fresh food for their families, they personally consume pork products, and they are over 16 years old. The survey data collected included the consumers' demographic background, ethical and moral cognition, and their pork consumption behaviour, among other things. Choice experiments were conducted on the selection of fresh lean pork to obtain consumers' WTP for pork with animal welfare and other quality attributes.

In February 2020, a pilot survey was conducted among 90 consumers who were the principal purchasers of family food. In the pre-test, most respondents had stated that they did not know about the "animal welfare" concept. Hence, we provided clear definitions of farm animal welfare and products with this particular attribute in the instruction part of the formal questionnaire. Based on the feedback and suggestions from sample consumers, we rephrased the questionnaire to make it more concise and easier to understand, removed survey questions inconsistent with the local situation, and added some more valuable questions.

The formal survey was conducted in March 2020 and a total of 1637 questionnaires were collected. Using completeness and quality of information as the screening criteria, we eliminated invalid questionnaires where crucial information or logical basis was missing. Respondents with monotonous response behaviour were also excluded because they might not have thoroughly read the questions but completed the survey only for the rewards. A total of 1274 valid questionnaires were finally obtained, with 7644 choices (1274 respondents × 6 choice sets) completed. The effective rate of the survey was 77.83%. All statistical analysis was carried out using the software package Stata 16.0 (Stata Corp. 2019, Stata Statistical Software: Release 16, Stata Corp LLC).

2.1.3. Statistical analysis

Discrete selection model has become an important tool to study consumer demand and to inform marketing strategy and food policy. Evaluation of consumer choice behaviour can help estimate the marginal value of various characteristics embodied in different commodities. In the literature on agriculture and applied economics, this method was adopted to analyse Chinese consumers' food safety concerns (Ortega, Wang, Olynk, Wu, & Bai, 2012; Phillips et al., 2010), country-of-origin labels (Ortega et al., 2016; Ying, Huihui, Goodman, Shangwu, & Huiqin, 2009), product traceability (Bai, Zhang, & Jiang, 2013; Wu et al., 2017; Wu, Liang, & Chen, 2020; Xu & Wu, 2010; Yuan, Wang, & Yu, 2020), organic or green food certification (Tariq, Wang, Tanveer, Akram, & Akram, 2019; Yu, Gao, & Zeng, 2014; Zheng, Li, & Peterson, 2013), animal welfare (Lai et al., 2018; Ortega et al., 2015) and the welfare effect of food policy (Wahl, Seale, & Bai, 2018).

Traditional literature assumes that consumer preferences are homogeneous, thereby it can be estimated using the conditional Logit model (McFadden, 1974; Train, 2009). However, consumer preferences are heterogeneous in reality (Wedel & Kamakura, 2012). In a body of literature on discrete choice models, different methods are used to model or explain preference heterogeneity. A commonly used method is to estimate the RPL model, also known as mixed Logit (Train, 2003). For food selection models, if the price coefficient is limited to a fixed range (e.g. estimating the RPL model in preference space), then when the change of actual scale exceeds the observed value, the change of scale will be mistakenly attributed to the WTP change of product characteristics. Hence, we estimated the RPL model in the WTP space which allowed variations on the price coefficient and directly estimated the distribution of WTP (See the full estimation methods and econometric models in the Appendix I for additional details).

2.2. Descriptive statistics

2.2.1. Sample characteristics

Table 2 reports the sample characteristics of the survey. The lack of reliable urban consumer demographic data (Ortega et al., 2012) hinders a clear comparison with our sample, thus making it challenging to establish how representative our sample might be. Nevertheless, official data available did show the female proportion of Chinese residents (48.76%), their average age (38.8 years), household disposable monthly income (32,189 / 12 = 2682.42 CNY), and the ratio of education with a college degree or above (15.47%) as of 2020.

In our study, the respondents spanned a wide range of industries, including but not limited to healthcare, science and technology, education, culture, business and government. Over 60% of respondents were female, which was in line with the fact that more women were responsible for the family diet. The average age of the respondents was about 32 years, and >65% of them had received higher education. Nearly 70% of the respondents' household income was between 6000 and 24,000 CNY per month. Our sample characteristics were consistent with that of Beijing surveyed by Lai et al. (2018), whose study included fewer samples.

In comparison to the Chinese population, our sample was younger, better educated, and better off financially. However, we argue that our sample can be considered fairly representative of the high-end supermarket consumers, who may be more likely to accept the idea of animal welfare and have more access to information that might drive changes in production systems.

2.2.2. Pork consumption habits

With regards to consumption habits, Table 3 shows that over 80% of respondents buy pork more than twice a week, and approximately 15% do it daily, indicating the importance of pork in consumer diet. Over 50% of respondents purchase >500 g of pork per time. Wet markets are the top source of meat products for consumers (82.34%), followed by large supermarkets (51.65%), small and medium-sized supermarkets (32.34%). Although our survey was carried out during the COVID−19 epidemic, only a minority of consumers order meat online, accounting for <7% of the total respondents. The possible reason for this is that online stores such as Fresh Hema and Wal-mart deliver their fresh meat (and produce) only to customers located within half an hour's drive or one kilometre from their premises, in order to ensure the hygienic condition and preservation of their products.

In recent years, especially since the outbreaks of African swine fever in 2018, China's pork imports have been constantly on the rise, with the

[7] Wenjuanxing (www.wjx.cn) has released 125 million questionnaires and collected 9.923 billion questionnaires from respondents as of July 2021. By recruiting and maintaining a clientele, the sample service provider can sometimes offer consumers rewards for participating in surveys. The rewards offered to participants are credits that can be accumulated and redeemed for retail vouchers. Emails with a link to the survey are sent to participants randomly and based on the researchers' requirements for the sample. Participation of each investigation is voluntary. Researchers can contact the sample provider, send the latter their survey and pay certain fees for access to consumers who are readily available to participate in their online survey. The fees depend on complexity of the questionnaire and duration of the survey as well as the required characteristics and number of the consumers.

Table 2
Socio-demographic characteristics of the sample.

	Consumers			Residents
	Guangdong	Shanghai	Beijing	China
Source	Our survey	Lai et al. (2018)	Lai et al. (2018)	National Bureau of Statistics, China (2020)
Study object	Pork	Pork	Pork	–
Sample size	1274	221	259	1.41 billion
Female (%)	62.48	68	63	48.76
Average age (in years)	32.25	43	33	38.8
Education level (%)				
Primary school and below	0.55	4	4	34.92
Junior high school	5.18			34.51
High school (secondary vocational school)	10.08	43	19	15.10
College (higher vocational school)	16.64	20	19	
Undergraduate	54.00	24	49	15.47
Graduate students and above	13.58	9	9	
Number of family members dining together (%)				
2 people and below	17.04			
3 people	24.88			
4 people	26.14			
5 people	21.11			
6 or more people	10.83			
Monthly household income (%)				
< 6000 CNY	17.03	27	36	
6000–12,000 CNY	33.28	43	38	
12,000–18,000 CNY	20.88	12	15	
18,000–24,000 CNY	13.34			
24,000-30,000 CNY	8.01	18	12[1]	
> 30,000 CNY	7.46			
Occupation (%)				
Personnel from healthcare, science and technology, education and culture	11.62			
Business staff	28.89			
Government and military personnel	12.32			
Workers and farmers	10.91			
Students	11.77			
Other (including retirees)	22.92			
Animal-related work (%)	5.18			
Raising pets at home (%)	23.86			

[1] Percentages may total >100% because of rounding.

deficit going up from 13,309 million CNY in 2017 to 63,228 million CNY.[8] When purchasing pork, consumers are most concerned with freshness (89.40%), followed by price (58.40%), colour (51.18%), pig varieties (19.00%), feeding methods (17.19%), convenience of purchase (16.64%), as well as brands (13.11%). It can be seen that consumers still mainly rely on their own experience when purchasing pork. The reasons for this may include the limited availability of pork product information in China and the lack of consumer confidence in the products. Therefore, consumers continue to use their experience and stick to "seeing is believing".

2.2.3. Consumer ethics and morality

When investigating one's ethical and moral status through self-reporting, a potential problem is that respondents may try to respond in a way more in line with social expectations, thereby increasing societal approval. Johansson-Stenman (2018) argued that animal welfare should matter intrinsically in public decision-making, and the intrinsic value of animal welfare should be included in conventional welfare economics. To ensure a higher level of objectivity in our measurement, consumers' opinions on how great a weight should be given to animal suffering in public decision-making were investigated to examine consumers' ethical and moral values towards animals. The question was based on a human-centred hypothesis and respondents were asked to compare the weight per suffering unit for animals and for humans in public decision-making. Following the practice of Johansson-Stenman, we further divided respondents' views into six levels of propositions, from "should not be taken into account at all' to 'should be highly considered", assigning 1–6 points.

As shown in Table 4, only 24.6% of Chinese respondents believe that animal suffering should be taken into account to the same extent as human suffering, much lower than the percentage (49.3%) of their Swedish counterparts in the survey conducted by Johansson-Stenman. The majority (about 66.3%) of Chinese consumers hold that animal suffering should be taken into consideration to some extent but given a

Table 3
Consumers' pork consumption habits.

Features	Effective Percentage (%)	Features	Effective Percentage (%)
Frequency of pork purchases per week		Most concerned when buying pork (multiple-choice)	
1 time and below	17.35	Brand	13.11
2–3 times	47.65	Packing	1.81
4–5 times	20.33	Origin	5.73
Almost every day	14.68[1]	Pig breeds	19.00
Pork quantity per purchase (500 g)		Freshness	89.40
≤ 0.5	10.28	Pork colour	51.18
0.5–1	39.09	Feeding methods	17.19
1–2	37.29	Mode of transport	1.10
> 2	13.34	Slaughtering methods	3.85
Purchase location (multiple-choice)		Growth time of Pig	6.36
Wet markets	82.34	Price	58.40
Small and medium-sized supermarkets	32.34	Convenience of purchase	16.64
Big supermarkets	51.65	Other	0.94
Online	6.99		
Other	1.96		

[1] Percentages may total >100% because of rounding.

Table 4
Distribution of consumer opinions on the weight that should be given to animal suffering in public decision-making.

Society can reduce the suffering of animals and humans through various measures, but these measures can be expensive. Do you think that animal suffering should be taken into account in public decision-making?	Frequency (%)	
	China	Sweden
A. Animal suffering should not be taken into account at all.	0.78	0.8
B. Animal suffering per se should not be taken into account, but the fact that some people suffer when knowing about animal suffering should be taken into account.	5.97	3.2
C. Animal suffering should be taken into account to some extent, but it should be given a much lower weight than human suffering.	33.99	13.2
D. Animal suffering should be taken into account to a large extent, but it should be given a lower weight than human suffering.	32.34	30.3
E. Animal suffering and human suffering should be taken into account to the same extent.	24.57	49.3
F. Animal suffering should be taken into account to a high degree and given a higher weight than human suffering.	2.35	3.2

Note: The data of China are based on the survey in this study, and those of Sweden are from the survey results of Johansson-Stenman (2018).

[8] Source: General Administration of Customs of People's Republic of China.

Table 5
Regression results of the RPL model for animal welfare consumption preference.

Attributes	Coefficient	Std. Dev.
Welfare Farming	17.678***	−9.467***
	(1.013)	(0.946)
Brand	15.376***	21.299***
	(0.981)	(1.114)
Humane Slaughter	13.923***	9.969***
	(0.893)	(1.141)
Environmental Friendliness	18.493***	7.845***
	(1.012)	(0.821)
Not to Buy	−56.284***	−37.875***
	(1.661)	(2.269)
Price / Scale	−2.525***	0.612***
	(0.060)	(0.052)
Wald chi2	2817.38	
Log likelihood	−5596.276	
AIC	11,216.55	

Note: Values with *** are statistically significant at the 1% level. Each number in () is the standard error.

lower or much lower weight than human suffering. Only 0.78% of Chinese respondents think that animal suffering should not be taken into account at all. Therefore, the standard economic assumption that animals should be seen as tools has to be questioned, and it would be fair to assert that Chinese consumers generally have good ethical beliefs about animals.

3. Results

3.1. Consumer preference and its heterogeneity

Table 5 presents the regression results of the RPL model in the WTP space. Empirically, consumers have strong preference for pork with various attributes such as welfare farming, brand, humane slaughter, and environmental friendliness. The premium price for pork with welfare farming attribute is 17.678 CNY/500 g, slightly lower than that for pork with environmental friendliness attribute (18.493 CNY/500 g), followed by that for pork with brand attribute (15.376 CNY/500 g) and humane slaughter attribute (13.923 CNY/500 g). The coefficients are all statistically significant at the 1% level.

The standard deviations of four attributes, including welfare farming, brand, humane slaughter, and environmental friendliness, are significant at the 1% level, indicating that consumer preferences for the attributes are heterogeneous. However, Ortega, Chen, Wang, and Shimokawa (2017) found that consumers from Guangzhou had homogeneous preferences for pork with animal welfare and environmental attributes, whereas those from Hong Kong had heterogeneous preferences.

Fig. 4 presents individual-level (conditional) estimates of WTP for the various attributes[9] and intuitively shows the heterogeneity of consumer preferences. It shows that consumers' preferences for the brand attribute differ the most, indicating that consumers have yet to form a unified understanding of brands. This may be due to the absence of unified production standards in the livestock industry, making it difficult to achieve the brand effect. For example, on Jingdong,[10] consumers can choose from many international brands such as Iberico (Spain), HuaDong (Canada), Sam (American), Elpozo (Spain), Joselito (Spain), Cinco Jotas (Spain), Lamontanera (Spain), Senorio (Spain) and Iber Bellota (Spain), in addition to domestic brands such as Muyuan, Zhengbang, and Wens, just to name a few. In contrast, consumer preferences for such attributes as welfare farming, humane slaughter and environmental friendliness differ less, and these attributes may be more representative for consumers to evaluate pork quality.

3.2. Ethics and animal welfare consumption preference

Interaction terms, including welfare farming variable and brand, humane slaughter, and environmental friendliness variables, were constructed and put into the baseline model for regression estimates. Regression results of RPL models are listed in Table 6. Coefficients of the interaction terms in Model (1) are positively significant at least at the 5% level, indicating that the welfare farming attribute is complementary to other attributes including brand, humane slaughter, and environmental friendliness.

Animal welfare covers the whole process of on-farm rearing, transport of the animals and slaughter at the abattoir. Thus, in order to examine how ethical values affect consumer preferences for animal welfare, interaction terms including consumer ethics and welfare farming, ethics and humane slaughter were sequentially put into Model (1) for regression estimates.

Results of Model (2) and Model (3) in Table 6 demonstrate that the coefficients of the interaction terms are all significantly positive. This indicates that improving consumers' ethical morality may increase their recognition of welfare farming and human slaughter, and thus help improve consumers' score utility and consumption confidence in pork products with animal welfare attribute.

3.3. Ethics orientations and pork consumer segments

Lund, Denver, Nordström, Christensen, and Sandøe (2021) identified consumer segments on the basis of animal ethics orientations. Building on their practice, we divided respondents into three types based on respondents' opinions on the weight that should be given to animal suffering in public decision-making: anthropocentrism,[11] animal protection,[12] and animal rights,[13] omitting the lay utilitarian orientation because it primarily relates to extreme trade-offs between animal pain and human benefits (Lund, Kondrup, & Sandøe, 2019). It helps to further explore consumer preference with different ethical and moral positions.

The regression results in Table 7 show that consumers with different ethical views have significantly positive preferences for various attributes including welfare farming, brand, humane slaughter and environmental friendliness. Respondents with anthropocentric values are willing to pay a premium of 6.563 CNY/500 g for pork with the welfare farming attribute, while animal protection respondents are willing to pay an additional 15.060 CNY/500 g, and animal rights respondents 44.516 CNY/500 g. All three types of consumers are also willing to pay relatively high premiums for pork with the humane slaughter attribute, namely 5.076, 11.064 and 35.409 CNY/500 g, respectively. The payment premiums for pork with the environmental friendliness attribute are 6.731, 16.080 and 40.514 CNY/500 g, respectively.

[9] Individual estimates are derived using the population distributions in conjunction with consumers' observed choices over different choice sets. These distributions represent an estimate of individual-specific preferences, conditional upon observed choices and the distribution of preferences in the population (Train, 2003).

[10] Jingdong, also known as JD.com, Inc., (https://www.jd.com) is a leading e-commerce platform in China, running its online fresh supermarket in addition to its longstanding retail business.

[11] On public decision-making, respondents with anthropocentric values hold that "animal suffering should not be taken into account at all", or that "animal suffering per se should not be taken into account, but the fact that some people suffer when knowing about animal suffering should be taken into account".

[12] On public decision-making, respondents with animal protection values hold that "animal suffering should be taken into account to some or a large extent, but it should be given a lower or much lower weight than human suffering".

[13] On public decision-making, respondents with animal rights as their values hold that "animal suffering and human suffering should be taken into account to the same extent", or that "animal suffering should be taken into account to a high degree and given a higher weight than human suffering".

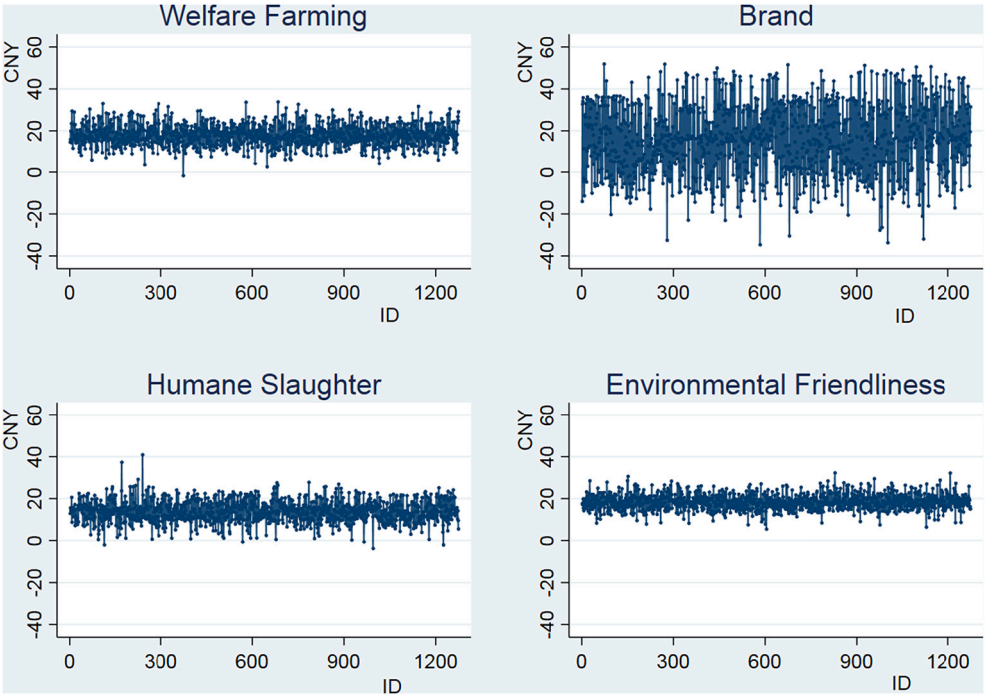

Fig. 4. WTP (conditional) estimation of pork attributes at the consumer level. Each dot represents an individual's expected WTP from conditional estimates.

Table 6
Regression results of RPL model of ethics and animal welfare preferences.

Attributes	Model (1)		Model (2)		Model (3)	
	Coefficient	Std. Dev.	Coefficient	Std. Dev.	Coefficient	Std. Dev.
Welfare Farming	3.579	5.329***	−4.678	−0.644	−8.173**	7.977***
	(2.970)	(1.870)	(3.816)	(2.969)	(3.762)	(1.802)
Brand	11.413***	−20.383***	12.240***	21.040***	12.550***	20.443***
	(1.731)	(1.314)	(1.702)	(1.236)	(1.704)	(1.254)
Humane Slaughter	10.945***	−5.659***	10.999***	9.192***	−0.837	3.307
	(1.590)	(1.686)	(1.589)	(1.123)	(2.637)	(2.467)
Environmental Friendliness	11.265***	5.235***	11.944***	6.112***	11.994***	5.626***
	(1.798)	(1.774)	(1.856)	(1.522)	(1.789)	(1.375)
Welfare Farming × Brand	8.328***	−14.739***	6.902**	−8.934***	6.482**	−13.319***
	(2.836)	(2.597)	(2.752)	(2.518)	(2.712)	(2.342)
Farming × Humane Slaughter	6.048**	9.681***	6.323**	−3.928	7.008**	7.392***
	(2.856)	(2.286)	(2.788)	(2.396)	(2.752)	(2.281)
Welfare Farming × Environmental Friendliness	14.742***	−11.979***	12.936***	−7.796***	13.596***	13.333***
	(3.166)	(2.435)	(3.147)	(2.389)	(3.103)	(2.299)
Ethics × Welfare Farming			2.474***	2.306***	3.340***	1.127*
			(0.667)	(0.353)	(0.660)	(0.636)
Ethics × Humane Slaughter					3.106***	1.456***
					(0.609)	(0.364)
Not to Buy	−68.954***	38.516***	−66.707***	−38.787***	−66.419***	37.619***
	(3.069)	(2.678)	(3.089)	(2.791)	(2.904)	(2.621)
Price / Scale	−2.626***	0.464***	−2.612***	0.516***	−2.628***	0.390***
	(0.061)	(0.058)	(0.061)	(0.057)	(0.063)	(0.063)
Wald chi2	2240.98		2391.87		2105.60	
Log likelihood	-5582.240		−5562.782		-5561.214	
AIC	11,200.48		11,165.56		11,166.43	

Note: Values with ***, **, and * are statistically significant at the 1%, 5%, and 10% levels, respectively. Each number in () is the standard error.

Fig. 5 intuitively shows the WTP for different pork attributes among consumers with different ethical positions. The brand attribute is most valued by anthropocentric respondents. A possible reason is that with insufficient information provided, most consumers have to try to judge the safety and quality of pork through their perception of the brand and their own experience. Therefore, the identification and description of the brand should be improved in terms of labelling and traceability. Animal protection respondents value the environmental friendliness attribute most. Animal rights respondents are willing to pay much higher premiums than other consumers. Their favourite attribute is welfare farming, followed by attributes of environmental friendliness, humane slaughter and brand.

Table 8 shows the socio-demographic characteristics of the three pork consumer segments. We identify statistically significant differences regarding all four socio-demographic variables reported among the segments. Anthropocentric respondents are mainly distributed in groups

Table 7
Regression results of RPL model for the three consumer segments.

Attributes	Anthropocentric		Animal Protection		Animal Rights	
	Coefficient	Std. Dev.	Coefficient	Std. Dev.	Coefficient	Std. Dev.
Welfare Farming	6.563***	7.324***	15.060***	−5.841***	44.516***	25.711***
	(2.421)	(2.045)	(1.030)	(1.013)	(8.244)	(5.894)
Brand	14.504***	16.534***	14.493***	18.759***	28.372***	−31.199***
	(3.064)	(2.222)	(1.036)	(1.157)	(5.455)	(5.973)
Humane Slaughter	5.076**	6.812***	11.064***	−5.542***	35.409***	−22.080***
	(2.031)	(2.229)	(0.853)	(1.135)	(6.991)	(4.920)
Environmental Friendliness	6.731***	0.463	16.080***	7.617***	40.514***	13.354***
	(2.041)	(1.859)	(1.035)	(1.034)	(7.618)	(4.149)
Not to Buy	−59.874***	24.462***	−58.756***	−31.060***	−40.379***	60.364***
	(6.887)	(5.130)	(2.245)	(2.503)	(7.687)	(14.804)
Price / Scale	−1.928***	0.801**	−2.388***	0.613***	−3.241***	0.559***
	(0.300)	(0.342)	(0.076)	(0.073)	(0.213)	(0.122)
Number of Experiments	516		5070		2058	
Wald chi2	490.14		1491.19		666.77	
Log likelihood	−359.270		−3681.064		−1491.898	
AIC	742.540		7386.127		3007.796	

Note: Values with *** and ** are statistically significant at the 1% and 5% levels, respectively. Each number in () is the standard error.

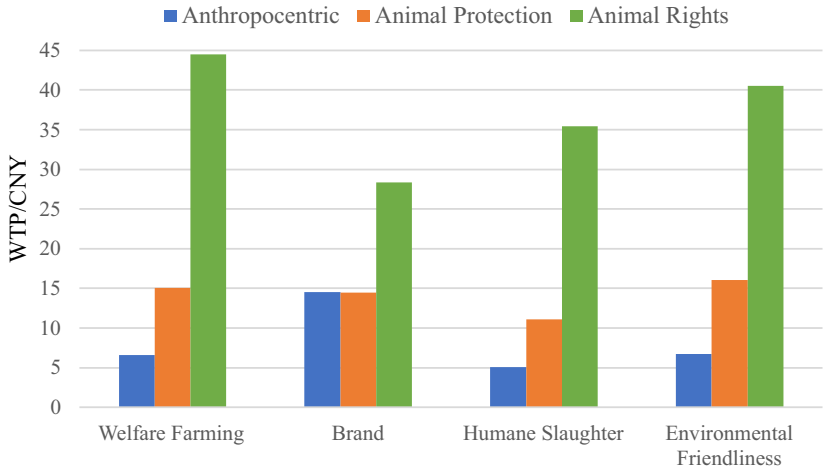

Fig. 5. Three segments of consumers' WTP for different pork attributes.

of male (58.14%), low-educated (43.02%), low-income (59.30%), and older age (35.465). The socio-demographic characteristics of animal protection respondents and animal rights respondents are more or less consistent, mainly concentrated in female, moderately-educated, and young age groups. The females show more concern for animal protection (61.30%) and animal rights (70.55%) than the male. Interestingly, the proportion of highly-educated respondents in the anthropocentric segment (20.93%) is higher than those in animal protection and animal rights segments (14.56%, 9.33%), while the proportion of the moderately-educated in the animal protection (56.33%) and the animal rights segments (52.77%) is higher than that in the anthropocentric segment (36.05%). We note that income differences between the segments are relatively modest, and that no clear pattern emerges.

4. Discussion

In China, the world's largest emerging country, there are different opinions among the public about animal welfare. “Why should we be concerned with animal welfare when issues related to human welfare remain unsolved?” This is the first question that the advocates should answer. There are no easy answers to this question, but there are at least two possible answers the literature provides. On the one hand, a large number of experiments have proved that improving farm animal welfare can help reduce the occurrence of infectious diseases (Deng, Mao, Feng, Gao, & Yin, 2016), eliminate the risks of food safety, and improve the quality of animal-derived products effectively (Boyle & O'Driscoll, 2011; Phillips et al., 2010). On the other hand, the idea of animal rights is different from that of animal welfare: The former is mainly about advocating for equality between animals and humans, while the latter is about advocating for humane use of animals and against any form of animal abuse, with the proposition that animals should not suffer unnecessary pain from human activities, which is consistent with the traditional Chinese ecological ethics. Generally speaking, improving animal welfare is conducive to the improvement of human welfare in both the material perspective of food quality and the spiritual perspective of ethical requirements. Hence, more concern for animal welfare is particularly necessary for the livestock industry in China.

The study finds that Chinese consumers have a fairly strong moral identity and emotional demand when it comes to animal welfare. The ethical relationship between human beings and other animals is a philosophical issue that transcends the traditional humane treatment (Phil, 1998). Fundamentally, people's moral concern for animals is also the moral concern for human beings. Our survey also found that >80% of respondents would feel bad when they saw animals being abused or suffering. Avoiding animals' unnecessary suffering can not only solve the problems of food quality and safety caused by the stress response by suffering, but also meet the special emotional needs of people for animal humanitarian care. The global outbreak of the COVID−19 epidemic in

Table 8
Socio-demographic characteristics of consumers with the three pork consumer segments (shares and mean (s.e.) and test of differences by Kruskal-Wallis).

Socio-demographics	Anthropocentric	Animal Protection	Animal Rights	*p*-Value (X2 (df))
Gender				
Male (%)	58.14	38.70	29.45	$p < 0.001$ (324.510 (2))
Female (%)	41.86	61.30	70.55	
Education[1]				
Highly-educated	20.93	14.56	9.33	$p < 0.001$ (171.895 (2))
Moderately-educated	36.05	56.33	52.77	
Low-educated	43.02	29.11	37.90	
Income[2]				
High-income	40.70	52.31	45.48	$p < 0.001$ (101.623 (2))
Low-income	59.30	47.69	54.52	
Age (in years) Mean (s.e.)	35.465 (11.625)	32.006 (9.666)	32.047 (10.222)	$p < 0.001$ (117.002 (2))

[1] Education is classified into three categories: highly-educated (graduate and above), moderately-educated (undergraduate) and low-educated (college, higher vocational education and below).
[2] Income is classified into two categories: high-income (monthly household >12,000 CNY) and low-income (monthly household <12,000 CNY).

2020 provokes profound rethinking of the relationship between humans and animals, and that between humans and the ecological environment. The concept of harmonious development among humans, animals and the ecological environment has been increasingly recognised by the Chinese public. The study also finds that only 6.75% of consumers are anthropocentric, while animal protection consumers account for 66.33% and animal rights consumers 26.92%. The public's strong consumption preference for animal welfare products may become an important incentive to promote farm animal welfare.

Furthermore, the study indicates a complementary relationship between consumer ethics and animal welfare preference, and positive eco-ethics helps to improve consumer preference for products with the animal welfare attribute. Though notably, consumers tend to exaggerate their propensity to buy ethical products (Langen, 2013), consumers' WTP for high welfare products may in essence originate not only from self-interest tendencies, but also from altruistic tendencies of consumers, or from a combination of both (Wang & Gu, 2014). At the point of purchasing meat, the information of egoistic attributes, such as freshness, price, nutrition, production date, and variety, is a focus to most consumers (Klink-Lehmann & Langen, 2019). While the information of altruistic attributes, namely ethical attributes, such as transportation process to slaughterhouses, breeding environment and slaughter conditions, may become less important (Grunert, Bredahl, & Brunsø, 2004; Klaus, 1997; Klink-Lehmann & Langen, 2019; Verbeke & Ward, 2006).

In general, there is a gap between consumers' WTP and actual purchase behaviour for animal welfare products. One highly possible explanation for this is that low income prevents them from doing what they actually believe they should do in practice. However, providing animal welfare information may become an important and indispensable strategy to better meet the differentiated needs of Chinese consumers, regardless of their income. Probably, this is because products with the animal welfare attribute can be regarded as credence goods (Darby & Karni, 1973), and the production process information through the identification of products, such as labels or certification, helps consumers buy the proper products (Dimara & Skuras, 2005; Sans & Sanjuán-López, 2015). In this regard, meat retailers play a key role in the purchasing behaviour of their customers and are the main source of information for their buying selection (Miranda-de la Lama, 2013). It is particularly important for retailers to explain the virtues of meat and its origin, both of which may increase consumers' confidence in animal welfare products. However, one aspect that consumers would highly value is the actual price charged by producers for the meat they are buying. Dual labelling with the price at origin and the final price could greatly affect the purchasing decision.

5. Conclusions and policy implications

The study empirically analyses the effect of ethical morality on animal welfare consumption preference by discrete choice experiment. There are several findings as below: consumers were willing to pay 13.923 to 18.493 CNY/500 g price premium for pork attributes that regarded welfare farming, brand, humane slaughter and environmental friendliness. Consumer preferences were significantly heterogeneous, where the brand differed most, followed by humane slaughter, welfare farming and environmental friendliness. There was a complementary relationship between consumer ethics considering public policy and animal welfare. It means that, the stronger the consumer ethics, the higher the WTP for the animal welfare attribute. Overall, consumers who held different animal ethics orientations have significant differences in their preferences and willingness to pay for welfare-enhanced pork. There are several policy implications as below.

Firstly, education on animal welfare is needed. People who are involved in animal welfare-related studies and activities may be generally more committed to animal welfare. It is important to make the public believe that animal welfare is an important issue. The government can seek to strengthen the education of ecological ethics and animal welfare ideology by means of media, organisation, education and training, so as to better inform the decision-making process. For example, it is advisable to teach humanism during compulsory education to instill generally recognised ideas, concepts, and values about animal protection and harmonious coexistence of humans and animals; provide animal welfare courses in colleges, enterprises and institutions in the field of animal husbandry offered to enhance the awareness of animal welfare; and to further popularize the concept and practice of moral consumption among the general public by means of media-based publicity and education.

Secondly, a security system of animal welfare is necessary. Animal welfare regulation is designed for preventative purposes and consists mainly of requirements relating to interior house design and management, i.e., resource- and management-based requirements, in order to detect and limit welfare risks (Lundmark Hedman, Berg, & Stéen, 2021). On one hand, a more systematic legal system should be established to provide long-term guidance on animal welfare, e.g. to address the regulation of aspects that affect all systems transversally: transport and slaughter. On the other hand, it is necessary to incorporate animal welfare into the industry production standards, which is helpful for animal husbandry enterprises to optimise their production structures and improve product quality. In addition, a system of farm animal welfare certification should be set up to eliminate information asymmetry, particularly in an emerging market. This is equally important to ensure food quality as regards imports of pork and pork- products and help increase the value and recognition of foreign agricultural products. Tough mandatory labelling may lead to negative selections of low-quality animal products, reducing consumers' choices. Mandatory legislation on animal welfare can improve the social welfare by increasing the private value of animal welfare products (Uehleke & Hüttel, 2016).

Thirdly, an innovative contractual arrangement for the value chain of the product is recommended. Farmers or enterprises are often bound by contracts at the downstream production stage. It is necessary to involve the slaughter and processing industries in the development of animal welfare standards, so that farmers or enterprises have the opportunity to produce under higher animal welfare standards. At the same time, compliance with higher animal welfare standards is a long-term capital investment. Producers may be able to leverage the financial guarantees provided by the downstream industry, both to gain the

opportunity to produce a high-quality product, and to avoid the financial pressure of improving animal welfare on their farms by increasing the profitability of their animal products. In this regard, it is important to identify target customers (e.g. female, moderately-educated, and low-age, etc.) and develop efficient marketing strategies for consumers with different ethics orientations. Through new contractual arrangements, animal industry practitioners can help better respond to the public demand and improve their reputation among the public.

The study has some shortcomings and limitations. First, the attribute level interaction effects should be considered in the choice experiment design to match the RPL model used, which is of particular concern in future studies. Second, the cross-section research design was applied, whereas future studies may use a longitudinal design to collect data at various points to better understand consumers' animal welfare preferences and the factors influencing those preferences. Finally, research funds and time limited the scope of the study in Guangdong province, China. Future research should expand the samples to other provinces to obtain more reliable empirical results.

Author statement

Liang Y. conceived and designed the project and experiments. Liang Y., Xu Y. and Huang D. conducted the experiments and investigations. Liang Y., Lai D. and Hua G. prepared the manuscript. Han L., Li H. and Wang H. performed critical review of the manuscript.

Declaration of Competing Interest

There are no conflicts to declare.

Data availability

Data will be made available on request.

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Appendix I. Estimation methods and econometric models

According to the random utility theory (McFadden, 1974), it is assumed that the indirect utility is linear in parameters and is composed of deterministic components and random components. Therefore, the personal indirect utility function can be expressed as:

$$V_{ijt}^{*} = \beta_i^{'} X_{ijt} + \epsilon_{ijt} \tag{1}$$

Where, X_{ijt} represents the vector of attributes obtained from the *jth* alternative in scenario *t*, β_i represents the vector of individual preference parameters, and ϵ_{ijt} represents a random utility component that is independent and identically distributed with a known (extreme) distribution. The random utility component denotes changes and errors unobserved in consumer preference. The indirect utility V_{ijt}^{*} is obtained by the actual selection V_{ijt}^{*}, where if $V_{ijt}^{*} = max\,(V_{1it}^{*}, V_{12t}^{*}, \ldots, V_{1kt}^{*})$, then $V_{ijt} = 1$, otherwise 0.

According to Train's explanation for the RPL model, the probability of individual *i* choosing alternative *j* in scenario *t* is:

$$Prob\left(V_{ijt} = 1 | X_{i1t}, X_{i2t}, \ldots, X_{ikt}, \Omega\right) = \int \frac{exp\left(\beta_i, X_{ijt}\right)}{\sum_{k=1}^{K} exp(\beta_i, X_{ikt})} f(\beta|\Omega) d\beta \tag{2}$$

Where, the vector Ω defines parameters characterised by preference distribution. Since the integral in Eq. (2) lacks a closed solution, simulated Maximum Likelihood Estimate (MLE) technique is usually used to estimate the model.

To estimate Eq. (2), it is necessary to specify the distribution family and draw random parameters from it. Typically, some studies specify that non-price parameters are normally distributed, while allowing the normal distribution of price coefficients is problematic, including the possible violation of downward-tilt demand curves and the derivation of WTP estimates with infinite variance (e.g., Revelt & Train, 1998). This is similar to assuming that people's preferences for the price are homogeneous, denoting that the standard deviation of unobserved utility or scale parameters are the same for all observations (Scarpa, Thiene, & Train, 2008).

Louviere (2004) believes that the scale parameters can and often change the observations randomly, ignoring this change will lead to wrong conclusions. For food selection models, if the price coefficient is limited to a fixed range, then when the change of actual scale exceeds the observed value, the change of scale will be incorrectly attributed to the WTP change of product characteristics.

One possible solution is to introduce heterogeneity and limit the sign of the price coefficient by specifying a distribution (such as lognormal distribution) whose domain is strictly located on one side of zero. Although the empirical and modifiable distribution of utility coefficients is consistent with the demand theory, it does not necessarily mean that WTP is a convenient distribution and vice versa (Scarpa et al., 2008).

Another solution is to estimate the model in the WTP space, where the model is re-parameterised so that the estimated parameter is the WTP of each attribute, rather than the marginal utility coefficient. For example, specifying utility in Eq. (1) is separable in the price *P* and non-price *X* attributes. Dividing the utility function by the scale parameter μ_i, we get:

$$V_{ijt}^{*} = -\left(\frac{\alpha_i}{\mu_i}\right) P_{ijt} + \left(\frac{\beta_i}{\mu_i}\right)^{'} \chi_{ijt} + \varepsilon_{ijt} \tag{3}$$

Where, ε_{ijt} is the extreme value of the independent identically distributed type I. Note that the WTP of each attribute is the ratio of attribute coefficient to price coefficient $\left(w_i = \frac{\beta_i}{\alpha_i}\right)$, thereby Eq. (3) can be converted into:

$$V_{ijt}^{*} = -\lambda_i \mathrm{P}_{ijt} + (\lambda_i \omega_i)^{'} \chi_{ijt} + \varepsilon_{ij} \tag{4}$$

Where, $\left(\lambda = \frac{\alpha_i}{\mu_i}\right)$ and w_i is the vector of WTP estimates for product attributes with normal distribution independent of scale.

Appendix II. Robustness test

In order to test the robustness of the above results, we firstly estimated the RPL models of Table 5 in the preference space.

Table 9 presents the regression results of the RPL model in the preference space. The AIC value of the RPL model in the WTP space estimation is smaller than that in the preference space estimation, and the premium for each attribute in the WTP space estimation is lower. Compared with the preference space estimation, the WTP space estimation using normal distribution of random parameters and logarithmic normal distribution of scaling factors is more suitable for our data.

Thereafter, we then estimated the RPL models of Table 6 in the preference space. The preference space estimation results in Table 10 are basically consistent with those in Table 6, and the AIC values estimated in Table 6 are smaller than their counterparts in Table 10. It can be seen that the regression results of RPL model based on the WTP space estimation in Table 6 are better.

Finally, we divided the ethics variable into two levels (high and low) based on its mean and median, and re-estimate Model (2) and Model (3) of Table 6 in the WTP space. Results in Table 11 and Table 12 show that the signs and significance of coefficients of the interaction between consumer ethics and animal welfare-related variables are basically consistent with their counterparts in Table 6. Therefore, the results are robust and reliable.

Table 9
Regression results of RPL model of animal welfare consumption preference based on the preference space estimation.

Attributes	Coefficient	Std. Dev.	WTP
Welfare Farming	1.134***	−0.694***	18.453
	(0.052)	(0.070)	[16.133, 20.773]
Brand	1.000***	1.397***	16.271
	(0.058)	(0.071)	[14.038, 18.504]
Humane Slaughter	0.917***	0.534***	14.929
	(0.045)	(0.086)	[12.875,16.983]
Environmental Friendliness	1.165***	−0.327***	18.963
	(0.050)	(0.105)	[16.648, 21.277]
Not to Buy	−3.768***	2.630***	
	(0.237)	(0.142)	
Price	−0.061***		
	(0.003)		
LR chi2	1452.80		
Log likelihood	−5631.566		
AIC	11,285.13		

Note: Values with *** are statistically significant at the 1% level. Each number in () is the standard error. Each number in [] is the 95% confidence interval.

Table 10
Regression results of RPL model of ethics and animal welfare preferences based on the preference space estimation.

Attributes	Model (1)		Model (2)		Model (3)	
	Coefficient	Std. Dev.	Coefficient	Std. Dev.	Coefficient	Std. Dev.
Welfare Farming	0.142	−0.549***	−0.326	0.103	−0.654**	0.527***
	(0.198)	(0.116)	(0.254)	(0.196)	(0.255)	(0.125)
Brand	0.766***	1.331***	0.770***	1.364***	0.812***	1.345***
	(0.114)	(0.081)	(0.113)	(0.074)	(0.114)	(0.078)
Humane Slaughter	0.662***	0.509***	0.678***	−0.251	−0.048	0.015
	(0.107)	(0.102)	(0.107)	(0.156)	(0.180)	(0.227)
Environmental Friendliness	0.679***	−0.228	0.669***	0.249**	0.687***	0.347***
	(0.120)	(0.146)	(0.119)	(0.121)	(0.120)	(0.093)
Welfare Farming × Brand	0.452**	−0.977***	0.474**	0.519**	0.462**	−0.914***
	(0.194)	(0.216)	(0.191)	(0.217)	(0.192)	(0.148)
Welfare Farming × Humane Slaughter	0.538***	−0.141	0.520***	−0.798***	0.503***	0.297
	(0.191)	(0.450)	(0.193)	(0.129)	(0.191)	(0.204)
Welfare Farming × Environmental Friendliness	1.013***	−0.749***	1.043***	0.824***	1.067***	0.897***
	(0.209)	(0.152)	(0.212)	(0.152)	(0.209)	(0.143)
Ethics × Welfare Farming			0.120***	−0.126***	0.214***	0.077**
			(0.042)	(0.027)	(0.044)	(0.034)
Ethics × Humane Slaughter					0.200***	0.113***
					(0.040)	(0.019)
Not to Buy	−4.384***	2.693***	−4.478***	2.624***	−4.518***	2.647***
	(0.258)	(0.135)	(0.269)	(0.125)	(0.264)	(0.122)
Price	−0.062***		−0.062***		−0.064***	
	(0.003)		(0.003)		(0.004)	
LR chi2	1505.68		1517.93		1514.63	
Log likelihood	−5603.034		−5578.356		−5570.583	
AIC	11,240.07		11,194.71		11,183.17	

Note: Values with *** and ** are statistically significant at the 1% and 5% levels, respectively. Each number in () is the standard error.

Table 11
Regression results of RPL model in the WTP space with the ethics variable classified by means.

Attributes	Model (1)		Model (2)	
	Coefficient	Std. Dev.	Coefficient	Std. Dev.
Welfare Farming	0.751	6.732***	2.142	9.441***
	(3.244)	(1.715)	(3.060)	(1.675)
Brand	12.935***	−21.459***	12.941***	20.640***
	(1.864)	(1.310)	(1.723)	(1.254)
Humane Slaughter	10.899***	−7.792***	6.872***	−0.863
	(1.684)	(1.443)	(1.629)	(4.038)
Environmental Friendliness	12.372***	−5.435***	12.523***	5.269***
	(1.967)	(1.351)	(1.814)	(1.395)
Welfare Farming × Brand	7.138**	10.060***	6.297**	−12.802***
	(3.006)	(3.780)	(2.731)	(2.487)
Welfare Farming × Humane Slaughter	8.685***	−1.123	7.410***	7.193***
	(3.001)	(3.351)	(2.805)	(2.443)
Welfare Farming × Environmental Friendliness	14.786***	−9.367***	12.912***	12.651***
	(3.452)	(2.923)	(3.209)	(2.750)
Ethics × Welfare Farming	5.086***	8.713***	5.287***	2.819
	(1.323)	(2.012)	(1.343)	(6.181)
Ethics × Humane Slaughter			6.798***	9.084***
			(1.236)	(1.328)
Not to Buy	−70.060***	−43.879***	−65.585***	37.204***
	(3.371)	(3.422)	(3.317)	(2.827)
Price / Scale	−2.668***	0.529***	−2.625***	0.402***
	(0.063)	(0.059)	(0.073)	(0.076)
Wald chi2	2129.24		1588.24	
Log likelihood	−5565.995		−5557.673	
AIC	11,171.99		11,159.35	

Note: Values with *** and ** are statistically significant at the 1% and 5% levels, respectively. Each number in () is the standard error.

Table 12
Regression results of RPL model in the WTP space with the ethics variable classified by median.

Attributes	Model (1)		Model (2)	
	Coefficient	Std. Dev.	Coefficient	Std. Dev.
Welfare Farming	4.027	−4.438	3.703	6.573**
	(3.064)	(3.349)	(3.077)	(3.109)
Brand	12.421***	−21.197***	13.276***	20.794***
	(1.762)	(1.245)	(1.800)	(1.375)
Humane Slaughter	11.382***	−6.114***	9.821***	6.439***
	(1.645)	(1.517)	(1.670)	(1.578)
Environmental Friendliness	12.332***	−5.985***	12.124***	6.005***
	(1.899)	(1.312)	(1.901)	(1.671)
Welfare Farming × Brand	7.055**	3.355	5.965**	−13.434***
	(2.816)	(3.726)	(2.889)	(3.869)
Welfare Farming × Humane Slaughter	6.365**	−7.393**	7.556**	2.347
	(2.933)	(3.010)	(2.946)	(4.530)
Welfare Farming × Environmental Friendliness	13.268***	−11.990***	13.957***	11.437***
	(3.352)	(2.261)	(3.318)	(3.012)
Ethics × Welfare Farming	3.783**	14.255***	4.837***	13.388***
	(1.576)	(2.360)	(1.699)	(3.710)
Ethics × Humane Slaughter			4.535***	−1.582
			(1.443)	(5.032)
Not to Buy	−68.926***	−42.346***	−68.604***	40.609***
	(3.448)	(3.562)	(3.139)	(2.993)
Price / Scale	−2.645***	0.528***	−2.692***	0.365***
	(0.067)	(0.058)	(0.065)	(0.062)
Wald chi2	2071.36		2309.96	
Log likelihood	−5569.467		−5576.712	
AIC	11,178.93		11,197.42	

Note: Values with *** and ** are statistically significant at the 1% and 5% levels, respectively. Each number in () is the standard error.

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Article

Knowledge of Animal Welfare and Consumers' Behavioral Intentions in China: A Moderated Mediation Model of Product Cognition and Empathy

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Simple Summary: In this study, consumer perceptions of animal welfare have been assessed. The results can strongly support the development of policies and legislation regarding animal-friendly production. In China, the demand for animal-friendly products is increasing, but so far, the research on the relationship between the knowledge of animal welfare and animal-friendly consuming intentions is limited. The objective of this study was to examine the impact of the knowledge of animal welfare on consumers' behavioral intentions and its mechanism. The survey covered 1499 food consumers in Guangdong province, China. Our empirical results suggest that increasing knowledge of animal welfare is significantly positive for the intention of animal-friendly products consumption. Furthermore, empathy moderates the indirect effect between animal-friendly product cognition and the behavioral intention both to purchase and recommend.

Abstract: As purchase power and consumption knowledge increase, consumers gradually demand safer and healthier products. Animal welfare is expected to be an important attribute of high-end food in the future and a major concern for the high-quality development of the livestock industry. The objective was to shed new light on our understanding of consumers' perceptions and behavioral intentions toward animal-friendly food. Using sample data of 1499 food consumers in Guangdong province, China, this study explored the role of product cognition and empathy in the relationship between consumers' knowledge and behavioral intentions. Results indicate that knowledge of animal welfare significantly influences consumers' behavioral intentions, and there is a mediating effect on cognition. Meanwhile, empathy moderates the relationship between product cognition and consumers' intentions to purchase or recommend animal-friendly products. Improving consumers' knowledge of animal welfare and cognitive levels of animal-friendly products may contribute to promoting animal-friendly product consumption and sustainable development of the livestock industry.

Keywords: animal welfare; knowledge; behavioral intention; product cognition; empathy

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1. Introduction

Animal welfare has been a widely discussed topic in recent decades. It plays an important role in promoting food safety and quality and achieving sustainable development of animal husbandry. As the largest and most populous developing country worldwide, China has been making heroic efforts to address the issue of human welfare, yet animal

welfare has been less of a concern. With the remarkable improvement in people's living standards, Chinese people have paid more and more attention to a healthy diet and food production management processes. High-end foods represented by organic foods are increasingly popular with the public. The number of product varieties has risen roughly every year since the implementation of organic food acts (China's Certification and Accreditation Administration (CNCA) developed Organic Product Certification Implementation Rules in 2005 and revised them in 2012, 2014, and 2019 to standardize the food certification process.) in 2012, and sales of organic food products have grown tremendously, reaching CNY 804 billion in 2020 (See Figure 1). The structure of public food consumption structure in China is moving toward an emphasis on quality together with economic development.

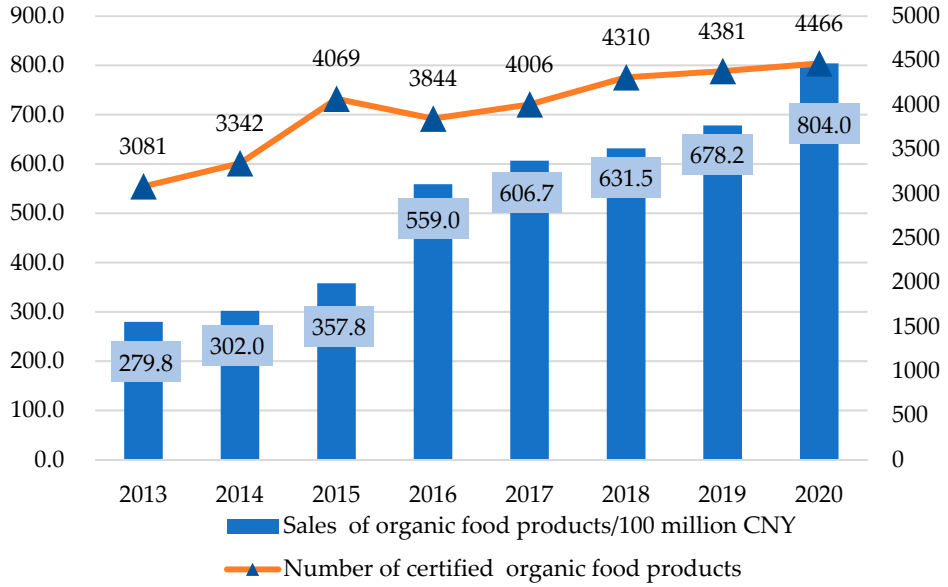

Figure 1. Trends of Chinese Organic Food Products. (Source: Green Food Development Center China and Prospective Industry Research Institute.)

Animal welfare is generally regarded as one of the quality attributes of food products [1]. Although over 60% of respondents had never heard of the concept of animal welfare in mainland China [2], based on a survey in Jiangsu province, Wang and Gu [3] found that consumers were willing to pay 16.2% more for animal-friendly products when not informed about the correlation between animal welfare and meat quality, and 21.3% more when informed of that information. Though there is no animal welfare product label in China at present, consumers are increasingly turning to products with higher welfare standards in Chinese daily consumption, exhibiting a positive perception and increased demand. Additionally, a growing number of Chinese consumers seem to consume broiler chickens from the free-range poultry system, natural grain-fed fattening pigs, and milk products without exogenous agents such as antibiotics, etc. These products with animal welfare attributes also tend to be more expensive. For example, fresh tenderloin of ecological black pigs fed with Chinese herbal medicine for more than 300 days sold for 129 CNY/kg on JOYBUY (JOYBUY, powered by jd.com, is one of the largest e-commerce companies in China.) on 31 December 2020, and the price was at least 1.5 times higher than that for ordinary pork.

Animal welfare is consistent with ethical requirements. Numerous scientific studies have demonstrated that increasing animal welfare may benefit animal production and health and the quality of animal-derived products while minimizing food safety risks and other related issues in the livestock industry [4,5]. Chinese consumers' willingness to pay (WTP) for animal welfare products may be because they think not only that animal welfare products are better, but also that animals deserve more consideration. In 2018, China

promulgated the Law of Wildlife Protection, aiming to maintain biodiversity and ecological balance and promote the harmonious development of man and nature. Particularly, under the influence of the global pandemic caused by COVID-19 in 2020, China has comprehensively banned eating wild animals, and the concept of a "community of destiny" between humans and animals has become more popular. In 2021, China moved to introduce the Animal Epidemic Prevention Law to prevent, control, purify and eliminate animal epidemics, promote the development of aquaculture, prevent and control zoonotic infectious diseases, and ensure public health safety and human health. Farm animal welfare plays a crucial role in promoting food safety and quality and achieving the sustainable development goals of animal agriculture. Currently, Chinese consumers' attitudes and willingness to pay for animal welfare improvements have been studied in a few articles [1,2,6]. There are also very few studies that show that information about the husbandry system may affect consumers' willingness to pay for animal-friendly products [7]. However, research on the relationship between knowledge of animal welfare and consumers' behavioral intentions in China remains rare.

As knowledge about animal welfare has increased, growing consumer demand has prompted the agricultural sector to adopt more sustainable and animal-friendly practices. The Chinese government is gradually becoming more aware of the need to provide higher standards of animal husbandry, so as to ensure farm animal health, the quality of animal-derived products, and the development of green agriculture. The International Cooperation Committee of Animal Welfare (ICCAW) of the China Association for the Promotion of International Agricultural Cooperation (CAPIAC) was approved by the Chinese Ministry of Agriculture in 2013. Since then, more regulations and policies have been introduced in China, such as Farm Animal Welfare Requirements: Pigs, China's first set of farm animal welfare standards. Soon, a widening range of animal-friendly products will be available to meet the consumer demand in China. Furthermore, behavioral intentions are a strong predictor of behavioral performance and a prerequisite for behavior [8]. A more intensive understanding of Chinese consumers' behavioral intentions regarding products with animal welfare attributes and in-depth research on its formation process and mechanism are urgently needed.

This paper is concerned with consumers' behavioral intentions regarding animal welfare products in China, and in particular, examines the impact of animal welfare knowledge and product cognition on consumers' behavioral intentions and its mechanism, and further seeks to investigate the role of empathy in the above mechanism. The main contributions of our work are reflected in the following aspects. Firstly, this study may shed new light on the relationship between knowledge of animal welfare and consumers' behavioral intentions. Secondly, it may provide an analytical foundation for stakeholders to better understand the heterogeneity in Chinese consumers' behavioral intentions toward animal welfare products and its intrinsic causes. And finally, the findings of this study can also provide a rationale for increasing demand for high-end animal husbandry products and promoting improvements in food consumption structure in China.

The structure of this paper is organized as follows. The theoretical background and hypotheses are discussed in Section 2. Sample data and measures are explained in Section 3. Empirical results are presented and discussed in Section 4. Conclusions and policy implications are presented in Section 5.

2. Theories and Hypotheses

Consumer knowledge refers to stored information or general background knowledge used to identify products in consumers' memory [9], such as product properties, users' experiences, etc. Knowledge focuses on consumers' degree of familiarity with and level of expertise in products, as well as professional opinions about the products [10]. Studies have shown that knowledge affects consumers' preferences for new products. For example, Suárez-Cáceres et al. [11] found that consumers' knowledge significantly affected their attitudes and WTP for aquaponic products in Spain and Latin America. Particularly, con-

sumers were more likely to pay a premium for products from aquaponics systems when the benefits of these products (i.e., the sustainability perspective) were highlighted [12,13]. Furthermore, some studies show that subjective knowledge has a stronger predictive effect on consumer purchase-related behavior than objective knowledge [14]. House et al. [15] found that a higher level of subjective knowledge would significantly improve the willingness to accept genetically modified foods, while objective knowledge did not play a role. Donoghue et al. [16] showed that subjective knowledge played a predictive role in the willingness of South African consumers to pay a premium for Karoo lamb, but that objective knowledge did not.

Animal welfare is a state of complete mental and physical health in which farm animals are in harmony with their surrounding environment. It generally refers to everything necessary to maintain animal physiology, mental health, and normal growth, such as good feeding, good housing, good health, and appropriate behavior [17]. Animal-derived products with high welfare standards are more guaranteed in terms of both nutritional quality and safety [18], and consumers are demanding safer, healthier, and higher quality foods under the same conditions [19]. If animal welfare information is readily available to the public, particularly through mass media, consumers will learn more about animal welfare and understand more about animal welfare products. Importantly, consumers can seek and find useful knowledge in their daily lives and use it to make purchase decisions, which implies consumers' different subjective purchase intentions and preferences [20,21]. It can be inferred that if consumers learn more about animal welfare knowledge, they will realize that animal welfare is beneficial, and their acceptance of and preference for animal-friendly products are likely to increase. On this basis, we propose a hypothesis:

Hypothesis 1 (H1). *Consumers' animal welfare knowledge has a positive effect on their behavioral intentions*.

Cognition is the process in which consumers choose, organize and explain external information and convert it into internal information [22]. It can be further specified as consumers' perceptions of specific products [23], that is, the better consumers' understanding of animal welfare products, the higher the level of consumer awareness. Consumers use knowledge to convert objective information into subjective cognition in purchasing decisions, thus affecting consumer attitudes and behaviors [24]. However, changes in consumer attitudes or perceptions of a product may affect one's consumption habits [25]. Vermeir and Verbeke [26] argued that a positive attitude towards sustainable products was closely related to purchase intentions. Part of what makes animal welfare an important issue in livestock husbandry is that people can recognize the impact of improved animal welfare on the public or consumer utility [27]. Heng et al. [28] found that consumers' cognition of animal welfare would be increased by appropriate education, promoting consumption of animal welfare products. Wang et al. [2] analyzed consumers' understanding of animal welfare and perception of food safety using a survey conducted in Jiangsu Province, China. They found that consumers were willing to pay a certain premium for animal welfare. Yan et al. [29] and Clark [30] found that education level had a positive and significant impact on people's understanding and behavioral intentions regarding animal welfare, and those with higher knowledge levels would be more likely to choose animal welfare products. Accordingly, animal welfare knowledge affects consumers' understanding, judgment, and evaluation of animal welfare products, and thus affects their own consumption preferences and actual consumption behaviors. We propose a hypothesis:

Hypothesis 2 (H2). *Product cognition has a mediating effect on the relationship between animal welfare knowledge and consumers' behavioral intentions*.

Various brain structures process information, and our decision-making processes involve both reason and emotion [31]. These two systems communicate with each other, impacting behavior together [32,33]. Empathy is an ability to put oneself in the position of

others and to understand or feel what others have experienced [34] and contains cognitive factors that make people think from the perspective of people in need [35]. According to ecological ethics, animal welfare originates from humans' moral responsibility for animals, and its core assumption is that animals have equal moral status and rights with humans to some extent [36]. Treating animals kindly conforms to people's ethical cognition, affects people's emotions, and increases people's utility [37]. If animal welfare products arouse consumers' empathy, consumers' purchasing desire may increase [38]. Cornish et al. [39] found that younger females with lower household income had a higher level of empathy for animals, which was related to the intention to buy animal welfare products.

Empathy focuses on people's subjective feelings about others, the other side of which is rational feelings and emotions. Product cognition is a comprehensive understanding of products, including composition, function, usage, advantages and disadvantages, characteristics, market, consumer groups, etc. It is the standard to measure consumers' awareness and understanding of brand connotation and value. It can be seen that product cognition is based on objective feelings and rational emotions. Usually, rational consumers tend to make purchase decisions according to their familiarity with products. However, the decision-making process cannot be described as exclusively rational and conscious, as it is affected by emotional and subjective elements [40]. If emotion is a key factor in consumers' purchase decision-making process [41], product cognition and behavioral intentions may be different between people with strong empathy and weak empathy. If consumers belong to the weak empathy group, their intentions to purchase or recommend may depend more on product cognition. If consumers belong to the strong empathy group, their purchase intention may rely more on empathy itself rather than product cognition. Specifically, consumers with strong empathy for animals may consider whether animals are suffering rather than whether animal products are delicious or not. That is, the effect of consumers' cognition of the products on their behavioral intentions may be adjusted by empathy. Therefore, we hypothesize:

Hypothesis 3 (H3). *Empathy negatively moderates the relationship between knowledge of animal welfare and consumers' behavioral intentions via product cognition.*

Figure 2 shows a conceptual model of this study. As indicated, product cognition mediates the relationship between knowledge of animal welfare and consumers' behavioral intentions. In addition, empathy moderates the link between product cognition and consumers' behavioral intentions. Thus, the indirect effect of knowledge of animal welfare on consumers' behavioral intentions based on product cognition is strong when empathy is weak and weak when empathy is strong.

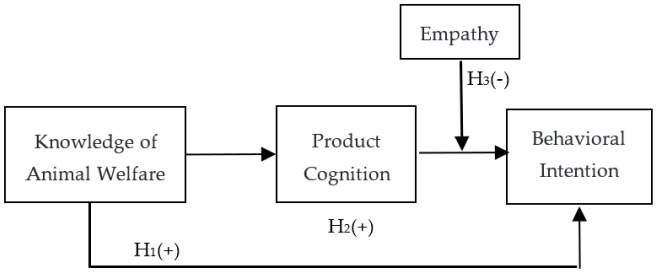

Figure 2. The conceptual framework of animal welfare knowledge, product cognition, empathy, and consumers' behavioral intentions.

3. Data, Variables, and Methods

3.1. Data

The development of animal welfare is constrained by the level of regional economic and social development. In order to control costs, our survey was limited to major cities in Guangdong province. There were mainly two reasons for this. On the one hand, Guang-

dong province, neighboring two special administrative regions, Hong Kong, and Macao, is one of the provinces at the forefront of reform and opening up in China. Additionally, Guangzhou and Shenzhen, both located in Guangdong, are two of the top four cities, making Guangdong province a major province for foreign trade in China. On the other hand, Cantonese cuisine in Guangdong is one of the eight major cuisines in China. Cantonese people generally speak (or listen to) Cantonese, eat Cantonese cuisine, and have a good reputation for being "food experts". All of these facts help control the unobserved factors not controlled in the data, such as household food supply, regional tastes, diet, and other cultural factors.

Since we were interested in consumers' knowledge of animal welfare and behavioral intentions toward animal-friendly products instead of societal opinions, our survey respondents were those who buy food for their families, eat meat products, and over the age of 16 years. As such, our survey may have avoided the bias problem of measuring consumers' willingness to pay for private products with a sample including some consumers who buy the products for others.

Due to the coronavirus disease (COVID-19) outbreak worldwide, China has implemented strict epidemic prevention and control measures based on home isolation. Many Chinese people have had to transfer their daily studies, work, and lives to the Internet. For this reason, the questionnaires were uploaded onto Wenjuanxing (By recruiting and maintaining clientele, Wenjuanxing can sometimes offer consumers rewards for participating in surveys. The rewards offered to participants are points that they can collect and exchange for retail vouchers. Surveys are sent to participants randomly via email and online according to the sample requirements of the researchers. Participation in each investigation is voluntary. Researchers can contact and provide suppliers with questionnaires and pay fees in exchange for access to consumers who are prepared to participate in online surveys. The cost depends on the difficulty of the questionnaire, the duration of the survey, consumer characteristics and number of samples.), the first and largest domestic online questionnaire survey and test platform in China. Data were collected in two phases: a pilot survey and formal survey.

In February 2020, a pilot survey was conducted among 90 consumers mainly responsible for purchasing household food. In the pre-test, most respondents were not familiar with the concept of "animal welfare". Searching for information is a key factor in the consumer decision-making process [42,43], and should be given enough attention in studies of consumer preferences [44]. Consequently, we clearly defined farm animal welfare and its products in the guide for the formal questionnaire. According to the feedback and suggestions of sample consumers, we revised the expressions in the questionnaire to make it simpler and easier to understand, removed the survey questions inconsistent with the local situation, and added some more valuable questions.

In March 2020, we conducted a formal survey through the Wenjuanxing platform and collected 1637 completed questionnaires in total. We treated completeness and quality of information as the screening criteria and eliminated invalid questionnaires that lacked crucial information or logic. Respondents with monotonous response behavior were also excluded because they may not have thoroughly read the questions or only completed the survey to obtain rewards. Finally, 1499 valid questionnaires with responses regarding demographics, meat consumption habits, knowledge of animal welfare, product cognition, and consumers' behavioral intentions were obtained, with an effective response rate of 91.6%. All statistical analysis was carried out using Stata 16 (Stata Corp. 2019, created by StataCorp LLC, Texas, TX, USA).

3.2. Variables

3.2.1. Dependent Variables

Purchase and recommendation are two common behaviors in consumers' food decision-making. Following the practice of Weinrich et al. [45], we treated respondents' willingness to purchase or recommend animal-friendly products as dependent variables to exam-

ine consumers' behavioral intentions. Thus, the purchase intention variable measured one's willingness to buy animal-friendly products and the recommend intention variable measured one's willingness to promote animal-friendly products to friends. The above dependent variables were quantified by a 5-point scoring method, ranging from 1 for "absolutely not" buy or recommend to 5 for "always" buy or "absolutely" recommend. Table 1 shows that more than 80% of the respondents wanted to purchase and recommend farm animal welfare products.

Table 1. Consumers' behavioral intentions regarding farm animal welfare products.

Purchase Intention			Recommend Intention		
Options	**Number of People**	**Ratio**	**Layer**	**Number of People**	**Ratio**
Absolutely not	55	3.67%	Absolutely not	20	1.33%
Rarely	135	9.01%	Rarely	151	10.07%
Sometimes	879	58.64%	Possibly	670	44.70%
Often	368	24.55%	Probably	509	33.96%
Always	62	4.14%	Absolutely	149	9.94%

3.2.2. Core Independent Variables

At the beginning of the questionnaire, we asked respondents whether they knew about farm animal welfare. However, measuring animal welfare knowledge by simply asking respondents about their understanding of animal welfare is prone to bias. In order to make all respondents reach the same level before evaluating the dependent variables, we then provided a detailed description of the connotation of animal welfare. Respondents were told that animal welfare was a way of farming that met the basic natural needs of animals and kept animals in good living conditions, mainly including five freedoms for animals: freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury and disease, freedom from fear and distress and freedom to express normal behavior [46].

In addition, respondents were informed that animal welfare products or animal-friendly products referred to products that meet animal welfare standards to varying degrees in the process of farm feeding, such as free-range chicken, eggs, pork, etc. According to the connotations of animal welfare and opinions that may easily be misunderstood by the public, we examined respondents' cognition of animal welfare from four aspects: the ethical relationship between human beings and animals, weight between human welfare and animal welfare, opinions of animal health as well as the understanding of animal welfare cultural basis.

Table 2 presents items for evaluating consumers' animal welfare knowledge in our questionnaire and the descriptive statistics of respondents' answers to the questions. It can be seen that respondents had a high level of awareness of animal health and animal welfare culture, with correctness ratings of up to 88.99% and 88.59%, respectively. Unlike animal rights, animal welfare advocates the humane use of animals against any form of animal abuse rather than equating animals with humans. In this regard, 33.16% of respondents correctly understood this relationship, and 83.92% of respondents believed that animal welfare should not be considered before human welfare was guaranteed. It shows that most Chinese consumers tend to put people's interests first when considering the relationship between humans and animals.

We further assigned values based on respondents' answers to questions about animal welfare knowledge. Respondents who answered correctly would receive 1 point for one question, otherwise, 0, and thus, respondents' knowledge of animal welfare was obtained. In order to observe the changes in respondents' knowledge before and after providing animal welfare information, we also assigned values for respondents' understanding of animal welfare before the survey, ranging from 0 for "do not know animal welfare at all" to 4 for "know animal welfare very well". Table 3 shows that 50.63 % of the respondents did not know about animal welfare at all, and 28.75% had heard of but did not know

about animal welfare before receiving animal welfare information. This corresponded to 40.56% of respondents who obtained a full score of 4 points, and 41.96% who obtained 3 points after receiving animal welfare information. Although most respondents did not know about animal welfare at first, their cognitive level of animal welfare was significantly improved after a brief animal welfare literacy review during the survey. This indicates that Chinese consumers have good cognitive ability regarding animal welfare.

Table 2. Answers to questions related to animal welfare knowledge.

Items	Correct	Wrong	Do Not Know
Animal welfare is completely equating animals with people.	33.16%	54.30%	12.54%
People's welfare has not been achieved yet, so there is no need to consider animal welfare.	6.74%	83.92%	9.34%
Animal welfare considers both the "physical" and "mental" health of the animal	88.99%	3.87%	7.14%
Animal welfare conforms to people's modern ecological and ethical requirements for animals.	88.59%	4.14%	7.27%

Table 3. Respondents' mastery of animal welfare knowledge.

Types	0	1	2	3	4	Mean Difference
Self-statement	50.63%	28.75%	14.88%	4.67%	1.07%	−2.390 ***
Knowledge test	1.67%	3.94%	11.87%	41.96%	40.56%	

*** is statistically significant at 1% level.

3.2.3. Mediating Variables

Product cognition is the result of consumers internalizing objective animal welfare information about the product into subjective cognition, which in turn reflects consumers' understanding of the quality of animal-friendly products. Animal welfare is related to attributes such as health [47], delicacy [7,48]), safety [49,50]), ethics [51,52]) and environmental friendliness [53–55]). Thus, we measured consumers' cognition of animal welfare products from the five aspects mentioned above. The expression of the items was adapted from Carnovale et al. [56]. Each item was measured on a 5-point Likert scale, from "1" as "very disagree" to "5" as "very agree". To avoid sequential effects, all items of the same scale were displayed at random in the survey. Internal consistency was measured using Cronbach's α coefficient. Table 4 demonstrates that the reliability coefficient of each item was greater than 0.75, and total reliability was over 0.84, which was in line with the standard of a good reliability coefficient (above 0.6). The KMO value was close to 1 (0.82), the significance level of LR test results was less than 0.001 (chi-square value 3161.32). The reliability and validity were shown to be good.

Table 4. Cognition of farm animal welfare products.

Items	Mean	Standard Deviation	Reliability (Cronbach's α)	Total Reliability
Meat from friendly-treated animals is healthier.	3.953	0.971	0.785	0.842
Meat from friendly-treated animals tastes better.	3.610	1.043	0.817	
Meat from friendly-treated animals is safer.	3.966	0.956	0.797	
It is more ethical to eat animal products with better welfare.	3.660	1.073	0.840	
Eating animal products with better welfare is better for the environment.	3.783	1.014	0.812	

3.2.4. Moderating Variable

We measured empathy for animals by seeking respondents' comments on the statement "I feel uncomfortable every time I see animals being abused or suffering" [57]. According to the survey results, the proportion of respondents reporting "very disagree", "relatively disagree", "general", "relatively agree" and "very agree" was 3.94%, 3.67%, 17.95%, 46.43% and 35.62%, respectively. It can be seen that the respondents had a high level of empathy. In order to analyze the relationship between empathy and other variables more effectively, we merged the lowest three categories ("very disagree", "relatively disagree" and "general") into the level of "low", making the distribution of categories that made up the moderating variable more balanced. Accordingly, empathy was defined on three levels: low, medium and high, corresponding to "disagree or generally agree", "relatively agree" and "very agree".

3.2.5. Control Variables

Following previous research, we treated four kinds of demographic variables as controls. They included personal characteristics such as gender, age, years of education, household registration, family characteristics such as household income, number of people dining together, dining together with a child under 18, dining together with an elderly person over 60, and behavioral variables related to animal contact such as whether to raise pets, engaged in animal-related occupations, heard of animal welfare before. Additionally, the variable indicating whether the city of the respondent was a first-tier city was also included to control unobserved factors that were not clearly controlled in the data, such as regional economic development levels, household food supply, etc. Table 5 reports definitions and descriptive statistics of all variables used in the analyses.

Table 5. Definition and descriptive statistics of each variable.

Variables	Definition and Assigned Values	Mean	Standard Deviation
	Dependent variables		
Purchase intention	Willingness to buy animal welfare products: Absolutely not = 1, Rarely = 2, Sometimes = 3, Often = 4, Always = 5	3.165	0.788
Recommend intention	Willingness to recommend animal welfare products: Absolutely not = 1, Rarely = 2, Possibly = 3, Probably = 4, Absolutely = 5	3.411	0.850
	Independent variables and control variables		
AW knowledge	Scores of animal welfare knowledge test	3.158	0.899
Product cognition	Mean scores of five items for the respondent's attitude towards animal welfare products	3.795	0.793
Empathy	Feelings every time a respondent sees animals being abused or suffering: Low = 1, Medium = 2, High = 3	2.177	0.710
Gender	Male = 1, Female = 0	0.361	0.480
Age	Age of the respondent	32.04	9.976
Dining scale	Number of people eating together in a family	3.853	1.463
Child	Whether there is a child under 18 years old dining together: Yes = 1, No = 0	1.518	0.500
Elderly	Whether there is an elderly person over 60 years old dining together: Yes = 1, No = 0	1.616	0.487

Table 5. *Cont.*

Variables	Definition and Assigned Values	Mean	Standard Deviation
Income	Average household income per month, <6000 yuan = 1, 6000–12,000 yuan = 2, 12,000–18,000 yuan = 3, 18,000–24,000 yuan = 4, 24,000–30,000 yuan = 5, >30,000 yuan = 6	2.842	1.466
Education	Assigned values according to different educational levels: Primary school = 6, Middle school = 9, High school (Technical secondary or higher vocational school) = 12, Junior college = 14, Undergraduate = 16, Graduate or above = 19	15.32	2.440
Urban	Urban resident: Yes = 1, No = 0	0.849	0.359
Pet experience	Having experience of raising pets: Yes = 1, No = 0	0.229	0.421
Animal-related work	Engaged in animal-related occupations: Yes = 1, No = 0	0.049	0.217
Ever heard of AW	Heard of animal welfare before the survey: Yes = 1, No = 0	0.794	0.405
First-tier city	Living in Guangzhou or Shenzhen: Yes = 1, No = 0	0.726	0.446

3.3. Estimation Methods

Following the practices of Wykes et al. [58] and Preacher et al. [59], the proposed moderated mediation model can be tested by the stepwise method. In terms of the mediating effect test, the first step is to test whether the influence of independent variables on the dependent variable is significant, the second is to test whether the influence of independent variables on the mediating variable is significant, and the third is to test whether the influence of independent variables on the dependent variable is significantly reduced or even disappeared after controlling the mediating variable. The moderating effect is tested by constructing the interactive term between the independent variable and the moderating variable, and the moderating effect is judged by observing the significance level of the interaction. According to the theoretical hypothesis of this paper, the following moderated mediation model can be constructed:

$$BI_i = \alpha_{10} + \alpha_{11}K_i + \alpha_{12}X + \varepsilon_1 \quad (1)$$

$$Awp_i = \alpha_{20} + \alpha_{21}K_i + \alpha_{22}X + \varepsilon_2 \quad (2)$$

$$BI_i = \alpha_{30} + \alpha_{31}K_i + \alpha_{32}Awp_i + \alpha_{33}X + \varepsilon_3 \quad (3)$$

$$BI_i = \alpha_{40} + \alpha_{41}K_i + \alpha_{42}Awp_i + \alpha_{43}Emp_i + \alpha_{44}Awp_i \times Emp_i + \alpha_{45}X + \varepsilon_4 \quad (4)$$

In Equations (1)–(4): BI_i represents consumers' behavioral intentions, K_i represents animal welfare knowledge, Awp_i represents cognition of animal welfare products, Emp_i represents animal empathy, and X represents a series of control variables mentioned above; α_{10}, α_{20}, α_{30}, α_{40} are the corresponding constant terms; ε_1, ε_2, ε_3, ε_4 are the corresponding random error terms, which are assumed to be normal distribution; the subscript i denotes the ith respondent. Coefficient α_{11} in Equation (1) denotes the total effect of animal welfare knowledge on consumers' behavioral intentions; coefficient α_{21} in Equation (2) denotes the impact of animal welfare knowledge on product cognition; coefficients α_{31}, α_{41} in Equations (3) and (4) denote the direct effect of animal welfare knowledge on consumers' behavioral intentions, and coefficients α_{32}, α_{42} denote the direct effect of product cognition on consumers' behavioral intentions. $\alpha_{21} \times \alpha_{32}$, . which can be obtained by bringing Equation (2) into Equation (3), showing the indirect effect of animal welfare knowledge on consumers' behavioral intentions, namely the impact of animal welfare knowledge on consumers' behavioral intentions through product cognition. Coefficient α_{43} in Equation (4) represents the direct effect of the moderating variable on consumers' behavioral intentions.

$\alpha_{42} + \alpha_{44} Emp_i$ means the mediated effect of product cognition moderated by Emp_i on consumers' behavioral intentions.

4. Empirical Results and Analysis

4.1. Total Effect and Robustness Test

Table 6 reports the regression results of Equation (1). The OLS estimation results in columns (1) and (2) show that animal welfare knowledge has a significant positive impact on consumers' behavioral intentions. Increasing animal welfare knowledge is conducive to improving consumers' purchase and recommend intentions. In terms of control variables, women are more likely to recommend animal welfare products to others, which is consistent with the fact that women are more willing to share life experiences with others; young people in first-tier cities with better family economic conditions are more likely to accept animal welfare products; respondents with pet experiences prefer animal welfare products to those without pet experiences, and those that never heard of animal welfare are more willing to buy and recommend animal welfare products.

Table 6. Total effects of animal welfare knowledge on consumer's behavioral intention.

Variable	(1)	(2)	(3)	(4)
	OLS	OLS	Ordered Probit	Ordered Probit
	Purchase Intention	Recommend Intention	Purchase Intention	Recommend Intention
AW knowledge	0.103 ***	0.151 ***	0.144 ***	0.195 ***
	(0.025)	(0.025)	(0.035)	(0.032)
Gender	−0.027	−0.106 **	−0.039	−0.138 **
	(0.042)	(0.046)	(0.061)	(0.059)
Age	0.010 ***	0.007 ***	0.016 ***	0.009 ***
	(0.003)	(0.003)	(0.004)	(0.003)
Education	−0.003	−0.010	−0.005	−0.014
	(0.010)	(0.011)	(0.014)	(0.014)
Urban	0.035	0.044	0.065	0.059
	(0.058)	(0.061)	(0.083)	(0.079)
Income	0.048 ***	0.038 **	0.068 ***	0.050 **
	(0.016)	(0.017)	(0.023)	(0.022)
Dinning scale	0.016	0.011	0.025	0.014
	(0.019)	(0.019)	(0.026)	(0.025)
Child	−0.014	−0.048	−0.024	−0.063
	(0.048)	(0.051)	(0.068)	(0.066)
Elderly	0.060	−0.027	0.089	−0.037
	(0.048)	(0.051)	(0.068)	(0.067)
Pet experience	0.106 **	0.133 **	0.158 **	0.175 ***
	(0.048)	(0.052)	(0.069)	(0.068)
Animal-related work	0.111	0.112	0.165	0.149
	(0.101)	(0.114)	(0.143)	(0.147)
Ever heard of AW	−0.101 **	−0.099 **	−0.145 **	−0.128 **
	(0.041)	(0.044)	(0.059)	(0.057)
First-tier city	0.096 **	0.066	0.147 **	0.085
	(0.048)	(0.050)	(0.068)	(0.065)
Constant	2.216 ***	2.800 ***		
	(0.287)	(0.309)		
Observation	1499	1499	1499	1499
R-squared/Pseudo R2	0.055	0.057	0.026	0.024
Wald chi2			81.86	91.43
Log pseudo-likelihood			−1646.082	−1821.981

*** and ** are statistically significant at 1% and 5% levels, respectively. Numbers in parentheses are robust standard errors.

Some previous studies have shown that statistical results share a very similar significance level between ordinal and cardinal numbers [60]; the ordered Probit model is

employed to estimate the impact of consumer welfare knowledge on consumers' behavioral intentions. The ordered Probit model regression results in columns (3) and (4) of Table 6 are entirely consistent with the OLS regression results in the significance level and symbolic direction.

4.2. Mediating Effect of Product Cognition and Robustness Test

Considering that animal welfare knowledge has a significant effect on consumers' behavioral intentions, we further explore product cognition's mediating role. The stepwise regression method was used to estimate Equations (1)–(3), respectively, and robust standard errors were obtained. The estimation results are shown in Table 7. Column (1) and column (4), respectively, indicate the total effect of animal welfare knowledge on consumers' purchase intentions and recommend intentions. Column (2) shows that animal welfare knowledge can significantly improve the levels of product cognition. Column (3) shows the direct effect of animal welfare knowledge and product cognition on consumers' purchase intentions. The estimated coefficient of animal welfare knowledge variable was 0.077, which was significant at the 1% statistical level, indicating that the direct effect of animal welfare knowledge on purchase intention was 7.7%. The direct effect of product cognition on purchase intention was 0.263, significant at the 1% statistical level. When multiplying it with the animal welfare knowledge coefficient in column (2), we obtained the indirect effect of animal welfare knowledge on purchase intention (0.026), accounting for 25.24% of the total effect, which means that the mediating effect of animal welfare knowledge on purchase intention was about 25% by improving product cognition. Similarly, according to columns (2), (4), and (5) in Table 7, the mediating effect of animal welfare knowledge on recommend intention by increasing product cognition was about 21%.

Table 7. Mediating effects of product cognition.

Variables	(1)	(2)	(3)	(4)	(5)
	Purchase Intention	**Product Cognition**	**Purchase Intention**	**Recommend Intention**	**Recommend Intention**
AW Knowledge	0.103 ***	0.098 ***	0.077 ***	0.151 ***	0.119 ***
	(0.025)	(0.023)	(0.024)	(0.025)	(0.024)
Product Cognition			0.263 ***		0.330 ***
			(0.035)		(0.036)
Control variables	controlled	controlled	controlled	controlled	controlled
Constant	2.216 ***	3.069 ***	1.408 ***	2.800 ***	1.788 ***
	(0.287)	(0.281)	(0.299)	(0.309)	(0.306)
Observation	1499	1499	1499	1499	1499
R-squared	0.055	0.046	0.121	0.057	0.147

*** is statistically significant at 1% level. Numbers in parentheses are robust standard errors. Due to space limitations, only brief results are represented.

Significance of indirect effects was estimated by the Sobel test and the bootstrap test. The Sobel test statistic Z for the purchase intention model was 4.113, and for the recommend intention model, 4.199. The associated p-values were both significant at the level of 1%, indicating significant mediation. Following the bootstrapping method of Preacher and Hayes [61] (setting 1000 iterations), results of the bootstrap test are shown in Table 8. The confidence intervals of both indirect and direct effects after bias correction did not include 0, indicating that there was indeed a transmission mechanism from animal welfare knowledge to purchase or recommend intention through improving product cognition. Both tests demonstrated that the stepwise regression method has a high degree of robustness for estimating the mediation effect.

Table 8. Bootstrap test results for mediating effect.

Dependent Variables	Bootstrap Test	Coefficient	Deviation	Standard Deviation	95% C.I.	Bias-Corrected C.I.
Purchase intention	indirect effect	0.027	−0.000	0.007	[0.015,0.042]	[0.016,0.045]
	direct effect	0.077	−0.000	0.024	[0.032,0.124]	[0.033,0.124]
Recommend intention	indirect effect	0.034	−0.000	0.008	[0.019,0.051]	[0.019,0.052]
	direct effect	0.117	−0.000	0.025	[0.070,0.167]	[0.069,0.166]

4.3. Moderating Effect of Empathy and Robustness Test

To investigate the moderating role of empathy in the link between product cognition and consumers' behavioral intentions, we constructed an interactive term between empathy and product cognition. Equation (4) was estimated using the OLS approach. The estimation results are shown in Table 9. The regression coefficient of the interactive term in column (2) was negative and significant at the level of 10%, showing that empathy may negatively regulate the positive impact of product cognition on purchase intention and recommend intention.

Table 9. Moderating effects of empathy.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Purchase Intention			Recommend Intention		
	All Sample	Weak Empathy Group	Strong Empathy Group	All Sample	Weak Empathy Group	Strong Empathy Group
AW Knowledge	0.062 **	0.088 ***	0.022	0.097 ***	0.122 ***	0.082
	(0.024)	(0.027)	(0.051)	(0.023)	(0.025)	(0.055)
Product Cognition	0.433 ***	0.320 ***	0.153 ***	0.499 ***	0.372 ***	0.232 ***
	(0.108)	(0.041)	(0.059)	(0.110)	(0.039)	(0.062)
Empathy	0.448 **			0.519 ***		
	(0.190)			(0.195)		
Product Cognition × Empathy	−0.083 *			−0.086 *		
	(0.048)			(0.049)		
Control Variables	controlled	controlled	controlled	controlled	controlled	controlled
Constant	0.551	0.892 ***	2.560 ***	0.854 *	1.473 ***	2.635 ***
	(0.503)	(0.345)	(0.571)	(0.515)	(0.347)	(0.595)
Observation	1499	965	534	1499	965	534
R-squared	0.139	0.166	0.066	0.177	0.195	0.091

***, ** and * are statistically significant at 1%, 5% and 10% levels, respectively. Numbers in parentheses are robust standard errors. Due to space limitations, only brief results are represented.

As mentioned above, the classification of the empathy variable may have an impact on the results. To check the robustness of the results and provide further insight into the relationship, all samples were divided into a strong empathy group and weak empathy group according to the mean of empathy. Subsequently, categorical analysis was conducted to compare the performance of the two groups (strong empathy vs. week empathy). The regression results in Table 9 show that the correlation coefficient of product cognition on purchase intention decreased from 0.320 in column (2) to 0.153 in column (3), which was significant at the level of 1%, indicating that the positive impact of product cognition on purchase intention decreases when empathy gains strength.

Figure 3 presents a more intuitive comparison of the regression results. It demonstrates that the purchase intention of the strong empathy group was stronger than that of the weak empathy group, which conformed to the expectation that empathy helps to promote animal welfare product consumption. The negative moderating effect of empathy was mainly manifested in the slope for the strong empathy group, which was smaller than that of the weak empathy group; that is, the impact of consumers' product cognition on purchase intention in the strong empathy group was smaller than that in the weak empathy group,

which was also in line with our expectations. The reason may be that empathy may be an important factor in motivating consumers to buy animal welfare products.

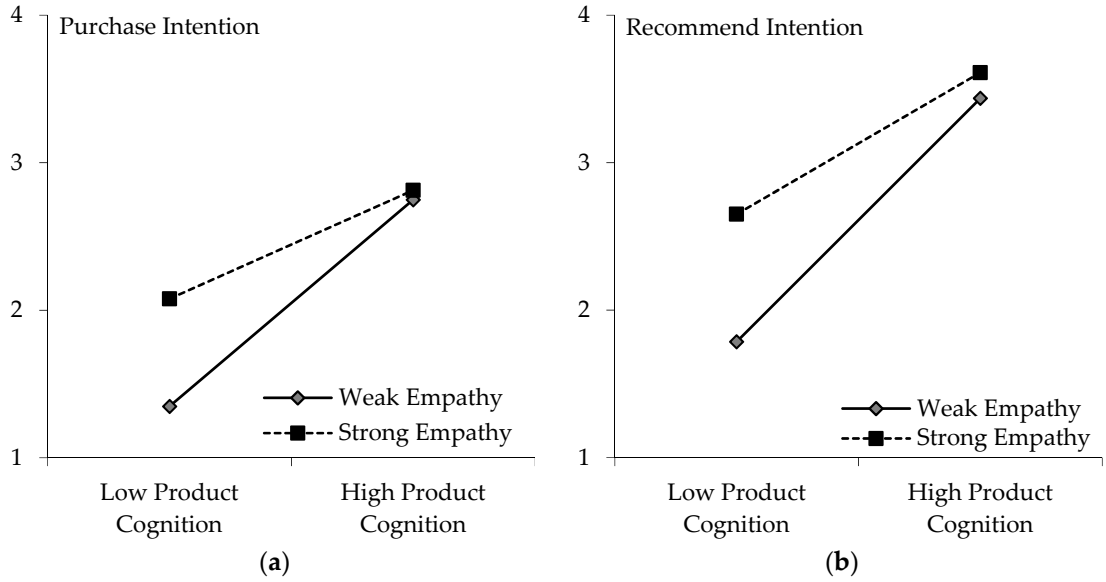

Figure 3. Effect of Empathy on Product Cognition Affecting Consumers' Behavioral Intentions. (**a**) Purchase Intention, (**b**) Recommend Intention.

Animal welfare products are considered to possess both quality and ethical attributes. The strong purchase intention of the strong empathy group may be mainly due to their strong empathy for animals. In this regard, consumers' purchase intentions would only be improved slightly even when the quality attributes of animal welfare products are identified. It is worth noting that animal welfare knowledge here did not have a significant impact on purchase intention for the strong empathy group. From another perspective, this may explain that consumers' behavioral intentions regarding animal welfare products in the strong empathy group mainly depended on their animal ethics. For consumers with weak empathy, their purchase intentions for animal welfare products may be mainly due to quality attributes such as taste, health, quality, safety or other considerations. Improving their cognitive level of animal welfare products may be conducive for them to accept animal welfare products.

According to the results in columns (5) and (6) in Table 9, empathy moderates the effect of product cognition on recommend intention, similarly to the moderating effect of empathy on product cognition affecting purchase intention. Figure 3 also intuitively demonstrates that people's recommend intentions for animal welfare products were stronger than their purchase intentions.

4.4. Further Discussions

This study investigated the relationship between animal welfare knowledge and consumers' behavioral intentions with respect to animal welfare products with the mediating role of product cognition and the moderating role of empathy. Consumers' perceptions and demands for farm animal welfare products determine the market outlook for animal husbandry producers to improve farm animal welfare and reflect public opinions and demands for the government to formulate laws, regulations and policies related to farm animal welfare.

This study found several interesting results. Animal welfare knowledge has a positive impact on consumers' behavioral intentions, and increasing animal welfare knowledge may help improve consumers' intentions to buy or promote animal welfare products. Our results were consistent with the findings in developing countries that consumers with

positive attitudes towards animal welfare are willing to pay more for animal-friendly products [62–64]. Carnovale et al. [56] found that consumers with higher levels of animal welfare knowledge had higher purchase intentions for animal welfare products in China. In the past, it was generally believed that animal welfare was a matter for developed countries. However, the findings of this study show that that is not entirely the case. As a largest developing country, China has become an affluent society in a general sense since 2020, and people's living standards have improved significantly. The demand for healthier, safer, higher-quality meat that meets their ethical requirements has been increasing. Therefore, a key issue going forward will be how to guide the public to fully understand animal welfare through publicity and promotional activities.

Furthermore, product cognition has a mediating effect on the link between animal welfare knowledge and consumers' behavioral intentions. This finding indicates that increasing animal welfare knowledge helps to increase consumers' product cognition. That is, consumers may link animal welfare knowledge with product cognition and make their purchase decisions. When acquiring knowledge about animal welfare, consumers may perceive and evaluate products with animal welfare attributes as of high quality because animal welfare products are generally known as high-end products with higher quality in nutrition, health, safety and taste than traditional products [5,18,65]. Hence, consumers may purchase more animal welfare products. Our findings support those of Jiang et al. [66], who suggested that positive animal welfare information made participants feel satisfied, healthy and happy, and consumers with higher product consumption showed a higher level of approval for animal welfare products. Consumers who often buy animal welfare products have more animal welfare knowledge and better product cognition. In addition to promoting animal welfare, it is necessary to achieve reasonable market segmentation and provide a more differentiated system for those who are interested in animal welfare, want higher standards of animal-derived products, and consider animal welfare in the search for information [67,68].

Finally, empathy plays a moderating role in the indirect effect of animal welfare knowledge on consumers' behavioral intentions via product cognition. This finding suggests that consumers with strong empathy may integrate their concern for animals into their purchase decisions. The motive of perceptual consumption, or a type of moral consumption, may reduce the impact of product cognition on purchase or recommend intentions. Consumers with weak empathy are less affected by animal ethics. Instead, they mainly use animal welfare knowledge available to make purchase decisions by rationally evaluating product quality. Overall, consumers with strong empathy are more likely to purchase animal welfare products than consumers with weak empathy under the same conditions, possibly due to the dual influence of product cognition and animal ethics. The moderating effect of empathy on product cognition affecting consumers' behavioral intentions confirms the ecological ethics of harmonious development between human and animals, and the existence of moral purchase behavior of consumers [69,70]. According to non-anthropocentrism, animals as the subject of life can feel pain and enjoy happiness. Freeing animals from unnecessary pain has become one of the motivations for consumers to consume animal welfare products. Therefore, promoting farm animal welfare not only fits the ethical perception of consumers but also has a functional impact on improving food safety [71]. However, consumers have to accept a higher price for the improvement of animal welfare, which to some extent inhibits consumer demand. Still, it is a fact that consumers can obtain additional benefits, such as health, deliciousness, safety, and even moral sentiment based on ecological ethics during animal welfare product consumption.

5. Conclusions and Implications

China is the most populated country in the world. Until now, people did not know much about animal welfare. Improving the level of animal welfare knowledge will help to cultivate market demand for farm animal welfare products and promote the high-quality development of animal husbandry. Based on the survey data of 1499 food consumers in

Guangdong Province, China, this paper revealed the influence and orientation of animal welfare knowledge on consumers' behavioral intentions by introducing product cognition and empathy.

The results from the moderated mediation model make three points. Firstly, the level of animal welfare knowledge has a significant positive impact on consumers' behavioral intentions. Secondly, product cognition significantly increases consumers' behavioral intentions and plays an intermediary role in the impact of animal welfare knowledge on consumers' behavioral intentions. Thirdly, empathy has a significant positive effect on consumers' behavioral intentions, and plays a negative moderating role through the indirect effect of animal welfare knowledge on consumers' behavioral intentions via product cognition.

There are several policy implications to be drawn from the above findings. First, China needs to create a good institutional environment for animal welfare development in a planned way. In any case, improving animal welfare levels and product safety is an inevitable trend. Animal welfare will be an important attribute of high-end food in the future and an important factor restricting the high-quality development of animal husbandry. As farm animal welfare products are typical trust products, the formation of an effective market for these products requires that the government or third-party institutions establish regulatory measures to ensure the quality of farm animal welfare products. It is necessary for China to gradually establish and improve regulatory measures for the animal products market, strengthen the formulation and evaluation of animal welfare standards, and guide the meat production chain to improve its facilities, equipment and management, so as to meet the requirements of more sensitive markets.

Second, universal education pertaining to animal science is especially important. A growing interest in animal welfare can be attributed to urbanization, social education and economic development, as well as the influence of media and civil society organizations. Improving the level of animal welfare knowledge and awareness of animal welfare products helps to solve the problem of information asymmetry between consumers and producers. The Chinese government and related institutions can strengthen education in ecological ethics and animal welfare ideology by means of media, organizations, education and training in order to provide consumers with more information that they can use in the decision-making process.

Third, the precise positioning of people with high consumption tendencies is required. With China's economy and society entering a transition period, people's eating habits and food consumption patterns have diversified. Consumers are no longer limited to the issue of nutritional intake in the selection of animal-derived food, but have begun to pay more attention to taste, safety, health, and even ethical and environmental requirements. Consumers are the end receivers of animal-derived products, and their needs are dominant factors significantly affecting the development of farm animal welfare. If governments and enterprises perceive changes in consumer needs and that trend over time, they may find more new growth points and tap into new business opportunities. Enterprise marketing personnel can communicate with different customer groups according to the animal welfare characteristics of meat products to better meet the needs of customers and improve market share.

The present study has some limitations that deserve comment. Firstly, the selection of research samples was limited by social constraints, research costs and other practical factors. In the future, the number of samples and the coverage of respondents need to be expanded to further test the stability and universality of our findings. Secondly, this paper measured consumers' behavior by behavioral intentions, and there was still a gap between intention and behavior. Therefore, future research on animal welfare product consumption can focus on consumers' actual purchase behavior regarding animal welfare-related attribute products. Finally, this study controlled many factors such as personal and family characteristics, animal contact experience, level of city, etc. to explore the mechanism of animal welfare knowledge and product cognition affecting consumers'

behavioral intentions. The study was limited to cross-sectional data, and longitudinal design could better clarify consumers' behavioral intentions and their influencing factors.

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Consumer Preferences for Animal Welfare in China: Optimization of Pork Production-Marketing Chains

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Simple Summary: In this study, consumer preferences for pork produced using animal-welfare-enhancing farming strategies were assessed. In China, the demand for animal-friendly products is increasing, but so far, studies on consumer preferences for animal welfare farming attributes are limited. The objective of this study was to analyze consumer preferences for pork based on four animal welfare farming attributes, namely feed nutrition, living environment, health care, and activity space. The study employed a choice experiment approach. The survey covered 1274 pork consumers in Guangdong province, China. Our empirical results suggest that Chinese consumers were willing to pay an additional 2.359–10.477 CNY/500 g (5.27–23.39%) for animal welfare pork. Furthermore, there was significant heterogeneity in consumer preferences. China is the world's largest producer and consumer of pork. Since the outbreaks of African swine fever in 2018, China's pork imports have been constantly on the rise. The results can contribute to the optimization of pork production structures and marketing plans for stakeholders and can assist with the timely development of international competition strategies for animal-derived trade products.

Abstract: Consumption demands for pork produced by farms that employ strategies to improve animal welfare ("animal welfare pork") will be an important indicator for predicting domestic pig feeding standards and pork industry development. This paper analyzes consumer preferences for animal welfare pork based on the choice experiment data of 1274 pork consumers in Guangdong province, China. The results show that consumers had a significant preference for animal welfare pork and that they were willing to pay a premium of 2.359–10.477 CNY/500 g (5.27–23.39%) on average. There is heterogeneity in consumer preferences regarding age, education level, and income. Producers of animal-derived products can not only adjust the mix of production conditions to improve pig welfare and innovate contractual arrangements for industry chain stakeholder groups, but they can also develop differentiated marketing strategies for animal welfare products to meet consumer demands for animal welfare.

Keywords: animal welfare; consumer preferences; willingness to pay; choice experiment

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1. Introduction

There is a large international debate regarding the welfare of animals raised for food [1]. Many scholars consider animal welfare to be a positive attribute of food [2]. According to the Terrestrial Code of World Organisation For Animal Health (WOAH), animal welfare

refers to: "the physical and mental state of an animal in relation to the conditions in which it lives and dies". It is a branch of science and looks at these measurable states in almost all areas of our interaction with animals, including areas of agriculture, entertainment, companionship, research, and others [3]. Studies have shown that animal welfare can not only have a positive impact on the growth and health of farm animals [4,5], thereby improving the quality of animal-derived products, but that it also helps meet ethical and moral requirements of the public. If the living environment can be modified according to the physiological and behavioral habits of different animals, consideration of the concept of animal welfare will undoubtedly reduce animals' stress; improve their immunity, fitness, and health; and reduce the use of pesticides, feed additives, and veterinary drugs that pose serious health hazards to consumers. Improving animal welfare may become an important issue in the breeding industry.

China is a major producer and consumer of pork worldwide, and pig rearing is the backbone of the domestic livestock industry (pork production in China has reached 52.96 million tons in 2020, accounting for more than 59.6% of meat production according to the 2021 China Statistical Yearbook). With the optimization of industrial structures, farms that produce fewer than 500 pigs per year decreased from 82.2 million in 2007 to 20.6 million in 2020, while farms that produce more than 50,000 pigs per year increased from 50 in 2007 to 554 in 2020 (Figure 1). The issue of animal-derived food safety and farm animal welfare caused by intensive pig farming has become an urgent concern. In May 2014, China introduced the Farm Animal Welfare Requirements for Pigs, the first farm animal welfare standard concerning advanced foreign farm animal welfare concepts concerning the existing domestic scientific, technological, and socio-economic conditions. According to the requirements, the whole process of animal welfare management regarding pigs' breeding, transport, slaughter, and processing is to be regulated as it relates to aspects such as feed and drinking water, farming environment, farm management, health plans, transportation, slaughter, splitting and processing, records and traceability, etc. This increases the possibility of exploring issues related to pig welfare in China.

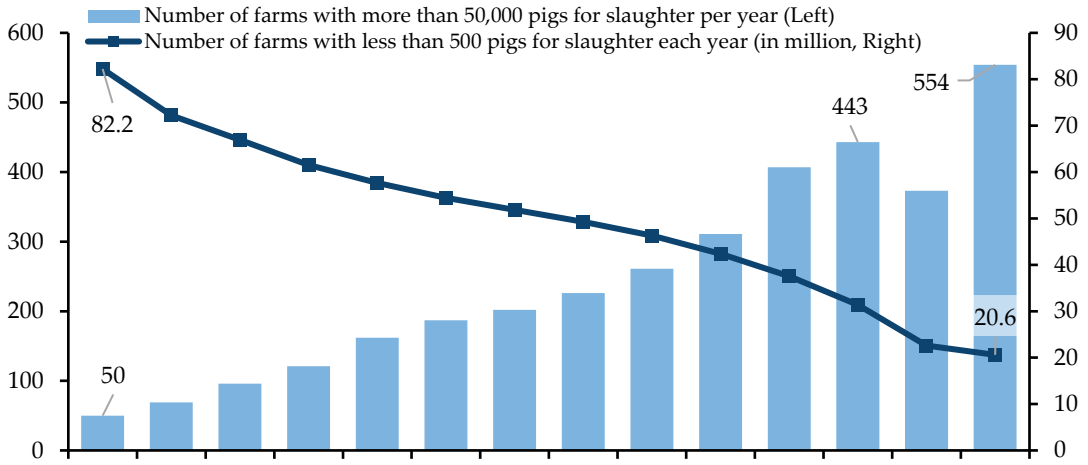

Figure 1. Number of Pig Farms in China from 2007 to 2020. (Source: China Animal Husbandry and Veterinary Yearbook).

The future of agriculture depends in large part on consumer demand. It is critical for public health departments and animal-derived product marketers to understand consumer preferences and willingness to pay (WTP) for animal welfare. According to the results of a survey conducted by You et al. (2014) among 6006 consumers in 29 provincial administrative regions in China (excluding Tibet, Hainan, Taiwan, Hong Kong, and Macau), 54.5% of the respondents were willing to pay a higher price for animal welfare pork at least to some extent [6]. Wang and Gu (2014) found that consumers in Jiangsu province were willing to pay an average of over 16.2% of the base price for animal-friendly pork before being

given information about the association between animal welfare and meat quality, and they were willing to pay over 21.3% of the base price after being given information about the association [7]. At present, most of the studies on Chinese consumer preferences for farm animal welfare still remain at the level of descriptive statistical analysis. Only a few studies, such as Wu et al. (2014) [8] and Xu et al. (2019) [9], focus on empirical methods. Additionally, studies on consumer preferences for animal welfare breeding attributes are uncommon in China.

This paper focuses on how much of a premium consumers are willing to pay for animal welfare pork in China. The study mainly covers the following aspects. First, the paper incorporates a limited choice experiment examining consumer preferences for animal welfare pork based on four attributes: feed nutrition, living environment, health care, and activity space. Second, it helps the stakeholders better understand the heterogeneity in Chinese consumer preferences for animal welfare farming methods, and it provides theoretical support for the formulation of farm-animal-management-related policies and marketing strategies for livestock products in China. This not only helps domestic stakeholders grasp the dynamic consumer preferences and optimize production structures and marketing plans, but it also improves the world's understanding of China's huge animal-derived food consumption market and the development of international competition strategies for agricultural trade products.

The structure of this paper is as follows. The choice experiment and survey design, estimation methods, and sample data are explained in Section 2. Empirical results are analyzed in Section 3. Discussions and policy implications are considered in Section 4. Finally, conclusions are presented in Section 5.

2. Research Methodology

2.1. Choice Experiment Design

In China, consumers do not know much about animal welfare, and there are no products with animal welfare labels on the market. Consumers tend to choose animal foods to meet their consumption needs by considering the manner, conditions, and environment in which animals are raised (e.g., whether they have a healthy diet, a good living environment, scientific health care, and adequate space to move around). Due to the lack of a real market, consumer-preference-assessment methods based on actual market prices are not suitable for evaluating consumer demand for non-market product attributes. However, hypothetical choice experiments can be advantageous in such cases and are thus widely used in this regard [10]. In particular, choice experiments have been widely used to measure consumer preferences for food with certain attributes, e.g., Wu et al. (2016), Ortega et al. (2017), Wang et al. (2018). Kallas et al. (2019), Czine et al. (2020), Huang et al. (2022), Lin-Schilstra et al. (2022) [11–17].

Pig welfare products can be seen as a collection of different welfare attributes from which consumers can obtain utility. Choice experiments enable evaluation of multiple attributes by replicating real life shopping scenarios [18]. Using this approach to determine consumers' willingness to pay has become a better way of assessing consumer demand and animal welfare preferences [19]. It provides important information to policymakers or marketers who are preparing and implementing such certification systems and promoting them widely [20]. Such information would be useful for stakeholders in the supply chain for designing production processes and developing marketing strategies based on these production attributes, and it would be valuable for developing appropriate marketing communication tools [21].

In order to meet social concerns about the welfare quality of animal food and the related market demand, and to promote access to products that meet specific animal welfare standards, the EU published a welfare quality assessment scheme in 2009 for three categories of farm animals: pigs, cattle, and poultry. The standards of animal welfare practices are assessed in four areas: good feeding, good housing, good health, and appropriate behavior. Accordingly, we designed the choice experiment of animal welfare consumption

preference with reference to the above four aspects. Specifically, we are more concerned about such aspects as feed nutrition, living environment, health care, and activity space, which seem to be the more prominent problems in China's pig industry [22–24].

It is worth noting that providing activity space and outdoor access are the two most important attributes necessary to obtain an acceptable level of welfare, as this prevents injuries and suffering [25]. Most consumers share this concern and cite the permission of outdoor access as a very important characteristic of pig welfare [26]. In terms of activity space, this paper refers to the welfare levels set up by Denver et al. (2017) [27], in which outdoor access is considered in addition to increased activity space. Therefore, the activity space attribute is defined in three levels, while the other three attributes are defined in two levels.

The price consists of four levels. The reference is based on the average market price of lean pork loin in large, medium, and small supermarkets as well as wet markets and online fresh food platforms (JD Fresh, Suning Commerce and Fresh Hema) in Guangzhou city (the capital city of Guangdong province) in February 2020. The pricing strategy of product marketing was also considered (e.g., any price ending with the number "8" is considered as a lucky number to Chinese consumers, as "8" has a similar pronunciation with "fa", the Chinese character of "wealth"). The animal welfare attributes and their levels in the choice experiment are shown in Table 1.

Table 1. Farm animal welfare attributes and their levels in the choice experiment.

Attribute	Level	Description
Feed nutrition	Common feed	The current national standards for nutrient content are met.
	Fermented feed	The current national standards for nutrient content are met. In addition, the feed is enriched with probiotics (which help intestinal digestion and reduce food residue).
Living environment	Standard environment	The air, ventilation, and other environmental parameters of the pig house are in line with the national standards.
	Recreational environment	The air, ventilation, and other environmental parameters of the pig house are in line with the national standards. In addition, toys, music, and other recreational facilities are provided.
Health care	Basic care	Basic, necessary epidemic diagnosis and treatment are provided. Measures such as frequent disinfection and disease monitoring are taken.
	Optimal care	Veterinarians provide a daily inspection and a timely diagnosis and treatment of sick or injured pigs. Pain-free surgery is given to avoid pain unrelated to the disease.
Activity space	Standard space	Indoor space in accordance with the national standard is at least 0.8–1.2 m^2 of bedding area per pig.
	100% more space	According to the national standard, 100% more indoor space takes up at least 1.6–2.4 m^2 of bedding area per pig.
	100% more space and outdoor access	100% more indoor space takes up at least 1.6–2.4 m^2 of bedding area per pig. In addition, access to outdoor pasture is provided.
Price	44.8, 54.8, 64.8, 74.8	These are the prices at which the respondents usually bought fresh lean pork in supermarkets or wet markets (unit: CNY/500 g).

In this paper, 24 choice sets were designed to estimate consumers' utility of animal welfare pork based on a D-optimal fractional causal analysis experimental design using the Ngene 1.2.1 software package (www.choice-metrics.com, (accessed on 16 September 2022)). The 24 choice sets were divided into four groups and each respondent was randomized to complete one of the groups for a total of 6 choice sets. In this way, respondents may have the ability to complete the entire choice experiment within a reasonable time frame. It is generally accepted that providing an "opt-out" or "no purchase" option in the choice set more closely resembles the real decision scenario [28]. Therefore, each choice set includes

the following three options with different animal welfare farming attributes: Pork A, Pork B, and neither. Figure 2. illustrates one of these choice sets.

Product Description		
	Pork A	**Pork B**
Health Care	Basic care	Optimal care
Feed Nutrition	Common feed	Fermented feed
Living Environment	Standard environment	Recreational environment
Activity Space	100% more space and outdoor access	Standard space
Retail Price	54.8 (CNY / 500g)	64.8 (CNY / 500g)

I will buy: A. Pork A B. Pork B C. None of these pork

Figure 2. Sample of a choice set.

2.2. Survey Design

Targeting pork buyers is a key part of the survey because targeting ordinary consumers may lead to bias in estimation caused by sample selection. Guangdong province was selected as the survey area for the following reasons. First, Guangdong's economic and social development level is among the highest in the country, with the GDP reaching about 1.92 trillion USD (Exchange rate: 1 USD/CNY 6.1798, December 31, 2021 (CFETS).) in 2021 and ranking first for 33 consecutive years in China. Second, Guangdong, adjacent to Hong Kong and Macau, is a major province of foreign trade, where people may be more likely to accept the concept of animal welfare. Third, there is a common belief that "people in Guangdong know about food" in China. Furthermore, consumers aged 16 and above were targeted as respondents in the survey, as China implements a nine-year compulsory education system, and 16 years old is usually the corresponding age for an individual to complete their compulsory education. Some previous research has included the 16-year-old group in survey subjects when assessing the purchasing of household food items, including Liu & Niyongira (2017), Liang et al. (2023) [29,30].

In developing countries, new ideas such as concern for animal welfare are generally easily accepted among young people with higher levels of education and better economic incomes [31,32]. In today's new media era, this group has access to a large amount of information via smartphones. Since a face-to-face survey method would substantially increase the cost of the survey and could lead to bias caused by limited consumer cognitive resources (time and energy) at the time of the survey, and because of the impact of the global COVID-19 pandemic, the data for this paper were obtained through an online survey.

The definitions of farm animal welfare and its products were clearly given in the guidelines of the questionnaire. The choice experiment was conducted immediately after respondents answered some basic questions about their perception of farm animal welfare and its products. In the survey, they were presented with a "cheap talk script" about the choice experiment designed to reduce their hypothetical bias [33,34]. The term "cheap talk" is borrowed from experimental economics, where it refers to communication between players prior to execution of an experiment. Here, a cheap talk script refers to open communication between the experimenter and the respondents about things to consider when responding to a subsequent question. The cheap talk script was followed by a description of the information about animal welfare farming attributes.

To ensure randomization of the survey, respondents were assigned to different groups of purchase scenarios based on the parity of the last two digits of their cell phone number (two odd numbers, two even numbers, odd followed by even, even followed by odd). They were only able to see one choice scenario at a time in order to exclude interference

from other choice scenarios. They spent at least 15 s in each choice scenario to ensure an acceptable quality of data. In addition, the order of the six choice scenarios faced by each respondent was randomized to exclude any order effects on the estimated results. The choice experiment was followed by a survey on respondents' pork consumption habits and basic personal information. The questionnaire would be completed in about 15 min.

To reach statistical significance and satisfy the rank condition of the choice experiment, we adopted a protocol generally used in choice experiments design [35–37] to determine the minimum sample size:

$$\mathrm{N} \geq 500 \times \left(\frac{\mathrm{L}}{\mathrm{A} \times \mathrm{C}} \right) = 500 \times \left(\frac{4}{3 \times 6} \right) = 111.111$$

Here, N is the number of the sample; L is the largest number of levels of any of the attributes; A is the number of choice options in a choice set; and C is the number of choice sets faced by each respondent. Given that we divided the 24 choice sets into four groups, the minimum sample size for this choice experiment would be 112.

2.3. Estimation Methods and Econometric Models

This paper uses a random utility model to analyze consumer preferences. The choice experiment is based on the following assumption: individual n obtains utility by choosing option i from a finite set of alternative options J of choice set C under scenario t. In the random utility model, utility consists of a deterministic component V_{nit} that depends on the attributes of the options and a random component ε_{nit}, i.e.,

$$U = V_{nit} + \varepsilon_{nit} \tag{1}$$

Thus, if $U_{nit} > U_{njt}\ \forall j \neq i$, then individual n will choose option i. Consequently, the probability that individual n will choose option i is

$$P_{nit} = Prob(V_{nit} + \varepsilon_{nit} > V_{njt} + \varepsilon_{njt}\ ;\ \forall j \in C,\ \forall j \neq i). \tag{2}$$

Given the underlying distribution of the error term, the final form of the logit selection probability can be expressed as:

$$P_{nit} = \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})} \tag{3}$$

While traditional logit models assume that consumers are homogeneous, the random parameter logit (RPL) model relaxes the constraints of traditional logit models by allowing random variation in in-sample preferences according to a specified distribution [38]. Accordingly, the RPL model can be used to measure heterogeneity in consumer preferences for animal welfare farming attributes. Based on the RPL model, the deterministic component of utility V_{njt} in the random utility model takes the following form:

$$V_{njt} = \beta' \chi_{nit} \tag{4}$$

where β is a vector of random parameters with their own mean and variance indicating individual preferences and χ_{nit} is a vector of all attributes in the ith choice. According to Train (2003) [39], the probability that individual n will choose option i from the choice set C under scenario t is:

$$P_{nit} = \int \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})} f(\beta) d\beta \quad (5)$$

where the random parameter $f(\ )$ of the distribution is specified. If the parameter is fixed to β_c (non-random), the distribution fails, i.e., $f(\beta_c) \to \infty$, otherwise $f(\beta) = 0$.

Considering that utility is non-basic in nature and that the estimated model coefficients cannot be interpreted in economic terms, the willingness to pay of consumers is estimated as:

$$WTP = \frac{-\beta_k}{\beta_p} \quad (6)$$

where β_k is the estimated coefficient of the kth attribute and β_p is the estimated price coefficient. A 95% confidence interval was created using a parametric bootstrap procedure as suggested by Krinsky and Robb (1986) [40]. Specifically, a multivariate normal distribution was created by parameterizing the coefficients and variance terms estimated using the RPL model, from which 1000 observations were extracted.

2.4. Sample Source and Data Description

This survey was anonymous and ethical approval was granted by College of Veterinary Medicine, South China Agricultural University. A pre-survey was conducted in February 2020. We rephrased the questionnaire to make it more concise and easier to understand, removed survey questions inconsistent with the local situation, and added some more valuable questions based on the feedback and suggestions from 90 sample consumers.

Thereafter, a formal investigation was conducted in March 2020 via the paid online platform provider Wenjuanxing, which is a professional online survey platform in China that focuses on providing users with services such as powerful, user-friendly online questionnaire design, data collection, custom reports, and survey result analysis. The platform recruits and maintains a group of consumers who participate in surveys from time to time with small incentives. Participants will randomly receive email invitations and URLs directing them to the survey, and they subsequently receive rewards in the form of credits that can be converted to vouchers for shopping. Participation in each investigation is voluntary. The sample service of Wenjuanxing provides strict quality-control mechanisms, including sample quality control, filler control, filling process control, the whole tracking effect, etc., to ensure recovery of true and valid response data.

Finally, a total of 1637 questionnaires were collected, and 1274 respondents completed the entire survey. This produced a sample of 7644 choices (1274 respondents $\times$ 6 choice sets). The choice experiments included a significant number of pork consumers, which allowed us to investigate consumption preference and heterogeneity. All statistical analyses were carried out using the software package Stata 16.0 (Stata Corp. 2019, Stata Statistical Software: Release 16, StataCorp LLC, College Station, TX, USA).

The demographic characteristics of the sample consumers in Table 2 show that the proportion of females (62.48%) is significantly higher than that of males (37.52%), which is consistent with the fact that more women are responsible for taking care of the family's food. The average age of the respondents is 32.2 years old, and more than 50% have a university degree or higher, indicating that the sampled consumers are younger and more highly educated. Nearly 70% of the surveyed households have a monthly income between 6000 and 24,000 CNY. Nearly 50% of the households have children eating with them. Nearly 40% of the households have elderly people eating with them.

Table 2. Some socio-demographic characteristics of respondents (n = 1274).

Socio-Demographics		Socio-Demographics	
Gender (%)		Monthly household income (%)	
Male	37.52	<6000 CNY	17.03
Female	62.48	6000–12,000 CNY	33.28
Age (in years) Mean (s.e.)	32.25 (9.998)	12,000–18,000 CNY	20.88
Education level (%)		18,000–24,000 CNY	13.34
Primary school and below	0.55	24,000–30,000 CNY	8.01
Junior high school	5.18	>30,000	7.46
High school/technical secondary school)	10.08	Number of dining members (%)	
College/higher vocational	16.64	≤2	17.04
Undergraduate	54.00	3	24.88
Postgraduate and above	13.58 [1]	4	26.14
Eat with children under 18 years old (%)	49.69	5	21.11
Eat with the elderly above 60 years old (%)	39.87	≥6	10.83

[1] Note: Percentages may total >100% because of rounding.

3. Results

3.1. Consumer Preferences for Welfare Attributes of Fattening Pigs

As shown in Table 3, there is a significant preference for animal welfare pork. Consumers have the highest preference for the attribute of providing 100% more space and outdoor access. They are willing to pay a premium of 10.477 CNY/500 g (23.39%) compared to that of providing indoor rearing space in accordance with the national standard. However, their willingness to pay for 100% more rearing space is relatively low (a premium of 2.359 CNY/500 g or 5.27%), which suggests that Chinese consumers prefer the farming method of "free range" over simply increasing indoor rearing space. The premiums for the attributes of optimal care and fermented feed are 6.689 and 5.893 CNY/500 g, respectively. The premium is the lowest (2.560 CNY/500 g) for the attribute of providing recreational facilities such as toys and music instead of merely providing a ventilated, clean, and odor-free living environment.

Table 3. Random parameter logit results of consumer preferences for animal welfare pork.

Variables	Mean	Standard Deviation	Willingness to Pay	Willingness to Pay (%)
Fermented feed	0.380 ***	0.372 ***	5.893	13.15
	(0.033)	(0.075)	[4.912, 6.874]	
100% more space	0.152 ***	−0.027	2.359	5.27
	(0.041)	(0.102)	[1.100, 3.618]	
Increase 100% space and outdoor access	0.676 ***	−0.229	10.477	23.39
	(0.045)	(0.154)	[9.114, 11.839]	
Optimal care	0.431 ***	0.434 ***	6.689	14.93
	(0.034)	(0.067)	[5.640, 7.737]	
Recreational environment	0.165 ***	0.754 ***	2.560	5.71
	(0.036)	(0.056)	[1.455, 3.666]	
Would not buy	−6.770 ***	2.849 ***		
	(0.234)	(0.169)		
Price	−0.064 ***			
	(0.002)			

Table 3. *Cont.*

Variables	Mean	Standard Deviation	Willingness to Pay	Willingness to Pay (%)
Number of observations	22,932			
LR chi2	848.02			
Log likelihood	−5684.849			
AIC	11,395.7			

*** indicates statistical significance at the 1% level. The numbers in parentheses are standard errors, and the numbers in brackets are 95% confidence intervals. Willingness to pay (%) calculates the proportion of payment premiums obtained through the RPL model, i.e., the ratio of WTP to the base price (44.8 CNY/500 g) in the choice set, so as to facilitate comparison of the proportion of price premiums between different products in the existing literature.

Table 3 also shows that the standard deviation coefficients of all three variables (fermented feed, optimal care, and recreational environment) are significant at the 1% level except the "activity space" variable. It also indicates the heterogeneity of consumer preferences for pig welfare farming attributes. Specifically, consumer preferences for the recreational environment attribute are the most varied, with a standard deviation coefficient of 0.754, followed by the optimal care attribute (0.434) and the fermented feed attribute (0.372). This suggests that heterogeneity should be considered in studying consumers' preferences for animal welfare farming attributes, and the hypothesis of using the RPL model to analyze consumer preferences for animal welfare is confirmed.

3.2. Heterogeneity Analysis of Consumer Preferences

As mentioned previously, there is heterogeneity in consumer preferences for animal welfare pork. It is practically relevant for pork producers and marketers to visualize consumer preferences for farm animal welfare through demographic characteristics. The random utility model shows the difference in utility brought to consumers by different product options rather than the absolute value of utility brought by a single product. Hence, the effect of individual consumer characteristics on utility is usually omitted directly in the expression of the function because individual characteristics do not vary with product options [39]. A common approach is to set interaction terms between consumer socio-demographic characteristics and product attribute levels in the model to analyze the effect of consumer characteristics on consumer preferences or willingness to pay, as done in Wu et al. (2014) and Wu et al. (2016). Following this approach, we formed interaction terms to examine how demographic variables affect consumption preferences related to animal welfare.

According to the age distribution, the sample can be divided mainly into three groups: ≤25 years, 26–35 years, and ≥36 years. The proportions in these groups are 33.12%, 36.74%, 30.14%, respectively. Some of these age nodes can be found in the existing literature, such as Lim et al. (2013), Wu et al. (2015), Han et al. (2015), and Denver et al. (2017) [8,27,41,42]. Education levels of primary school and below; junior high school; high school/technical secondary school; college/higher vocational; and undergraduate, postgraduate, and above correspond to 6, 3, 3, 3, 4, and 3 years of education, respectively. Furthermore, we divided the sample into high-income and low-income categories based on income distribution, which accounted for 50.31% and 49.69% of respondents, respectively. In summary, the above socio-demographic variables can be classified as follows:

Gender:	female, male;
Age:	low age (≤25), middle age (26–35), and advanced age (≥36);
Education:	high education (≥16 years) and low education (<16 years);
Income:	high income (≥12,000 CNY) and low income (<12,000 CNY).

Accordingly, they formed interaction terms with each attribute variable of pig welfare, and RPL model regression estimation was conducted separately. Strictly speaking, the experimental design has to be adjusted after the introduction of the interaction effect, and the design scheme that only considers the main effect will lead to inefficient estimation [21]. In this paper, the interaction effects between attributes were not considered in the experimental design. In addition, we considered only one interaction term of consumer characteristics when conducting the RPL model estimation in order to avoid adding too many independent variables and over-parameterization caused by crossover between all of the individual characteristic terms and attribute terms [43]. Fortunately, the significance and sign of each welfare attribute may largely be consistent with those of the baseline model in the estimated model with the introduction of the interaction term.

It can be seen from Table 4 that, except for gender, age, education level, and income, all variables significantly affect consumer preferences regarding pig welfare farming attributes, albeit to varying degrees. Compared with consumers in the low age group (25 years old and below), consumers in the advanced age group (36 years old and above) are more concerned about the expansion of activity space and outdoor access (an interaction coefficient of 0.202), while consumers in the middle age group (25–35 years old) are less concerned about optimal care for pigs. The coefficients of interaction between the variables of being highly educated and preferring fermented feed as well as between being highly educated and preferring optimal care are significantly positive (0.196, 0.126). This indicates that consumer preferences for fermented feed and optimal care can be improved with increased education. In addition, the interaction coefficient between the higher income and fermented feed variables is significantly positive (0.253), which indicates that the two variables are associated. Increasing consumer income level is linked to higher consumer preferences for the fermented feed attribute.

Table 4. Random parameter logit results with socio-demographics interaction terms.

Variables	With Gender Interaction	With Age Interaction		With Education Interaction	With Income Interaction
Price	−0.064 ***	−0.065 ***		−0.065 ***	−0.065 ***
	(0.002)	(0.002)		(0.002)	(0.002)
Fermented feed	0.393 ***	0.347 ***		0.246 ***	0.252 ***
	(0.052)	(0.055)		(0.055)	(0.044)
100% more space	0.142 **	0.146 **		0.106	0.121 **
	(0.067)	(0.071)		(0.070)	(0.057)
100% more space and outdoor access	0.603 ***	0.572 ***		0.602 ***	0.618 ***
	(0.070)	(0.074)		(0.074)	(0.061)
Optimal care	0.440 ***	0.512 ***		0.344 ***	0.386 ***
	(0.053)	(0.057)		(0.056)	(0.046)
Entertainment environment	0.166 ***	0.240 ***		0.174 ***	0.114 **
	(0.059)	(0.063)		(0.062)	(0.050)
No purchase	−6.768 ***	−6.773 ***		−6.776 ***	−6.745 ***
	(0.234)	(0.234)		(0.236)	(0.232)
Interaction items between attributes and socio-demographics	Female	Middle Age (26–35)	Advanced Age (≥36)	High Education (≥16)	High Income (≥12,000)
Fermented feed ×	−0.021	0.088	0.002	0.196 ***	0.253 ***
	(0.065)	(0.075)	(0.079)	(0.067)	(0.063)
100% more space ×	0.016	−0.026	0.044	0.063	0.060
	(0.083)	(0.098)	(0.100)	(0.086)	(0.081)

Table 4. *Cont.*

Variables	With Gender Interaction	With Age Interaction		With Education Interaction	With Income Interaction
100% more space and outdoor access ×	0.117	0.105	0.202 *	0.109	0.116
	(0.086)	(0.100)	(0.105)	(0.088)	(0.083)
Optimal care ×	−0.015	−0.134 *	−0.103	0.126 *	0.086
	(0.066)	(0.077)	(0.080)	(0.068)	(0.064)
Recreational environment ×	−0.001	−0.095	−0.128	−0.017	0.102
	(0.074)	(0.086)	(0.090)	(0.076)	(0.072)
Number of observations	22,932	22,932		22,932	22,932
Wald chi2	−5683.6497	−5678.736		−5678.379	−5673.9201
Log likelihood	847.75	847.31		846.94	831.47
AIC	11,403.3	11,403.47		11,392.76	11,383.84

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The numbers in parentheses are standard errors. The standard deviation of random parameters for each attribute variable is not reported in this paper due to space limitations.

3.3. Personality Portrait Analysis of Consumers

It can be helpful for marketers to more intuitively understand the preferences of consumers for pig welfare farming attributes and to identify which groups to target for sales. In general, there are more female respondents in charge of family food shopping. It can be assumed that the consumers were female, and education level and income can be assumed to be positive correlates, i.e., higher education level would result in higher income (see Lim et al., 2013 [41]). In this paper, a total of six specific types of consumers were selected based on four socio-demographic characteristics of respondents: gender, age, education level, and income. The relative preferences of these six types of consumers with different socio-demographic attributes for each attribute of pig welfare (Table 5) were calculated and comparatively analyzed.

Table 5. Random parameter logit results of consumer preferences by six groups.

Variables	Lower Education (<16 Years), Lower Income (<12,000 CNY)			Higher Education (≥16 Years), Higher Income (≥12,000 CNY)		
	Low Age (≥25)	Middle Age (26–35)	Advanced Age (≥36)	Low Age (≥25)	Middle Age (26–35)	Advanced Age (≥36)
Price	−0.178 ***	−0.052 ***	−0.035 ***	−0.139 ***	−0.071 ***	−0.059 ***
	(0.037)	(0.013)	(0.007)	(0.016)	(0.007)	(0.011)
Fermented feed	0.518	0.346 *	0.095	0.865 ***	0.512 ***	0.692 ***
	(0.520)	(0.194)	(0.116)	(0.212)	(0.116)	(0.163)
100% more space	−0.571	−0.058	0.239 *	−0.008	0.154	0.440 **
	(0.426)	(0.344)	(0.136)	(0.208)	(0.128)	(0.180)
100% more space and outdoor access	0.366	0.377	0.669 ***	0.773 ***	0.836 ***	1.175 ***
	(0.451)	(0.302)	(0.151)	(0.231)	(0.148)	(0.239)
Optimal care	0.026	0.710 ***	0.359 ***	0.900 ***	0.513 ***	0.685 ***
	(0.374)	(0.235)	(0.108)	(0.209)	(0.107)	(0.156)
Recreational environment	0.198	0.123	−0.052	0.263	0.096	0.399 **
	(0.491)	(0.220)	(0.123)	(0.189)	(0.109)	(0.189)
Would not buy	−12.425 ***	−5.041 ***	−5.732 ***	−11.567 ***	−8.231 ***	−7.541 ***
	(2.499)	(1.105)	(0.885)	(1.337)	(1.005)	(1.533)

Table 5. *Cont.*

Variables	Lower Education (<16 Years), Lower Income (<12,000 CNY)			Higher Education (≥16 Years), Higher Income (≥12,000 CNY)		
	Low Age (≥25)	Middle Age (26–35)	Advanced Age (≥36)	Low Age (≥25)	Middle Age (26–35)	Advanced Age (≥36)
Number of observations	522	738	1836	1638	2664	1332
Wald chi2	44.53	51.88	94.72	68.89	91.25	59.63
Log likelihood	−116.292	−196.791	−487.112	−335.2545	−616.9963	−299.408
AIC	258.584	419.582	1000.223	696.509	1259.993	624.8168

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The numbers in parentheses are standard errors. The standard deviation of random parameters for each attribute variable is not reported in this paper due to space limitations.

The results in Table 5 show that consumer preferences for animal welfare pork change with age. For female consumers in the low age group with low education and low income, their preference for pigs' welfare is not significant. In the middle age group, those with low education and income have a significant preference for the attributes of optimal care and fermented feed (utility coefficients are 0.710 and 0.346, respectively). In the advanced age group, those with low education and income still have a significant preference for the optimal care attribute (0.359), although the degree of preference is reduced. The preference for the activity space attribute also becomes significant, especially for the outdoor access attribute, whose coefficient is the largest (0.669). It is clear that female consumers with low education, low income, and low age primarily pay attention to animal welfare attributes related to food safety and health (i.e., optimal care and fermented feed), while concern for attributes related to food quality (i.e., activity space) increases with age.

If factors such as education and income limit consumers' actual purchases of animal welfare products, then a comparison of consumer preferences between low-education, low-income groups and high-education, high-income groups in the different age categories may help confirm this hypothesis. Table 5 also shows that the preferences of the high-education and high-income group for animal welfare pork are more or less consistent in different age groups. The utility coefficients for optimal care, fermented feed, and 100% more space and outdoor access are all significant at the 1% level, but the priorities of attributes are varied. This is somewhat consistent with the preferences of low-education, low-income people in the middle and old age groups, while the preferences of the high-educated and high-income group are stronger. Consumers in the high-education, high-income, and high age group are also concerned with the recreational environment (with the coefficient of 0.399), an animal welfare farming attribute that meets the needs of animal mental health.

It is worth noting that consumers in the low-education, low-income group, and middle age group prefer the optimal care attribute more, which seems to contradict the results in Table 4 that indicate that low-aged consumers care more about the optimal care attribute than middle-aged consumers. This may be due to the fact that the sample size of the high-education and high-income group (64.54%) is larger than that of low-education and low-income group (35.46%). Nevertheless, this illustrates the heterogeneity of consumer preferences for pork with animal welfare farming attributes. It suggests that more empirical research should be carried out regarding consumers with different characteristics.

The WTPs of the above six groups for animal welfare pork were calculated and presented in Table 5. In order to describe their characteristics more intuitively, we further assumed that the low-education and low-income group received 9 years of education and 6000 CNY per month on average while the high-education and high-income group received 16 years of education and 24,000 CNY per month.

Table 6 shows the payment premium of female consumers with different educational background, income, and age characteristics. For the low-education and low-income group, the premiums paid by middle-aged consumers for fermented feed and optimal care are

6.677 and 13.715 CNY/500 g, respectively. The premiums paid by advanced-age consumers for the attributes of 100% more space, 100% more space and outdoor access, and optimal care are 6.909, 19.335, and 10.391 CNY/500 g, respectively.

Table 6. Estimates of consumers' willingness to pay by six groups.

	Fermented Feed	100% More Space	100% More Space and Outdoor Access	Optimal Care	Recreational Environment
			Lower income, lower education		
			Income = 6000 CNY, education = 9 years		
Age = 22.379	2.906	−3.202	2.053	0.144	1.112
	[−2.419, 8.230]	[−7.772, 1.369]	[−2.896, 7.003]	[−3.971, 4.259]	[−4.205, 6.430]
Age = 32.250	6.677 *	−1.122	7.276	13.715 ***	2.375
	[−0.686, 14.040]	[−14.066, 11.823]	[−4.772, 19,325]	[4.447, 22.984]	[−6.085, 10.836]
Age = 45.216	2.743	6.909 *	19.335 ***	10.391 ***	−1.503
	[−3.832, 9.318]	[−0.975, 14.792]	[9.510, 29.161]	[3.430, 17.351]	[−8.438, 5.433]
			Higher income, higher education		
			Income = 24,000 CNY, education = 16 years		
Age = 22.379	6.204 ***	−0.056	5.541 ***	6.454 ***	1.889
	[3.643, 8.764]	[−2.971, 2.860]	[2.498, 8.584]	[3.636, 9.272]	[−0.715, 4.493]
Age = 32.250	7.730 ***	2.175	11.792 ***	7.240 ***	1.35
	[4.052, 10.408]	[−1.387, 5.737]	[7.815, 15.769]	[4.355, 10.125]	[−1.668, 4.367]
Age = 45.216	11.780 ***	7.499 **	20.002 ***	11.671 ***	6.801 **
	[6.465, 17.095]	[1.261, 13.737]	[11.671, 28.333]	[5.565, 17.777]	[0.553, 13.049]

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The numbers in brackets are 95% confidence intervals.

The WTPs in Table 6 also show that highly educated and high-income consumers may generally have a significant payment premium for animal welfare farming attributes. Among them, the low-age consumers are willing to pay the highest premium for the optimal care attribute, reaching 6.454 CNY/500 g. The middle-age and advanced-age consumers are willing to pay the highest premium for the 100% more space and outdoor access attribute, reaching 11.792 CNY/500 g and 20.002 CNY/500 g, respectively. Those in the advanced-age group are also willing to pay a premium of 6.801 CNY/500 g for the entertainment environment attribute. As we expected, highly educated and high-income consumers are the focus of animal welfare marketing.

4. Discussions and Policy Implications

4.1. Discussions

This study empirically analyzes consumer preferences for pigs' welfare farming attributes in terms of feed nutrition, living environment, health care, and activity space. In general, consumers have a significant preference for these attributes and are willing to pay a premium of 2.359–10.477 CNY/500 g (5.27–23.39%). Among them, the premium for the attribute of 100% more space and outdoor access is the highest, reaching 10.477 CNY/500 g (23.39%). These results are generally consistent with other domestic studies. For example, Wang and Wu (2013) [44] examined the consumption preferences of urban residents in Changchun, Beijing, Hangzhou, Hohhot, and Chengdu, China, and found that consumers were willing to pay 2.814 CNY/500 g (11.73%) more for animal welfare pork.

However, the premium paid by Chinese consumers may be lower than that of Western developed countries. Liljenstolpe (2008) showed in a study with a choice experiment that Swedish consumers were willing to pay a 32% premium for outdoor-raised pork [45]. Denver et al. (2017) classified pig welfare as standard, medium, and high based on rearing space, i.e., rearing space stipulated by current legislation (at least 0.65 m^2 per fattening pig), 30% more space (at least 0.85 m^2), and 100% more space (at least 1.3 m^2), respectively [27]. Their study showed that Danish consumers were willing to pay a 17–75% premium for

medium-level animal welfare pork over standard animal welfare pork while willing to pay a 14% premium for high-level over medium-level animal welfare pork.

Although there is a gap between consumers' recognition of animal welfare and their actual purchasing behavior, providing information on animal welfare certification may become an important strategy to meet the differentiated needs of Chinese consumers. Currently, the packaging of fresh meat products in supermarkets, farmers' markets, and the three online fresh food platforms—JD Fresh, Suning Commerce and Fresh Hema—mainly involves information about animal species, parts of the meat, origin, and brand. There is lack of information regarding the farming methods with which the animals are raised. Consumers have to buy meat products based on experience, i.e., relying on personal observations of meat color, texture, etc. Our study found that consumers were willing to pay a significant premium for animal welfare pork. Policymakers and production suppliers may be able to further increase consumer confidence and product premiums by releasing information on the details of good production processes for meat products.

How can consumers be provided with better information for making these decisions? Information regarding animal welfare pork is well trusted by the populace [11]. Information regarding animal welfare attributes can be a useful tool to indicate the high-quality nature of the product if it is available to consumers through markings on the packaging [46]. Many studies have shown that product labeling is an effective tool to ensure that food products meet the individual needs of consumers, e.g., as in Gracia et al. (2011) and Kehlbacher et al. (2012) [47,48]. Therefore, product labeling is increasingly becoming an important regulatory strategy in the EU, especially as it relates to food safety issues [49]. Mandatory labeling, on the other hand, may lead to a negative selection of products with low animal husbandry standards, thus reducing consumers' choices. However, mandatory or enhanced legislation can improve consumer welfare by increasing the private value of animal welfare meat products [50].

An additional question is how to increase the market supply of animal welfare products. Many studies on willingness to pay for animal welfare have suggested potential strategies for improving the market supply of animal welfare products. However, there are still relatively few animal welfare products in the market, with the exception of a small number of countries such as Switzerland, the UK, and the Netherlands. This suggests that stakeholders in the food supply chain are very important for the improvement of animal welfare.

As pointed out by Thorslund et al. (2017), many steps have to be taken to improve farm animal welfare [51]. First, agribusinesses must be willing and able to produce to higher welfare standards. Second, there must be economic incentives to enable firms to gain, or at least not lose, revenue through animal welfare farming. Third, other entities such as slaughterhouses and meat processors must be willing to sell special products with animal welfare labels. Furthermore, retailers must be willing to market and sell the products. Lastly, consumers must be willing to buy the product at a premium price. In any case, the supply of animal welfare products requires changes in the governance structure between agricultural and production organizations in the food value chain. For example, the issue of animal welfare has to permeate the entire value chain when it cannot be solved at the end-handling stage, which in turn necessitates changes in the relationships between value chain members. In addition, new forms of contractual arrangements between farms and processors need to be established when animal welfare farming methods have been differentiated at the farm (rearing) stage.

Farmers or animal breeding enterprises are the most important stakeholder group for the improvement of animal welfare. Another reason for the low market share of farm animal welfare products may be that producers have doubts about animal welfare. Although many of them have positive attitudes toward farm animal welfare, previous studies have shown that only a minority of farmers recognize the need to improve the level of animal welfare in livestock production systems [25,52]. Practically, production system adjustments may entail high economic risks for producers, i.e., the cost of investment in improving animal

welfare may not be matched by a return and selling the product at a higher price may itself be a big problem [53–55]. It has also been shown that farmers' attitudes are closely related to their behavior of improving animal welfare [56,57]. Future investigation of farmers' attitudes toward animal welfare farming is essential to understand their actual willingness to participate in improving animal welfare and to increase the market supply of animal welfare products in China.

4.2. Policy Implications

China is the world's largest producer and consumer of meat. The present study potentially contributes not only to promoting the high-quality development of animal husbandry, but also to promoting the transformation and upgrading of consumption structure. The following suggestions can be made for meat production suppliers.

The first suggestion is to adjust the mix of improved animal welfare production conditions. In developing product differentiation policies to address the issue of public claims for animal welfare, animal welfare preference must be correlated with production costs. For producers, the benefit–cost ratio of improving breeding conditions may vary greatly. Producers may gradually improve the animal production environment and adjust animal feeding methods according to the differences in consumers' concerns about animal welfare and their preferences for different welfare breeding conditions. In addition, they may choose to prioritize animal welfare improvements by considering the farm's own advantageous conditions.

The second suggestion is to establish innovative contractual arrangements between industry chain stakeholder groups. Farmers or enterprises are often bound by contracts at the downstream production stage. It is necessary to involve the slaughter and processing industries in the development of animal welfare standards so that farmers or enterprises have the opportunity to operate under higher animal welfare standards. Additionally, compliance with higher animal welfare standards is a long-term capital investment, and producers may be able to leverage the financial guarantees provided by the downstream industry both to gain the opportunity to produce a high-quality product and to escape the financial pressures of improving animal welfare on their farms by increasing the profitability of their animal products.

The third suggestion is to develop marketing strategies to differentiate animal welfare products. Achieving better economic outcomes has always been the main motivation for farmers to improve animal welfare. Manufacturers need to provide sufficient product information to guide consumers to take responsibility and purchase animal welfare products rather than just treating animal welfare as a problem that needs to be addressed through regulation. In addition, the consumers who buy animal welfare products are not homogeneous. It is important to consider the heterogeneity in consumer preferences during the market launch process, to segment the product market, and to improve the valuation of and demand for animal products with higher-than-average welfare production conditions from different consumer groups so as to obtain the best cost-benefit ratio.

5. Conclusions

The issue of animal welfare is still not commonly recognized and there are currently no farm animal welfare-certified products in China. However, the Chinese government has recently launched programs to improve animal welfare. For example, China approved the establishment of the Animal Welfare International Cooperation Committee of the China Association for the Promotion of International Cooperation in Agriculture in 2013. Since then, more regulations and policies have been introduced, such as Farm Animal Welfare Requirements for Pigs (2014), Meat Sheep (2015), Chicken (2017), Laying Hen (2017), Cashmere Goat (2020), and Cows (2021). The process of promoting animal welfare development in China is gradually accelerating. Soon, a widening range of animal-friendly products will be available to meet the consumer demand in China.

Improving animal welfare may lead to increased production costs. If consumers have a willingness to pay for farm animal welfare, it will help strengthen the determination and confidence of producers to improve animal welfare. In this regard, this paper examined the consumer preferences for animal welfare pork using data from a choice experiment with 1274 pork consumers in Guangdong province. The results showed that consumers had a significant payment premium of 2.359–10.477 CNY/500g (5.27–23.39%) for pork with different animal welfare characteristics. Products with the "100% more space and outdoor access" animal welfare attribute are the most valued, followed by "optimal care", "fermented feed", "recreational environment", and "100% more space" attributes. The study found no significant gender differences in consumer preferences, but age, education, and income all had varying degrees of influence on animal welfare pork consumption preference. The empirical findings are useful to both industry practitioners and decision-makers in promoting the transition to more sustainable animal welfare farming practices in society.

Our study has some limitations, which should be addressed by future research. Our survey was conducted at the beginning of the global COVID-19 outbreak in 2020, when quarantine and isolation rules were implemented in China. Further research is needed to determine whether people's consumption habits for products with animal welfare attributes could change before and after the pandemic. Additionally, despite the fact that the scope of our study is limited to China, these results may produce useful pieces of information that might help developing countries creating policies to improve animal welfare and enhance their competitiveness in international trade of livestock products.

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Optimizing Dog Rabies Vaccination Services to the Public: A Discrete Choice Experiment in Guangdong, China

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Simple Summary: A discrete choice experiment was designed to explore dog-keeping households' preferences for dog rabies vaccination services. Dog-keeping households can be classified into three types based on the latent class model: resolute executors, mischievous rebels, and incentivized compliers. The residence, children in the household, perception of the safety risks, and knowledge of rabies may contribute to the heterogeneity among the households. Supportive measures should be provided to improve the convenience of dog rabies vaccination services in emerging countries like China.

Abstract: Vaccination for dogs is essential for controlling rabies and achieving the goal of eliminating dog-mediated rabies globally by 2030. This paper aims to investigate the preferences for public services regarding rabies vaccination, in an effort to optimize the existing rabies vaccination and prevention programs in China. The households investigated had significant preferences for dog rabies vaccination service attributes. The households can be classified into three types: resolute executors (52.13%), mischievous rebels (5.85%), and incentivized compliers (42.02%). The residence, the presence of children in the household, perception of the safety risks, and knowledge of rabies may be sources of heterogeneity. Supportive services on dog rabies vaccination should be made available, such as arranging weekend vaccination services, building mobile vaccination stations, providing home vaccination services, and increasing vaccine supply through multiple channels. Furthermore, multiple measures can be taken to increase rabies vaccination awareness among family members and facilitate dog management innovation to further increase the level of rabies prevention and control.

Keywords: rabies; vaccination; preference; discrete choice experiment

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1. Introduction

Rabies is a fatal zoonotic disease caused by the rabies virus that invades the central nervous system. The disease has an almost 100% case fatality rate, and it threatens more than 150 countries and regions worldwide, with Asia having the highest number of cases, followed by Africa. Despite the invention of the rabies vaccine by Louis Pasteur as early as 1886, the World Health Organization (WHO) estimates that 59,000 people still die of rabies annually (source: Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of High-Consequence Pathogens and Pathology), with children accounting for about 40% of the cases [1–4]. Given that the prevention and control of rabies is crucial for human well-being, the 28 September was officially designated as World Rabies Day in 2007 by the WHO, the World Organization for Animal Health (WOAH), and the United States Centers for Disease Control and Prevention. In December 2015, these organizations, together with the Food and Agriculture Organization

of the United Nations, and the Global Alliance for Rabies Control, held the International Conference on the Elimination of Rabies in Geneva. The conference set ambitious goals to eliminate dog-mediated human rabies and achieve zero case worldwide by 2030 [5].

China is among the countries most affected by human rabies, with deaths related to the disease being reported in all 31 of its provincial administrative regions as of 2021. In response, in 1980, four statutory bodies, namely the Ministry of Health, the Ministry of Agriculture and Forestry, the Ministry of Foreign Trade, and the National Supply and Marketing Cooperation, jointly issued the "Notice on the Control and Elimination of Rabies" and "Dog Management Regulations". Following the decree on the "Animal Epidemic Prevention Law" in 1998, detailed implementation rules were established throughout the country, with major cities adopting standardized measures for dog management, including compulsory rabies vaccination and pet registration. As a result of these efforts, and the increase in rabies immunity nationwide, the incidence of rabies in China has been declining annually since 2007, when the country reached the highest incidence of the disease this century (with 3300 cases per year). The total number of rabies-related deaths in the country dropped to 150 in 2021, as shown in Figure 1.

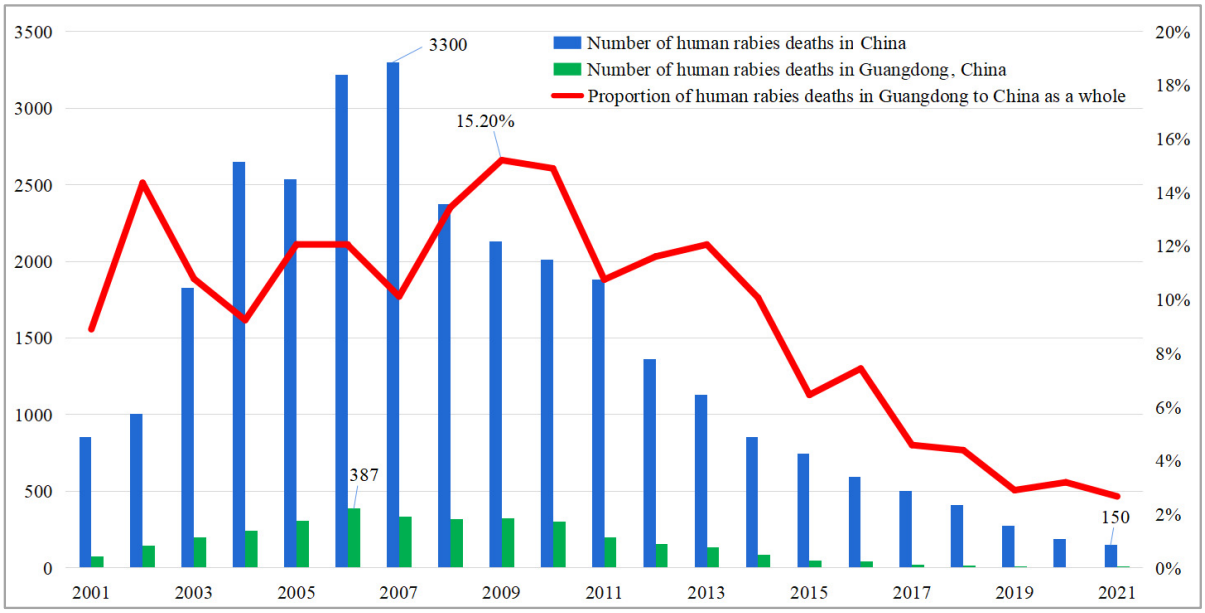


Figure 1. Trends in human rabies deaths from 2001 to 2021. (Source: China Center for Disease Control and Prevention, Guangdong Provincial Health Commission. Mortality = number of deaths in the year/number of cases in the year. The national data do not include data from Hong Kong, Macao, or Taiwan).

Despite China's significant progress in the prevention and control of rabies in recent years, the situation remains challenging. On one hand, rabies cases are widely dispersed across the country, often occurring in rural areas, making centralized prevention and control management difficult. On the other hand, the general public still lacks awareness of the risks and prevention measures for rabies. A survey conducted by Yang et al. [6] of 1906 students in three rural middle schools in Guangxi found that only 12.01% of the students recognized their vulnerability to rabies, 21.51% knew they should be vaccinated immediately after being bitten by dogs, and 13.69% were aware of preventive measures against rabies. In a study of 1015 patients, who had been bitten by animals, in a rabies prevention clinic in Wuhan, Li et al. [7] found that only 56.85% of respondents knew that rabies is infectious. More than 20% of respondents believed that rabies vaccination for dogs and cats was unnecessary, and about 70% of participants reported that they never needed reminders to get vaccinated after being bitten.

Currently, research on rabies and its prevention and control in China is primarily focused on natural sciences, such as virus infectious mechanisms, vaccine development, and epidemiology, with limited studies in the fields of humanities and social sciences. According to Miao et al. [8], post-exposure prophylaxis is not only expensive but also ineffective in preventing the spread of rabies from dogs to humans and other susceptible animal species compared to large-scale dog vaccinations. However, rabies control in China has become polarized, resulting in excessive vaccinations for registered dogs, but a lack of regulation for unregistered dogs [9]. Although dog registration and rabies vaccination are mandatory, neither has been strictly implemented, and accurate statistical data on registration are lacking [10]. Furthermore, while vaccination coverage in some major cities in China exceeds the recommended rate of 70% by the WHO, it is still insufficient to eliminate rabies epidemics, as unregistered or stray dogs and other rabies hosts are easily neglected [11,12]. Therefore, regulating dog registration and increasing the immunization rate for dogs remain some of the most effective measures to achieve the goal of eliminating human rabies in China.

To achieve this, it is crucial to provide rabies vaccination programs that are well received by the public. Identifying and responding to public demand for rabies vaccination for dogs is essential. However, limited empirical studies have investigated this topic. This study surveyed 633 dog-keeping households across 21 cities in Guangdong province, which is located in southern China, between latitude 20°09′~25°31′ N and longitude 109°45′~117°20′ E, covering an area of 179,700 square kilometers. The study had three main objectives: to explore the preferences of dog-keeping households on the attributes of rabies vaccination, to analyze the heterogeneity of the dog-keeping households' preferences for vaccination services using a mixed logit model and the latent class model, and to propose suggestions for optimizing local rabies vaccination-related services in emerging countries like China. The findings provide an important reference for improving the rabies immunization rate for dogs and contributing to the achievement of the 2030 goal.

2. Methods and Materials

2.1. Discrete Choice Experiment Design

The discrete choice experiment (DCE) is a frequently used method for optimizing medical intervention programs [13]. This approach is widely utilized to investigate public preferences for the attributes of a particular product or service, as demonstrated by studies such as McPhedran et al. [14] and Makabayi-Mugabe et al. [15]. In the DCE, respondents are presented with a series of choices between two or more options that differ in various dimensions, or "attributes", each of which has multiple "levels". By analyzing the choices made by participants, researchers can infer the utility value of different attributes and levels for different groups [16,17], allowing them to understand the relative importance and impact of policies on different sectors of society. This, in turn, can help predict the degree of public support for specific policies [18]. Additionally, evaluating respondents' preferences for policies may also involve measuring their willingness to pay (WTP), which can reveal the range of public preferences in favor of certain products or services.

This paper utilized the DCE methodology to examine the preferences of dog-keeping households for dog rabies vaccination services. We selected attributes for the experiment based on common factors associated with the use of the rabies vaccine for dogs, such as time, place, appointment, origin of vaccine, subsidy, and price (see Table 1). Specifically, attributes such as time, place, and appointment reflect the accessibility of the vaccination services. The origin of the vaccine, either domestically produced or imported, reflects the respondents' trust in the safety and quality of the vaccine. The subsidy level reflects the degree of concern shared by local authorities and society about rabies prevention and control. Many domestic organizations and departments frequently engage in "public service" activities to provide free or discounted rabies vaccines for dogs for the general public. We set the subsidy level at 25%, 50%, and 75% to make it easier for respondents to calculate the discounts in the DCE and distinguish the subsidy levels to a greater extent.

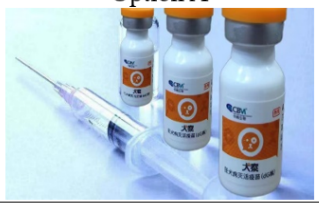
The prices for dog rabies vaccination services are primarily based on the average market price in rural areas (25 CNY/needle), and we set them at four levels, namely 25, 50, 75, and 100 CNY/needle, in an arithmetical manner.

Table 1. The attributes and levels used in the discrete choice experiment.

Attribute	Description	Level
Time	Time of rabies vaccination	Vaccination on Monday to Friday Weekend vaccination
Place	Location for rabies vaccination	Home vaccination Half-hour travelling distance One hour or more travelling distance
Appointment	Appointment for rabies vaccination	On-site appointment Online appointment
Origin	Origin of the vaccines	Domestic vaccines Imported vaccines
Subsidy	Government subsidies for residents to encourage rabies vaccination at vaccine original cost	25% subsidy 50% subsidy 75% subsidy
Price	Original price of rabies vaccine (CNY/needle)	25, 50, 75, 100

Accordingly, $2 \times 3 \times 2 \times 2 \times 3 \times 4 = 288$ possible product or service options could be obtained, and $288 \times 287/2 = 41{,}328$ combinations or choice sets could be generated. However, when there are three or more factors involved, interactions between the factors may increase the complexity of the experiment, making it difficult to implement. Therefore, we utilized the Ngene version 1.2.1 software package to design 36 choice sets based on the D-optimal fractional factorial experiment design method to estimate the utility of the attributes of dog rabies vaccination services for dog-keeping households. These choice sets were divided into 6 groups with 6 choice tasks in each group to minimize the probability of choice fatigue.

In the DCE, each choice set comprised of two hypothetical alternatives and an opt-out or "no vaccination" option to make the experiment more realistic. Respondents were assigned to different choice scenarios randomly based on their birth months. For example, respondents born in January or July received the first group of choice tasks, while those born in February or August received the second group, and so on. A cheap talk script was provided before the experiment to reduce the hypothetical bias of the respondents [19] and ensure that the data quality was acceptable. Figure 2 displays one of the choice sets.

Description	Option A	Option B
		
Time	Monday to Friday	Weekend
Place	One hour or more travelling distance	Home
Appointment	Online	On-site
Origin	Domestic	Imported
Subsidy	50%	25%
Price	CNY 25 (CNY 12.5 after subsidy)	CNY 100 (CNY 75 after subsidy)

I will choose: A. Option A B. Option B C. Neither of them

Figure 2. A sample of the choice sets.

2.2. Survey Design

Guangdong province was selected as the research site for our study due to several reasons. Firstly, Guangdong has a high incidence of rabies historically, with 3365 deaths between 2001 and 2021, accounting for 11.22% of the country, and reaching a peak period in 2006 with 387 cases of illness and death, equivalent to 11.80% of the country that year (as shown in Figure 1). Secondly, Guangdong has the largest population of pet-keeping households in China, accounting for 10.87% of the country in 2017 (source: Beijing LinkApp Technology Co., Ltd., Beijing, China, (http://linkip.cn (accessed on 30 March 2023))), with the number of pet dogs expected to reach 5.9 million in 2021. (The number of dogs and cats in China exceeds 112 million, including 54.29 million pet dogs, according to the 2021 China Pet Industry White Paper). Thirdly, Guangdong has a large number of pet-related enterprises, with 55,273 new pet-related enterprises registered in 2021, accounting for 5.76% nationwide, and 234,162 by 15 August 2022, accounting for 9.41% of the country. (We used "pet" as the keyword and searched in the National Enterprise Credit Inquiry System (https://www.qcc.com/ (accessed on 30 March 2023)) for pet-related enterprises in China and around the world. The results show that as of 15 August 2022, the number of pet-related enterprises in Guangdong is second only to Fujian (288,558) and Jiangxi (286,002)). Finally, the diverse economic classes in Guangdong contribute to a stronger willingness for pet-related consumption, with an average consumption in pet-keeping households of CNY 600–1000 per month, higher than the national average of CNY 200–500 (retrieved from https://www.sohu.com/a/231803695_100086638 (accessed on 31 October 2022)). Furthermore, Guangdong covers 2 first-tier cities, 5 second-tier cities, and 14 cities below the third tier, and its GDP has ranked first for 33 consecutive years in China up to 2021. Therefore, our study provides valuable insights into the preferences of Chinese dog-raising households for dog rabies vaccination services through a survey of households in Guangdong province.

We utilized a hybrid field- and web-based research method for the survey due to the strict quarantine isolation regulations enforced in China during the COVID-19 outbreak. In addition, face-to-face surveys could significantly increase the survey costs and lead to bias caused by respondents' limited cognitive resources, including time and energy. The survey was conducted anonymously with ethical approval from the College of Veterinary Medicine at South China Agricultural University. The respondents were households that either kept dogs or had dog-petting experiences within the past two years. The aim of the survey was to investigate the basic information from households, their dog-keeping experiences and risk perception, as well as their knowledge on rabies prevention and control.

In August 2022, a survey team was formed to conduct a pre-test in the cities of Yangjiang and Wuchuan, as part of our research project. During the pre-test, it was noted that some respondents had difficulty understanding certain terminology related to rabies and other specialized terms used in the questionnaire. As a result, we made several adjustments to the questionnaire. Firstly, we rephrased the questionnaire terms to make them more concise and easier to understand. Secondly, we eliminated the survey questions that were not relevant to the local situation and added some more valuable questions. Finally, we adjusted the structure of the questionnaire to allow respondents to answer the questions more fluently. These changes were made to ensure that the survey instrument was clear and effective in collecting the necessary data for our study.

After conducting the pre-test, we proceeded with a formal survey in 21 cities within the province using both online and offline formats (refer to Figure 3). Each respondent who participated in the field survey was provided with a daily necessity award worth approximately CNY 5 (equivalent to about USD 0.731, based on the exchange rate of the dollar against the RMB (1: 6.8361) on 31 December 2022). For the online survey, we utilized the services of Wenjuanxing, a professional online survey platform in China. This platform maintains a group of consumers who participate in surveys periodically for small incentives. The participants were invited to the survey through email invitations and URLs, and received rewards in the form of credits which could be converted into vouchers

for shopping. Participation in the survey was voluntary. Wenjuanxing's sample service includes a rigorous quality control mechanism, such as sample quality control, filler control, filling process control, and whole tracking effect, to ensure that the recovered response data are true and valid.

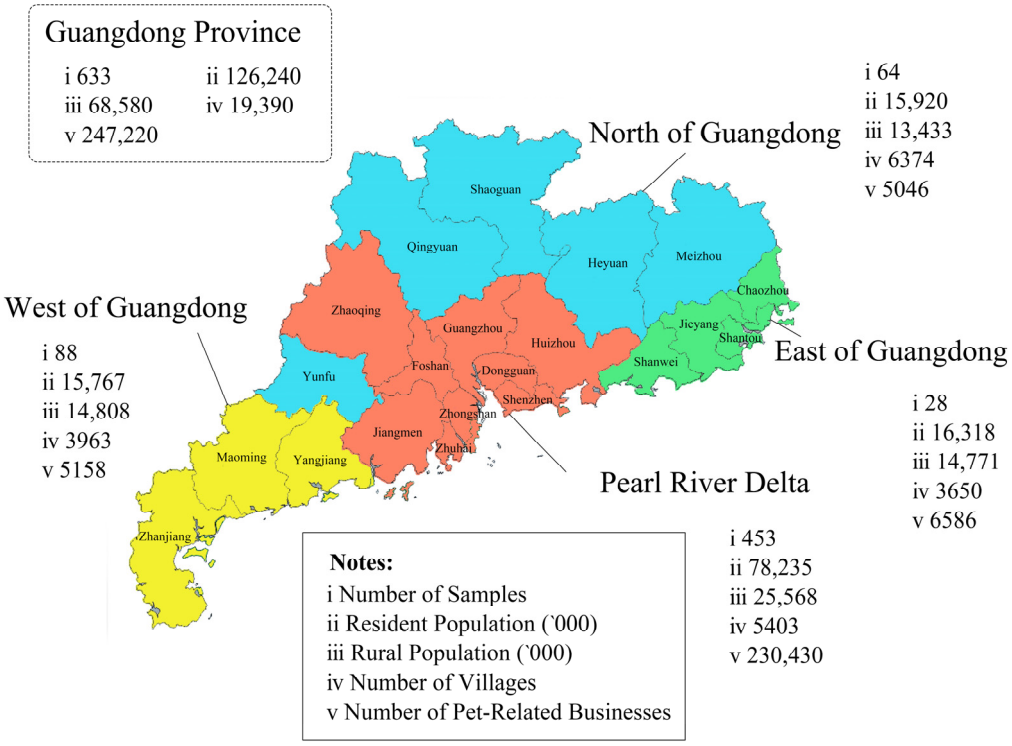


Figure 3. Survey locations. (Source: the Guangdong Statistical Yearbook 2021, the Guangdong Rural Statistical Yearbook 2021, the official government websites of various regions in Guangdong province, the Yigecun platform (http://www.yigecun.com/ (accessed on 30 March 2023)), the National Enterprise Credit Inquiry System (https://www.qcc.com/ (accessed on 30 March 2023))).

To achieve statistical significance and to meet the DCE rank condition, we followed the rules commonly used in choice experimental designs [20,21] to determine the minimum sample size:

$$N \geq 500 \times \left(\frac{L}{A \times C}\right) = 500 \times \left(\frac{4}{2 \times 6}\right) = 166.667$$

Specifically, N is the total samplings, L the number of strata with the highest level of hierarchy in the study attributes, A is the number of choice options in a choice set, and C is the number of choice sets faced by each respondent. Given that we divided the 36 choice sets into 6 groups for the study, the minimum sample size for the DCE was calculated to be 167. In August 2022, we received a total of 679 completed questionnaires. We used completeness and quality of information as the screening criteria and excluded invalid questionnaires with key information missing or logical basis. Respondents with a single response behavior were also excluded, as they may not have read the questions completely and may only have completed the survey for the reward. Ultimately, we obtained 633 valid questionnaires, with an effective rate of 93.23%, and 3798 completed choices (633 respondents × 6 choices), far exceeding the minimum sample size requirement.

2.3. Sample Description

2.3.1. Sample Characteristics

All the statistical analyses in this paper were conducted using the Stata 17.0 software. Table 2 displays the sampling characteristics of the survey. Of the respondents, 63.51%

were female with an average age of 29.156 years. Additionally, 66.51% of the respondents held a university degree or higher, and 14.53% worked in animal-related jobs. As there has been no census on domestic dogs for a significant period of time, the statistics were mainly collected from the pet industry. The results indicated that rural dog-keeping households accounted for 29.54%, while urban dog-keeping households accounted for 70.46%. The annual household income of the surveyed dog-keeping households was evenly distributed, with 55.45% reporting less than CNY 100,000 (equivalent to about USD 14,620, based on the exchange rate of the dollar against the RMB (1: 6.8361) on 31 December 2022). Of the respondents, 13.59% reported living alone, and 45.81% reported having children under 12 in their dog-keeping households.

Table 2. Demographic characteristics of the sample.

Demographic Characteristics	Value	Demographic Characteristics	Value
Gender (%)		Annual household income (%)	
Male	36.49	CNY < 10,000	15.17
Female	63.51	CNY 10,000–25,000	14.85
Age (in years) Mean (s.e.)	29.156 (9.184)	CNY 25,000–50,000	11.53
Urban (%)	29.54	CNY 50,000–100,000	13.90
Rural (%)	70.46	CNY 100,000–250,000	27.17
Education (%)		CNY 250,000–500,000	11.69
High school/technical secondary school or below	17.54	CNY > 500,000	5.69
College/higher vocational	15.96	Work related to animals (%)	14.53
Undergraduate	59.72	Living alone (%)	13.59
Postgraduate or above	6.79	Households with children $\leq$ 12 (%)	45.81

Note: Percentages may total >100% because of rounding.

2.3.2. Dog Keeping Conditions and Management

Table 3 provides an overview of the dog-keeping and management practices in the surveyed households. Among the respondent households, 77.57% kept one domestic dog, 15.96% kept two, and 6.48% kept three or more dogs. The majority (68.72%) have owned their pets for less than four years, while 31.28% have owned them for more than five years. The source of the dogs can be traced back to purchases from markets, pet stores, or other dog-keeping households (50.87%), while some dogs were received as gifts from friends or relatives (36.65%). Precautionary information about the risks from dog-keeping was received by 76.15% of the dog-keeping households, either from the buyers or givers. Regarding the reasons for keeping a dog, 71.72% of the households kept them for family companionship, 63.03% for personal preference, and 39.18% for home safeguarding.

In terms of the management of domestic dogs, 38.39% of the surveyed households did not impose social and spatial restrictions, which could increase the risk of dog attacks. However, 79.94% of households complied with the annual dog vaccination requirements. The remaining 20.06%, who did not adhere to the regular dog vaccinations, were the focus of rabies prevention and control efforts. The top four factors that affect vaccination rates were excessive workload and lack of time for vaccination (42.81%), vaccination sites being too far from home (32.86%), cumbersome procedures (29.38%), and high vaccination costs (27.80%). These four factors were reflected in the attributes of our DCE. About 32.70% of households believed that people should apply to local communities or village committees before keeping a dog, and 46.92% believed that they should register with the local community or village committee. Moreover, 74.09% of households regarded the frequency of rabies prevention and control publicity by local community or village committees as average, less, or inadequate.

Table 3. Dog ownership and management in the surveyed households.

	Percentage		Percentage
Number of dogs		Management style for domestic dogs	
1	77.57	Tethering	33.18
2	15.96	Cage or captivity	25.59
≥3	6.48	No restrictions on freedom	38.39
Dog ownership time		Other	2.84
1–2 years	25.28		
3–4 years	43.44	Regular annual vaccinations for dogs	79.94
5–6 years	15.01	Factors influencing regular vaccinations for dogs	
≥7 years	16.27	Did not know that vaccination is required	14.38
Domestic dog sources		There will be no problem for dogs kept at home	24.17
From markets, stores or homes that sell them	50.87	Vaccine prices are too expensive	27.80
Rescue station adoptions	4.11	Busy work, no time to vaccinate	42.81
Gifts from friends and family	36.65	Vaccination sites are too far from home	32.86
Picked up	6.16	Troublesome vaccination procedures	29.38
Other	2.21	No suitable tools (e.g., dog crates, etc.) to transport dogs to the vaccination site	20.06
		Other	13.59
Dog risk alert	76.15		
		Dog application	32.70
Reasons for having a dog		Dog registration	46.92
Housekeeping (watch the door)	39.18	Rabies prevention and control publicity	
Spending time with family	71.72	Never	10.11
Market sales	1.42	Less	34.28
Personal preference	63.03	General	29.70
Cultivating love in children	19.75	More	22.12
Other	3.79	Always	3.79

Note: Percentages may total >100% because of rounding.

2.3.3. Perception of Safety Risks Related to Dogs

Table 4 presents the perception of the safety risks related to dog-keeping households. These risks were measured in terms of life safety and property safety, with five and two items, respectively. The life safety risks included concerns such as "Dog shedding easily causes human allergies", "People who raise dogs are susceptible to diseases", "People who eat dog meat are prone to diseases", "I am worried about being bitten or scratched by a dog", and "I am worried about my dog biting or scratching others". The property safety risks included worries about "my dog damaging household items" and "the increased expenses caused by my dog's illness". Each item was measured using a 5-point Likert scale ranging from "1" for "completely disagree" to "5" for "completely agree". Cronbach's α value for each item related to dog safety risk perception was above 0.6, with a total α value of 0.72, indicating an acceptable reliability coefficient. The safety risk perception variable was obtained through the sum of the scores of the seven items, and we categorized the perception of safety risks as high or low based on the mean value.

Table 4. Perception of the safety risks related to dogs.

Item	Mean	Standard Deviation	Reliability	Total Reliability
Dog shedding easily causes human allergies.	3.330	1.009	0.686	
People who raise dogs are susceptible to diseases.	2.370	1.078	0.686	
People who eat dog meat are prone to diseases.	2.864	1.214	0.770	
I am worried about being bitten or scratched by a dog.	3.065	1.179	0.643	0.720
I am worried about my dog biting or scratching others.	3.368	1.160	0.654	
I am worried about my dog damaging household items.	3.316	1.165	0.660	
I am worried about the increased expenses caused by my dog's illness.	3.258	1.105	0.696	

2.3.4. Knowledge of Rabies among Households with Dogs

We assessed the extent of the rabies knowledge among households that kept dogs, by examining their understanding of rabies and any potential misconceptions surrounding it. Table 5 displays the descriptive statistics for the responses provided by dog-keeping households to questions related to rabies knowledge. The results indicate that the average percentage of correct answers for the four areas assessed, namely conceptual understanding, hosts and transmission routes, prevention, and treatment, were 81.58%, 86.94%, 89.62%, and 87.42%, respectively. It can be concluded that the level of rabies knowledge among dog-keeping households is relatively high.

Table 5. Level of knowledge about rabies among dog-keeping households.

Items	Correct Responses (%)	"Don't Know" Responses (%)
(1) Conceptual understanding:		
Rabies is a highly infectious disease caused by the rabies virus.	84.68	15.32
Rabies is a disease that can be transmitted between humans and animals.	87.68	12.32
Rabies is a fatal disease with an almost 100% mortality rate.	72.20	27.80
(2) Hosts and transmission routes:		
Only dogs can carry the rabies virus.	81.99	18.01
Healthy-looking dogs cannot carry the rabies virus.	87.68	12.32
The rabies virus can infect susceptible animals, including humans, through a bite or scratch from an infected animal.	91.15	8.85
(3) Prevention:		
Rabies cannot be prevented.	88.78	11.22
The rabies vaccine can effectively prevent rabies.	90.52	9.48
Dogs should receive a rabies vaccine annually.	89.57	10.43
(4) Treatment:		
If the wound from an animal bite is not bleeding, it does not need to be treated.	89.73	10.27
The wound from an animal bite should be immediately rinsed with clean water or soapy water.	81.52	18.48
Rabies immune globulin should be injected within 24 h of an animal bite.	91.00	9.00

Rabies is a zoonotic disease caused by the rabies virus that can be fatal once it invades the central nervous system, with a near 100% fatality rate. However, the severity of the disease was not fully recognized by 27.80% of dog-keeping households. Furthermore, 18.48% of households were unaware that washing the wound with water or soapy water immediately after being bitten is crucial, and 18.01% of households erroneously believed that only dogs can transmit the rabies virus. This suggests that dog-keeping households' knowledge of rabies needs to be improved, particularly regarding the conceptual understanding, hosts and transmission routes, and treatment.

To evaluate the level of rabies knowledge among dog-keeping households, we assigned values based on their responses to the questions related to conceptual understanding, hosts and transmission routes, and treatment. A value of 0 was assigned if the respondents answered, "don't know", while a value of 1 was assigned if their answer was deemed correct. The scores for all the items were added together, and the level of rabies knowledge among dog-keeping households was determined accordingly. We categorized the level of knowledge as either high or low based on the mean score.

3. Results and Analyses

3.1. Preferences for Dog Rabies Vaccination Services

According to Table 6, the results of the mixed logit model are consistent with those of the conditional logit model. Overall, the respondents had significant preferences for the three attributes for vaccination: time, location, and online appointment. Among them,

home vaccination had the highest utility value (β = 1.327). The respondents preferred imported vaccines (β = 0.131) to domestic vaccines. Increasing the subsidy from 25% to 50% motivated the respondents to vaccinate their dogs at a higher rate (β = 0.415), and the incentive can be doubled when the subsidy is increased to 75% (β = 0.855). This indicates that government subsidies can increase public utility scores and promote dog rabies vaccination.

Table 6. Estimates on the preferences for rabies vaccination services for dogs.

Variables	Mixed Logit Model		Conditional Logit Model
	Mean	Standard Deviation	Coefficient
Price	−0.011 ***		−0.008 ***
	(0.001)		(0.001)
Weekend vaccination	0.412 ***	0.997 ***	0.303 ***
	(0.064)	(0.089)	(0.036)
Based on 1 h or more travelling distance			
Half-hour travelling distance	0.705 ***	0.396 **	0.497 ***
	(0.082)	(0.172)	(0.053)
Home vaccination	1.327 ***	1.137 ***	0.909 ***
	(0.096)	(0.120)	(0.053)
Online appointment	0.141 ***	0.469 ***	0.093 ***
	(0.054)	(0.120)	(0.036)
Imported vaccines	0.131 **	0.929 ***	0.104 ***
	(0.061)	(0.091)	(0.036)
Based on 25% subsidy			
50% subsidy	0.415 ***	−0.024	0.304 ***
	(0.068)	(0.094)	(0.051)
75% subsidy	0.855 ***	0.431 ***	0.611 ***
	(0.078)	(0.134)	(0.052)
No vaccination	−4.460 ***	3.328 ***	−1.816 ***
	(0.474)	(0.344)	(0.106)
LR chi2	540.03		2463.44
Log likelihood	−2670.7937		−2940.8107
AIC	5375.587		5899.621
Observations	11,394		11,394

Note: *** and ** indicate statistical significance at 1% and 5% levels, respectively. The numbers in brackets are standard errors.

The results also reveal heterogeneity in respondent preferences for dog rabies vaccination services. The standard deviation coefficients for the attributes are statistically significant at least at the 5% level, except for the 50% subsidy. These include weekend vaccination, half-hour traveling distance, home vaccination, online appointment, imported vaccines, and 75% subsidy. Specifically, the preference for home vaccination varied the most, followed by weekend vaccination, imported vaccines, online appointment, 75% subsidy, and half-hour traveling distance.

3.2. Heterogeneity Analysis of Dog Rabies Vaccination Service Preferences

The study utilized the latent class model to investigate the heterogeneity of the preferences among households that kept dogs. The first step involved determining the appropriate number of classes, which was achieved by comparing the Bayesian information criterion (BIC) and the consistent Akaike's information criterion (CAIC). Despite attempts to test four or more classes, a singular covariance matrix rendered these efforts unsuccessful. Based on the information criteria presented in Table 7, a 3-class model was deemed most appropriate for the analysis, as it provided a balance between parsimony and interpretability [22].

Table 7. Latent class model classification.

Classes	LLF	Nparam	BIC	CAIC
2	−2774.379	19	5671.316	5690.316
3	−2665.868	29	5518.799	5547.799

Table 8 presents the results of the latent class model. The first section displays the utility coefficients for the dog rabies vaccination service attributes, while the second section lists the classification membership coefficients.

Table 8. Results of the latent class model.

Variables	Class 1	Class 2	Class 3
Utility function			
Price	−0.004 ***	−0.017 ***	−0.033 ***
	(0.001)	(0.005)	(0.004)
Weekend vaccination	0.264 ***	0.842 ***	0.284 **
	(0.057)	(0.273)	(0.120)
Based on 1 h or more travelling distance			
Half-hour travelling distance	−0.151	0.509	2.606 ***
	(0.096)	(0.383)	(0.311)
Home vaccination	−0.016	1.670 ***	3.886 ***
	(0.096)	(0.377)	(0.391)
Online appointment	−0.016	0.435 *	0.644 ***
	(0.061)	(0.264)	(0.127)
Imported vaccines	−0.044	0.376	0.718 ***
	(0.057)	(0.257)	(0.143)
Based on 25% subsidy			
50% subsidy	0.150 **	0.615 *	0.964 ***
	(0.074)	(0.320)	(0.160)
75% subsidy	0.383 ***	0.683 **	2.016 ***
	(0.086)	(0.342)	(0.248)
No vaccination	−3.769 ***	2.068 ***	−1.252 ***
	(0.277)	(0.554)	(0.421)
Classification membership function			
Urban	−0.249	−0.335	0.000
	(0.256)	(0.429)	
Child	−0.138	0.886 *	0.000
	(0.227)	(0.454)	
Safety risks perception	0.311	−0.885 **	0.000
	(0.226)	(0.440)	
Knowledge of rabies	−0.863 ***	−1.320 ***	0.000
	(0.247)	(0.413)	
Constant	1.289 **	−1.679	0.000
	(0.625)	(1.123)	
Dog-keeping households	633		
Observations	11,394		
Log likelihood	−2646.0116		
AIC	5366.023		
BIC	5637.634		
Shares (%)	52.13	5.85	42.02

Note: ***, ** and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. The numbers in brackets are standard errors.

In the first latent class (Class 1), the preferences of households with dogs for most rabies vaccination service attributes were not significant, except for the weekend vaccination and subsidy attributes (which also have the smallest coefficients among the groups). However, the coefficient for the "No vaccination" variable was the largest and significantly negative compared to the other groups. This indicates that this type of household is the most

determined to follow the vaccination schedule and does not require much motivation. Therefore, we refer to this type of household as "resolute executors". This type of household accounts for more than half of the sample (52.13%). The level of knowledge about rabies has a significantly negative impact on the probability of belonging to this type of household.

In the second latent class (Class 2), the preferences of dog-keeping households for most vaccination service attributes were not significant, except for the weekend vaccination attribute, which had the largest and significantly positive coefficient among the groups. However, the coefficient for "No vaccination" was significantly positive, indicating that this type of dog-keeping household may be the least willing to vaccinate their dogs. Fortunately, this type of dog-keeping households accounts for only 5.85% of the sample. Factors such as having children in the household, a low perception of the safety risks, and a low knowledge about rabies are likely to increase the probability of belonging to Class 2. Therefore, we refer to this type of household as "mischievous rebels".

In the third latent class (Class 3), most of the utility coefficients for attributes were significant at the 1% level and had relatively high values. This group of dog-keeping household is highly sensitive to price and other non-price attributes. They are more likely to choose a vaccination plan when certain incentives are provided. Therefore, we define this type of dog-keeping household as "incentivized compliers", accounting for 42.02% of the sample. This group may have a relatively high perception of the safety risks and knowledge about rabies.

Table 9 provides a more detailed comparison of the social characteristics for the three identified classes. The proportion of households with a high perception of the safety risks is highest in Class 1 (60.91%), compared to Class 2 (29.73%) and Class 3 (51.50%). In terms of households with children under 12 years old, Class 2 has the highest proportion (75.68%), which is significantly higher than Class 1 (49.70%) and Class 3 (56.77%). Class 3 has the highest proportion of urban residents (75.19%), and the proportion of households with a high knowledge level is significantly higher (77.82%) compared to Class 1 (52.73%) and Class 2 (45.95%).

Table 9. Demographic characteristics for the three types of dog-keeping households.

Demographic Characteristics		Class 1	Class 2	Class 3
		Resolute Executors	Mischievous Rebels	Incentivized Compliers
Residence	Rural (%)	32.73	35.14	24.81
	Urban (%)	67.27	64.86	75.19
Child	No (%)	50.30	24.32	43.23
	Yes (%)	49.70	75.68	56.77
Safety risks perception	Low (%)	39.09	70.27	48.50
	High (%)	60.91	29.73	51.50
Knowledge of rabies	Low (%)	47.27	54.05	22.18
	High (%)	52.73	45.95	77.82

To further evaluate the robustness of the latent class model estimation results, the model was re-estimated in three dimensions. Specifically, variables related to having children in the household, safety risk perception, and knowledge of rabies were removed in models 1, 2, and 3, respectively. The estimation results are presented in Table 10.

Upon comparing the estimation results presented in Table 8 with those in Table 10, it can be observed that the utility function coefficients have experienced slight changes after removing the variables related to having children in the household, safety risk perception, and knowledge of rabies. However, these changes are not significant and the overall trends remain consistent. This finding suggests that dog-keeping households' preferences for dog rabies vaccination services are highly stable. Additionally, the classification membership variables were found to have limited impact on utility, despite their ability to explain some of the heterogeneity in the respondents' preferences. This further confirms that the

utility derived by dog-keeping households during the DCE is primarily influenced by their selection of dog rabies vaccination service attributes [23].

Table 10. Results of the robustness tests in the latent class model.

Attribute	Model 1			Model 2			Model 3		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
Utility function									
Price	−0.004 ***	−0.016 ***	−0.033 ***	−0.003 **	−0.017 ***	−0.032 ***	−0.003 **	−0.015 ***	−0.033 ***
	(0.001)	(0.005)	(0.004)	(0.001)	(0.005)	(0.004)	(0.001)	(0.005)	(0.004)
Weekend vaccination	0.265 ***	0.849 ***	0.280 **	0.264 ***	0.856 ***	0.278 **	0.250 ***	0.857 ***	0.319 ***
	(0.057)	(0.276)	(0.121)	(0.058)	(0.276)	(0.116)	(0.058)	(0.285)	(0.120)
Based on 1 h or more travelling distance									
Half-hour travelling distance	−0.147	0.527	2.624 ***	−0.158	0.580	2.532 ***	−0.136	0.425	2.533 ***
	(0.096)	(0.392)	(0.311)	(0.097)	(0.381)	(0.300)	(0.099)	(0.397)	(0.319)
Home vaccination	−0.011	1.690 ***	3.906 ***	−0.028	1.703 ***	3.802 ***	−0.022	1.594 ***	3.854 ***
	(0.096)	(0.388)	(0.390)	(0.097)	(0.380)	(0.381)	(0.101)	(0.388)	(0.406)
Online appointment	−0.014	0.440 *	0.645 ***	−0.026	0.421	0.651 ***	−0.017	0.466 *	0.629 ***
	(0.061)	(0.264)	(0.129)	(0.062)	(0.265)	(0.125)	(0.063)	(0.270)	(0.128)
Imported vaccines	−0.040	0.356	0.713 ***	−0.049	0.394	0.702 ***	−0.044	0.303	0.721 ***
	(0.056)	(0.259)	(0.144)	(0.057)	(0.253)	(0.140)	(0.057)	(0.266)	(0.149)
Based on 25% subsidy									
50% subsidy	0.153 **	0.612 *	0.966 ***	0.144 *	0.651 **	0.953 ***	0.144 *	0.601 *	0.968 ***
	(0.074)	(0.321)	(0.162)	(0.075)	(0.321)	(0.157)	(0.077)	(0.330)	(0.163)
75% subsidy	0.387 ***	0.677 **	2.021 ***	0.372 ***	0.739 **	1.984 ***	0.367 ***	0.663 *	2.012 ***
	(0.086)	(0.345)	(0.250)	(0.087)	(0.351)	(0.243)	(0.091)	(0.351)	(0.257)
No vaccination	−3.763 ***	2.066 ***	−1.257 ***	−3.773 ***	2.091 ***	−1.349 ***	−3.833 ***	2.099 ***	−1.152 ***
	(0.283)	(0.568)	(0.442)	(0.281)	(0.563)	(0.425)	(0.284)	(0.561)	(0.412)
Classification membership function									
Urban	−0.251	−0.376	0.000	−0.284	−0.375	0.000	−0.384	−0.593	0.000
	(0.256)	(0.431)		(0.255)	(0.421)		(0.246)	(0.420)	
Child				−0.199	0.918 **	0.000	−0.227	0.810 *	0.000
				(0.222)	(0.447)		(0.219)	(0.468)	
Safety risks perception	0.336	−0.941 **	0.000				0.248	−1.029 **	0.000
	(0.222)	(0.440)					(0.219)	(0.446)	
Knowledge of rabies	−0.885 ***	−1.260 ***	0.000	−0.849 ***	−1.352 ***	0.000			
	(0.247)	(0.414)		(0.244)	(0.405)				
Constant	1.095 **	−0.133	0.000	1.579 ***	−2.001 *	0.000	1.095 *	−1.942 *	0.000
	(0.502)	(0.758)		(0.598)	(1.108)		(0.597)	(1.140)	
Dog-keeping households		633			633			633	
Observations		11,394			11,394			11,394	
Log likelihood		−2649.1530			−2650.8918			−2654.7783	
AIC		5368.306			5371.784			5379.557	
BIC		5625.235			5628.713			5636.486	

Note: ***, ** and * indicate statistical significance at 1%, 5%, and 10% levels, respectively. The numbers in brackets are standard errors.

The estimated results for the membership function coefficients are consistent with those shown in Table 8. When the variable "having children in the household" was removed from Model 1, the signs and significance of the other variables remained consistent with the previous results. The results for Models 2 and 3 also confirm the expected assumptions, which verified the robustness of the model results.

3.3. Willingness to Pay and Trade-Offs Analysis

The willingness to pay for different vaccination service attributes was calculated using the parameter estimation results from the latent class model presented in Table 8, and the results are shown in Table 11. The WTP reveals notable differences between the three latent classes. Specifically, the resolute executors (Class 1) exhibited a significantly

higher WTP for weekend vaccination (CNY 74.499), 50% subsidy (CNY 42.362), and 75% subsidy (CNY 37.168) than the mischievous rebels (Class 2) and the incentivized compliers (Class 3). In contrast, the incentivized compliers have a significantly higher WTP for half-hour travelling distance (CNY 80.153), and home vaccination (CNY 119.532) compared to the resolute executors and the mischievous rebels. Moreover, the mischievous rebels demonstrated a slightly higher WTP for online appointment (CNY 26.333) and imported vaccines (CNY 22.764) than the incentivized compliers.

Table 11. WTP for dog rabies vaccination service attributes.

Attribute	Class 1	Class 2	Class 3	WTP Weighted by Probability
	Resolute Executors	Mischievous Rebels	Incentivized Compliers	
Weekend vaccination	74.499	50.887	8.726	45.480
Half-hour travelling distance	−42.560	30.748	80.153	13.293
Home vaccination	−4.474	100.999	119.532	53.803
Online appointment	−4.478	26.333	19.797	7.525
Imported vaccines	−12.363	22.764	22.081	4.165
50% subsidy	42.362	37.168	29.656	36.719
75% subsidy	107.882	41.297	62.005	84.709

Weighted by the probability of the three classes, the importance of the dog rabies vaccination service attributes varied from high to low: 75% subsidy (CNY 84.709), home vaccination (CNY 53.803), weekend vaccination (CNY 45.480), 50% subsidy (CNY 36.719), half-hour travelling distance (CNY 13.293), online appointment (CNY 7.525), and imported vaccines (CNY 4.165).

By comparing the WTP of the three groups mentioned above, it is evident that the attributes of dog rabies vaccination services have conflicting values in terms of utility for dog-keeping households. Figure 4 illustrates the WTP position of the three latent classes for 75% subsidy, home vaccination, and weekend vaccination, with the size of each circle representing the proportion of each class of dog-keeping households. The proportion of mischievous rebels (Class 2) is significantly smaller than the other two classes, with positive WTP for 75% subsidy, home vaccination, and weekend vaccination. Moreover, the mischievous rebels assign a higher value to weekend vaccination than to the 75% subsidy.

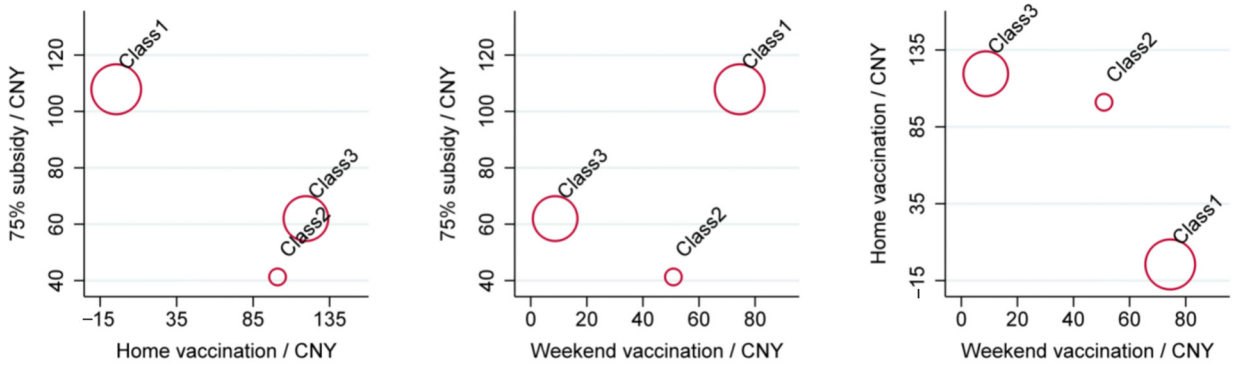


Figure 4. Comparison of the WTP.

Compared to home vaccination and weekend vaccination, resolute executors (Class 1) placed greater importance on the 75% subsidy attribute, exhibiting a much higher WTP for this attribute than the other two classes. On the other hand, the incentivized compliers (Class 3) have a significantly lower WTP for weekend vaccination at CNY 8.726, but a much higher WTP for home vaccination at CNY 119.532.

4. Discussions and Policy Implications

4.1. Discussions

Rabies remains a significant public health problem in China and, over the last decade, the country has invested inexhaustive human and financial resources and achieved significant results in rabies prevention and control. This has been made possible by the introduction of large-scale mandatory rabies vaccination for dogs. However, the decline in rabies deaths could be wrongfully labeled as a great step forward, which leads to subsequent relaxation of the controls. Any ensuing lifting of measures and further promises may potentially pose another "peak" or "epidemic wave" of rabies among the population [24]. We should, therefore, be vigilant in this regard to achieve the blueprint for eliminating dog-mediated rabies by 2030.

Effective health education on the risks of rabies is crucial for preventing and controlling the disease. The descriptive statistics presented in this paper indicate that a majority of dog-keeping households feel that their local community or village committee provides average, less, or inadequate information on rabies prevention and control (74.09%). There are various factors that can hinder households from vaccinating their dogs, including being too busy with work, living far away from vaccination points, encountering troublesome vaccination procedures, and facing the high cost of vaccines. It is concerning that 21.06% of households do not comply with the annual vaccination requirements, with urban households accounting for 66.14% of those not vaccinated regularly. The lack of awareness about rabies prevention is a significant challenge in implementing mandatory rabies vaccination policies for dogs. Although a larger sample size is needed to confirm the reliability of our data, our findings are consistent with other studies, such as those by Li et al. [7] and Sambo et al. [25].

Dog vaccination is an effective measure for preventing rabies and can help reduce the costs associated with rabies prevention and control [26]. The current study highlights that enhancing the accessibility of public vaccination services by providing vaccination during non-working hours and in close proximity can increase the marginal utility of rabies vaccination for dog-keeping households. These findings are consistent with previous studies on vaccination programs, such as Mouter et al. [27]. Dog-keeping households are likely to pay a higher premium for more convenient vaccination services, as demonstrated by their WTP an average of CNY 53.803 for home vaccination and CNY 45.480 for weekend vaccination. While there may be a gap between the WTP in the DCE and in reality, the premiums households are willing to pay suggest that there is potential for improving vaccination services.

This study identified significant heterogeneity in the preferences for dog rabies vaccination services, which can be attributed to factors such as residence, having children in households, perception of safety risks, and knowledge of rabies. Although the coefficient for the residence variable in the latent class model was not found to be significant, we believe that urban–rural differences could be an important factor contributing to the preference heterogeneity. The uneven development of public infrastructure in rural and urban areas could explain why most cases of rabies occur in rural areas [28]. Public services in rural areas are underdeveloped, and the return on investment is lower, which limits the ability to carry out tasks such as rescuing stray dogs. Additionally, unlike urban areas where dogs are mainly kept as pets, rural households keep dogs as guards and do not often register or leash them [9,10]. As a result, unregistered and free-roaming dogs in both urban and rural areas are primary hosts of rabies, creating shadow areas for rabies surveillance in China. Addressing these issues will be critical to achieving the goal of eliminating dog-mediated rabies worldwide by 2030.

This study has several limitations that should be acknowledged. First, due to cost and time constraints, the field surveys were only conducted in Guangdong province, which may not be representative of the entire population of dog-keeping households in China. In addition, online surveys may have excluded individuals with lower digital literacy, resulting in sample bias. Second, preferences expressed by respondents in the DCE may not

necessarily reflect their actual behavior in real-world scenarios, as they may be influenced by social interactions or other contextual factors. Nonetheless, previous research has shown that DCE is effective in predicting the overall vaccination rate [29], supporting the validity of our findings. Finally, our study was conducted in China, and the results may not be generalizable to other countries with different cultural, social, and economic contexts. Nevertheless, our findings may provide valuable insights for policymakers in emerging countries that are implementing policies to promote dog rabies vaccination and improve rabies prevention and control.

4.2. Policy Implications

The empirical findings indicate that there are several implications that could be useful to local governments and decision-makers in enhancing the management of rabies prevention and control by garnering public support.

Improving the accessibility of vaccination services is crucial for effective rabies prevention and control. Firstly, the government should optimize the schedule for vaccination services. For example, they could establish a vaccination appointment system through information networks like WeChat mini-programs and official accounts. In rural areas, they could organize events like a vaccination day to promote the services. Secondly, mobile points for rabies vaccination services should be established for frontline vaccination services. The location of these points should be strategically planned to establish a well-connected service network. Information about these service points should be widely publicized in districts, towns, and villages. The mobile service team could be formed by local institutions for animal epidemic prevention, relevant personnel, rural veterinarians, and animal clinics. They could offer accessible home vaccination services for dog-keeping households. Thirdly, the range of available vaccines could be expanded. One strategy is to use district, town, and village bulletin boards to advertise the manufacturer, production batch, and comprehensive utility of rabies vaccines. We also encourage vaccine competition between domestic and imported manufacturers to optimize the selection mechanism for rabies vaccines.

To sustain the increase in the vaccination rate, it is imperative to enhance dog immunization management. Firstly, the dog registration management system needs to be upgraded to include a comprehensive mapping of dog-keeping households. Dog owners should take responsibility for self-registration and provide information such as the owner's details, dog information, and vaccination records. The dog ownership registration mechanism should be explored and clarified in accordance with the law. Secondly, effective implementation of rabies vaccination measures can be achieved through public education and awareness-raising campaigns about the risks of rabies. The government should enforce the mandatory dog vaccination program, issue immunization certificates as required, and establish immunization records. Encouraging dog owners to vaccinate their dogs regularly through subsidies and other incentives is also necessary. Thirdly, the authorities should improve their efforts to rescue stray dogs by setting up special funds, improving the social system for capturing, sheltering, and adopting stray dogs, and creating qualified dog shelters and harmless disposal sites.

The third implication is to innovate the approach to dog management. Firstly, it is necessary for the authorities to collaborate with high-tech companies in establishing a dog information management system that includes a database, an APP system, and a unified information platform. This system should utilize electronic identification to manage and share information about dogs and their owners. Intelligent dog tags can also be used for real-time monitoring, identity inquiries, health vaccination, and owner tracking. Secondly, increased monitoring of rabies outbreaks is required. To keep abreast of the rabies epidemic in the region, regular sampling and testing should be conducted using rabies detection kits and antibody detection instruments. The communication between surveillance agencies and primary veterinary stations should be strengthened to promptly report suspected rabies cases. Real-time epidemic monitoring software can be useful in this regard. Thirdly, developing an animal health code system is a valuable option. This system should store

electronic immunization information and trace vaccine injections. The health code should be applied to the animal medical system and establish a database of animal electronic medical records.

5. Conclusions

Large-scale vaccination is crucial in the fight against rabies outbreaks. In response to the World Health Organization's call to "eliminate dog-mediated human rabies by 2030", emerging countries like China must strengthen their political commitment, public education, and strict dog management, while also implementing a viable vaccination program. This paper examines the preferences of 633 dog-keeping households in 21 municipalities in Guangdong province, China, for public services aimed at promoting dog rabies vaccination. The study found that dog-keeping households have significant preferences for accessibility attributes, including vaccination time, location, procedural arrangement, vaccine origin, and government subsidies. These households can be classified into three types: resolute executors (52.13%), mischievous rebels (5.85%), and incentivized compliers (42.02%). The sources of heterogeneity affecting dog-keeping households' preferences for dog rabies vaccination include the presence of children in the households, the perception of safety risks, and their knowledge of rabies. To improve the convenience and quality of public services, authorities can arrange weekend vaccination, build mobile vaccination stations, and provide home visits for vaccination. Emphasis should also be placed on improving the online appointment system, increasing the vaccine options, and providing diverse subsidies to encourage regular vaccination.

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荣誉证书

CERTIFICATE OF HONOR

为表彰2022年全国农科研究生乡村振兴志愿服务活动优秀成果奖获得者，特颁发此证书。

成果名称：狂犬科普惠万家 建言防控筑“长城”

获 奖 者：李　根　邓志乐　刘泓甫　曾颖心　赖德宝
李坤阳　黄敏仪　蔡　婷　陈巧珠

指导教师：梁耀明　罗永文　易　晖

完成单位：华南农业大学

获奖等级：二等奖

证书编号：NAGVSU－2022024

全国农科研究生志愿服务联盟秘书处

二〇二三年二月十二日

荣誉证书

华南农业大学梁耀明老师：

在“2020 全国金融与证券投资模拟实训大赛”决赛中，指导的“韭菜盒”荣获“团体一等奖”，特授予您“优秀指导教师”荣誉称号，特发此状，以资鼓励。

全国金融职业教育教学指导委员会

二〇二〇年八月

我校在两项全省网络短视频大赛中荣获佳绩

审核发布：宣传部 曹恩迎 来源单位及审核人：党委学生工作部（党委研究生工作部） 赵凯 发布时间：2021-04-26 浏览次数： 1093

近日，广东高校网络思想政治工作中心公布了“学四史，守初心，创未来”研学实践短视频大赛与“讲述‘四史’，薪火相传”微视频大赛获奖结果。我校在两项比赛中斩获佳绩，共有5个项目获奖，在“学四史，守初心，创未来”研学实践短视频大赛中荣获一等奖1项、二等奖1项，在“讲述‘四史’，薪火相传”微视频大赛中荣获一等奖1项、二等奖1项、三等奖1项。

为深入贯彻落实习近平总书记关于党史、新中国史、改革开放史、社会主义发展史学习的重要讲话和指示精神，推动广东高校青年大学生深入学习“四史”，引导青年大学生坚定理想信念，传承红色基因，奋力走好新时代的长征路，广东高校网络思想政治工作中心组织开展了“学四史，守初心，创未来”研学实践短视频大赛与“讲述‘四史’，薪火相传”微视频大赛。

我校党委学生工作部（党委研究生工作部）高度重视两个比赛，积极组织并动员全校师生踊跃投稿，进一步贯彻落实党史学习教育要求，迎接中国共产党成立100周年。在“学四史，守初心，创未来”研学实践短视频大赛中，陈雄锋老师指导作品《忆革命传精神，担使命助复兴》荣获一等奖，梁耀明老师指导作品《铭记党史，致敬英魂》荣获二等奖；在“讲述‘四史’，薪火相传”微视频大赛中，吴奕渠老师指导作品《蛇口，梦开始的地方》荣获一等奖，黄锴琪老师指导作品《一生永葆初心，一心为党为民——致敬我们伟大的老校长卢永根》荣获二等奖，宋政老师指导作品《致奋斗》荣获三等奖。（文/学工部（研工部）周志荣　谢庆彪）

附：获奖名单

一、“学四史，守初心，创未来”研学实践短视频大赛

作品名称	作者	指导老师	所获奖项
忆革命传精神，担使命助复兴	蒋宙龙、李灯辉、丁允贺、袁谋青、蔡炜	陈雄锋	一等奖
铭记党史，致敬英魂	邝文嘉、黄锦毅、陈思源、吴炜璇、庄恩祺	梁耀明	二等奖

荣誉证书

梁耀明同志：

在“2019年广东高校辅导员年度人物”评选活动中荣获“2019年广东高校辅导员年度人物”提名奖。

特发此证，以资鼓励。

高校思想政治工作队伍培训研修中心（华南师范大学）
教育部高校辅导员培训和研修基地（华南师范大学）
2020年10月26日

荣誉证书

梁耀明 同志：

您在研究生德育工作中爱岗敬业、为人师表、成绩突出，被评为“2021 年广东省研究生德育工作先进个人”。

特发此证，以资鼓励。

广东省学位与研究生教育学会

德育工作委员会

2022 年 10 月

荣誉证书

华南农业大学梁耀明同志荣获2022年广东省大中专学生志愿者暑期文化科技卫生“三下乡”社会实践活动优秀个人。

特发此证，以资鼓励。

中共广东省委宣传部　广东省精神文明建设委员会办公室　共青团广东省委员会　广东省教育厅　广东省学生联合会

2022年12月

2023年广东大中专学生志愿者暑期文化科技卫生“三下乡”社会实践活动暨

广东青年大学生“百千万工程”突击队行动

荣誉证书

广东青年大学生
百千万工程突击队

华南农业大学兽医学院使命必达队在2023年广东大中专学生志愿者暑期文化科技卫生“三下乡”社会实践活动暨广东青年大学生“百千万工程”突击队行动中荣获

优秀团队

特发此证，以资鼓励！

指导老师：梁耀明、罗永文、孙　坚

共青团广东省委员会　中共广东省委宣传部　广东省精神文明建设委员会办公室　广东省教育厅　广东省学生联合会

2023年12月20日

中共华南农业大学委员会
华 南 农 业 大 学 文件

华农党发〔2023〕70 号

中共华南农业大学委员会　华南农业大学
关于表彰 2021–2022 年度“十佳辅导员”的决定

为进一步加强我校辅导员队伍建设，充分发挥先进典型的示范引领作用，激励和引导全校学工队伍提升育人本领，增强工作实效，学校于 2023 年 12 月起开展 2021–2022 年度“十佳辅导员”评选工作，经过述职、评议、公示等程序，评选出毛丹鹃等 10 位同志为 2021–2022 年度“十佳辅导员”，现予以表彰。

希望受到表彰的同志珍惜荣誉、再接再厉、锐意进取、不懈奋斗，继续发挥榜样作用；希望全校学工队伍不忘立德树人初心，牢记为党育人、为国育才使命，学习先进，争当先进，守正创新，担当作为，为学生成长成才、学校一流党建思政建设作出新的贡

献。

附件：2021-2022年度“十佳辅导员”名单

中共华南农业大学委员会　　华　南　农　业　大　学

2023年12月28日

附　件

2021–2022 年度“十佳辅导员”名单

（按姓氏笔画排序）

毛丹鹃　　材料与能源学院

孔晓娟　　农学院

庄碧云　　园艺学院

严　颖　　数学与信息学院、软件学院

何　凯　　经济管理学院

陈　思　　数学与信息学院、软件学院

陈　巍　　食品学院

陈飞洋　　动物科学学院

梁春江　　生命科学学院

梁耀明　　兽医学院

公开方式：主动公开

华南农业大学党政办公室　　2023 年 12 月 29 日印发

中共华南农业大学委员会
华 南 农 业 大 学 文件

华农党发〔2022〕41 号

中共华南农业大学委员会　华南农业大学关于表彰 2022 年“教书育人、管理育人、服务育人”先进集体（个人）的决定

为深入贯彻落实教育部等印发《关于加强和改进新时代师德师风建设的意见》，加强师德师风建设，弘扬“爱岗敬业、勤于奉献、立德树人”的职业精神，推进“双一流”大学建设，根据学校《关于评选“教书育人、管理育人、服务育人”先进集体（个人）的通知》（华南农党政办〔2022〕16 号）和《关于进一步加强和改进离退休工作的实施意见》（华农党发〔2017〕65 号），学校组织开展了 2022 年“教书育人、管理育人、服务育人”（以下简称“三育人”）先进集体（个人）的推选活动。经各单位民主推荐，学校“三育人”

工作评选领导小组评选，结果公示等环节，对两年来在“三育人”工作中涌现出来的先进集体（个人）予以表彰。决定授予农学院等10个单位“三育人”先进集体，授予卫恒习等68人“教书育人”先进个人，授予马强等16人“管理育人”先进个人，授予王加平等15人“服务育人”先进个人。

希望受表彰的先进集体和个人珍惜荣誉，再接再厉。全校教职工要以先进为榜样，贯彻党的教育方针，全面落实立德树人根本任务，切实履行教书育人、管理育人、服务育人的神圣职责，努力使自己成为“政治素质过硬，业务能力精湛、育人水平高超”的教育工作者，在全面提高办学质量和水平，扎实推进“双一流”大学建设中做出新的更大贡献。

附件：“三育人”先进集体（个人）名单

中共华南农业大学委员会　　华　南　农　业　大　学

2022年7月11日

附件

“三育人”先进集体（个人）名单

一、“三育人”先进集体

农学院

林学与风景园林学院

兽医学院动物传染病教研室

马克思主义学院

党委学生工作部（党委研究生工作部）

本科生院（招生办公室）

科学研究院（新农村发展研究院）

财务处

采购招标中心

图书馆

二、“教书育人”先进个人（按姓氏笔画排序）

卫恒习　王　丽　王国维　王金凤　王　柯　王　超　元冬娟

孔晓娟　卢玉华　庄碧云　刘小蓓　刘自强　刘英菊　刘卓君

刘惠明　孙红岩　严慕婷　李向梅　李　青　李宗璋　李俊宏

李俊良　李娇娇　李　朗　李　博　杨　敏　吴章欣　吴道铭

邱　权　何晓芳　汪　沛　宋明伟　张　玉　张　彤　张沁岚

张建民　陈少华　陈烁娜　陈　洁　陈湘骥　林敏慧　林　绿

易继财　周玉亮　郑倩望　赵普艳　柳广斌　钟　珺　段洁利
贾　坤　晏嫦妤　殷惠莉　翁殊斐　郭圣琳　郭　萍　郭　涵
黄　晓　黄　琼　龚金红　崔翱鸽　梁耀明　舒迎花　蔡　欣
廖　杨　谭成全　熊俊涛　潘振晓　薛秀云

三、“管理育人”先进个人（按姓氏笔画排序）

马　强　王伟峰　叶可可　朱俏萍　李晨光　招栩圣　易　晖
郑庭义　赵　凤　赵孟瑜　姜　峥　唐家林　梁志辉　韩雨辰
薛婉雯　魏旭娇

四、“服务育人”先进个人（按姓氏笔画排序）

王加平　王泽槐　刘小波　李　薇　杨立平　张　冰　陈　敏
欧　群　罗宏珍　周恩浩　钟桂龙　贾正晖　彭文雄　谭　颖
潘　浩

公开方式：主动公开

华南农业大学党政办公室　　2022 年 7 月 15 日印发

荣誉证书

HONORARY CREDENTIAL

梁耀明、陈瑞祺、朱丹妮 同志:

您的论文《高校辅导员队伍稳定性激励机制构建：基于选择实验研究》，在第十九次全国高等农业院校学生工作研讨会优秀论文评选中获得一等奖。

特发此证，以兹鼓励！

全国高等农业院校学生工作研究会

二〇二三年五月

荣誉证书

证书编号：LW20220044

梁耀明、李文昊 同志：

您的论文《校园氛围对大学生学业成绩的影响研究》在2021年度广东高校思想政治工作优秀论文征集评选活动中荣获一等奖。

特发此证，以兹鼓励。

高校思想政治工作队伍培训研修中心
（华南师范大学）

教育部高校辅导员培训和研修基地
（华南师范大学）

广东省高等学校思想政治教育研究会
2022年1月

荣誉证书

证书编号：2024SZ0151

梁耀明、陈瑞祺 同志：

您的作品《后疫时代大学生的工作属性偏好：挑战与政策响应》在2023年广东高校思想政治工作 优秀论文 推选展示活动中获评：

一 等 奖

特发此证，以资鼓励。

高校思想政治工作队伍培训研修中心
（华南师范大学）
2024年1月18日

奖　状

梁耀明、陈焕荣、何骏浩、张振庭、郑艳虹、谯薇美：

你的作品：以吾辈之青春，建设农业之强国 在“学习二十大　奋进新征程”主题微党课比赛中荣获：

一等奖

特发此状，以兹鼓励。

华南农业大学党委组织部

2023 年 5 月

附件 1：

基层党建工作创新案例获奖名单

（按二级党组织排序）

一等奖：

序号	党组织名称	案例名称
1	动物科学学院 博士研究生党支部	筑牢支部堡垒 强化组织育人 服务强农兴牧
2	资源环境学院 生态学系教工党支部	聚焦三全育人 探索耕读教育
3	生命科学学院 遗传学教工党支部	凝练“乐天工作法”，打造科教育人坚实堡垒
4	工程学院党委	构建“三创”模式，营造“三优”局面，走新时代高校党建育人特色之路
5	食品学院党委	老有所为献余热 青年奋发有作为——我与老党员有个“约会”
6	食品学院 功能食品研究生党支部	守护食品安全线 共筑健康中国梦

二等奖：

序号	党组织名称	案例名称
1	植物保护学院 植物病理学系教工党支部	党群合力引领精准扶贫，平台建设助力乡村振兴
2	林学与风景园林学院 风景园林教工党支部	创建“党建+业务”融合新模式 助力乡村社区治理创新
3	兽医学院党委	坚持“四抓四强四化”，推进基层党建规范化
4	兽医学院 重大动物疫病防控团队教工党支部	高质量基层党建引领服务国家重大战略

5	动物科学学院党委	党建引领 校企协同 组织共建 提升质量——基于高校基层党组织共建协同育人模式的创新与实践
6	生命科学学院 研究生第一党支部	聚焦党建与科研融合，打造研究生党员教育管理模式
7	工程学院 电气类本科生第二党支部	汇聚青春力量，助力脱贫攻坚
8	材料与能源学院党委	寻访-分享-演绎三段式学习传承红色基因
9	电子工程学院（人工智能学院） 电子信息类工科专业本科生第一党支部	以学生实际需求为导引探索社区志愿服务多元化建设
10	公共管理学院 社会工作系教工党支部	党建引领社工服务，助力乡村振兴出新出彩
11	公共管理学院 行政管理专业本科生第一党支部	“预”见行一 ——以赤诚党心构筑民族团结同心圆
12	外国语学院党委	外语党课——大学生思想政治与专业教育双融双促的新路径

三等奖：

序号	党组织名称	案例名称
1	农学院党委	依托“卢永根办公旧址”，打造“情景启发式”主题党日活动
2	植物保护学院党委	深化“三个抓实”，助推研究生党建工作
3	园艺学院党委	欢乐田园党旗红——打造党支部专业+志愿服务组织生活新模式
4	园艺学院 研究生茶学党支部	凸显专业优势，开展特色组织活动——以全民饮茶日公益科普为例
5	动物科学学院 蚕丝科学系教工党支部	党建引领，深入推进蚕学人才精细化培养模式
6	资源环境学院党委	构建“五位一体”党建+“三全育人”，培育“耕读教育”新模式
7	海洋学院 水产养殖学本科生党支部	党员参与社区志愿服务 发挥先锋模范作用建设文明社区
8	工程学院 机械工程教工党支部	基于虚拟仿真技术的卢永根院士生平事迹虚拟展馆建设

9	水利与土木工程学院 建筑系教工党支部	党建科研育人协同，岭南乡建研学实践
10	材料与能源学院 本科生能源环境与制药工程党支部	犁好易班党建试验田，探索支部建设新模式
11	数学与信息学院、软件学院党委	“三全育人”视角下党建促竞赛育人机制、模式与成效
12	数学与信息学院、软件学院 信息与计算科学教工党支部	以高质量的党建促进高质量的本科人才培养
13	电子工程学院（人工智能学院） 电子科学与技术系教工党支部	以“芯”专业课程思政建设为载体，全面提升支部党建工作成效
14	经济管理学院 工管第三本科生党支部	守初心，强意识，担使命，构建“党建+心理”双融双促新模式
15	人文与法学学院 法学系本科生第二党支部	专业武装支部，法学服务社会——打造“专业+服务”支部建设新模式
16	外国语学院 商务英语本科生党支部	四译四化四提升，打造学生党建新阵地
17	艺术学院 动画系教工党支部	做好专业发展“领头雁”，党建创新促提升
18	马克思主义学院党委	发挥学科优势，推动“四史”学习教育“三进”工作走深走实
19	马克思主义学院 概论教工党支部	弘扬红色文化，提升思政课实践教学育人成效
20	体育教学研究部党总支	运动队党小组品牌化建设
21	机关党委本科生院教工党支部	“四功”兼修，全力推动党建业务双融双促
22	图书馆教工第五党支部	探索“五化并举”新模式，提升支部战斗力

附件 2：

优秀党课获奖名单

（按二级党组织排序）

一等奖：

序号	党组织名称	作品名称	负责人
1	生命科学学院党委	重温“红色起点”，传承“红色基因”	方媛媛
2	经济管理学院党委	传承英雄精神　筑牢信仰之基	梁耀明
3	马克思主义学院党委	新时代 新使命 新担当	卜艳华
4	马克思主义学院党委	思想建党 政治建军 古田再出发	何艳玲

二等奖：

序号	党组织名称	作品名称	负责人
1	林学与风景园林学院党委	立心铸魂：抗战中的大学生与抗疫中的大学生	高　翔
2	林学与风景园林学院党委	百年征程，农心向党	于耀泓 刘　祯
3	园艺学院党委	院士遗风，磬玉白茶	刘志鹏
4	材料与能源学院党委	大写中国，青春你我	梁雅晶
5	数学与信息学院、软件学院党委	奋斗是青春最靓丽的底色	严　颖
6	马克思主义学院党委	改革开放中的先行者	陈　洁

三等奖：

序号	党组织名称	作品名称	负责人
1	植物保护学院党委	服务国家发展战略 推动生态文明建设 ——华南农业大学农药学科发展史	刘家莉
2	资源环境学院党委	寓“农”一生，为“土”先驱 ——中国土壤学科奠基人邓植仪	李　博 蔡泽瀛
3	食品学院党委	党旗照亮脱贫路，基层党建促振兴	王曾惠
4	食品学院党委	共产党人的初心与使命	刘成诚
5	公共管理学院党委	赫赫“无名”，青史流芳 ——功勋英雄黄旭华先进事迹学习	陈泽辉
6	公共管理学院党委	中国共产党领导农村试点的百年探索	唐　斌
7	人文与法学学院党委	学习伟大抗疫精神，担当民族复兴大任	吴　琪
8	马克思主义学院党委	构建人类命运共同体的基本内涵	冯　浩
9	马克思主义学院党委	对革命新道路的艰苦探索	王　超
10	图书馆党总支	星火相传，奋飞不辍 ——广州农讲所的峥嵘岁月	潘　科

附件 3：

优秀组织奖获奖名单

序号	党组织名称
1	林学与风景园林学院党委
2	兽医学院党委
3	动物科学学院党委
4	生命科学学院党委
5	材料与能源学院党委
6	经济管理学院党委
7	公共管理学院党委
8	马克思主义学院党委

奖 状

梁耀明老师：

在华南农业大学2020年暑期“三下乡”社会实践活动中表现突出，被评为

优秀指导老师

特发此状，以资鼓励。

共青团华南农业大学委员会

2020年12月


名辅导员工作室
大学生职业规划与就业创业指导工作室
主持人：梁耀明
华南农业大学
二〇二二年八月