國立臺灣大學理學院氣候變遷與永續發展國際學位學程

碩士論文

International Degree Program in Climate Change and Sustainable Development

College of Science

National Taiwan University

Master Thesis

減少肉類攝取的障礙：台灣案例研究

Barriers to reducing meat consumption: A Taiwanese case study

羅素菲

Sophia Marguerite Palanca Roces

指導教授：小松光 博士

Advisor: Dr. Hikaru Komatsu Ph.D.

中華民國 112 年 08 月

August 2023

doi:10.6342/NTU202302118

國立臺灣大學碩士學位論文

口試委員會審定書

National Taiwan University Master Thesis

Oral Examination Committee Approval

減少肉類攝取的障礙：台灣案例研究

Barriers to Reducing Meat Consumption: A Taiwanese Case Study

本論文係羅素菲(R08247013)在國立臺灣大學氣候變遷與永續發展國際學位學程完成之碩士學位論文,於民國 2023年 07月 06日承下列考試委員審查通過及口試及格, 特此證明。

This master thesis is finished by Sophia Marguerite Palanca Roces (R08247013) at International Degree Program in Climate Change and Sustainable Development on July 6, 2023 of the Republic of China, passed the oral examination by the following examination committees.

口試委員 Oral examination committee:

Dr. Hikaru Komatsu
(指導教授 Advisor)

Dr. John Chung-En Liu

Dr. Li-San Hung

doi:10.6342/NTU202302118

Acknowledgments

First and foremost, I would like to express my utmost gratitude and appreciation to my advisor Professor Hikaru Komatsu for taking a chance on me at the very last minute and providing unwavering support, guidance, and inspiration to help me see this thesis through to completion. I will never forget your constant kindness and encouragement during a time when I needed it most. Academia is a friendlier, more inclusive community because of nurturing educators like yourself, and I will strive to be this kind of teacher to my own students. I'd also like to deeply thank the IPCS department, especially Prof. Crison, Prof. Fishball, and the incredible Ms. I-Ching and Gwen for helping me tirelessly throughout my time at NTU.

To my Mama and Papa, thank you for always encouraging me to pursue my passions, even if they've changed so many times that you can barely figure out what they are anymore. I am profoundly grateful for the good start in life that you gave me and all that you invested into my education so I could learn to stand on my own. This is your achievement as much as it is mine. I love you both forever. And to Margie, Nestor, Leny, Alex, and the CoolFarm staff who took such great care of me and my family for all these years so that I could focus on my studies, maraming salamat po!

To Claire Ku and Joshua Yang, who not only helped me with all the translation work that this thesis entailed, but also provided countless hours of moral support, I am blessed to have found such talented and committed friends like you.

To Kim Glidden, my writing coach-turned-confidante, thank you for the long hours you spent on the phone guiding me out of the proverbial woods. Things would have turned out very differently without you helping me get my life back on track.

doi:10.6342/NTU202302118

To Anna Katherine, Hannah, and Mariana, the ones who were present almost every day of my arduous four-year graduate school ordeal, honorable mention is in order for all the food comas, getaway trips, and hilarious memories that enabled me to hold on to my dwindling tenuous threads of sanity. You already know none of this would have been possible without you. All my love likewise goes to the rest of my chosen family in Taiwan: Anna, Annalisa, Charleston, Diane, Jenny, Jovanka, Natasha, Shohui, and Vaish for all the various ways you sustained me in the last four years. Furthermore, to my amazing friends from the past who stuck with me through extended periods of absence and supported me from across vast oceans, I'm thrilled to be able to say that your efforts finally paid off.

Finally, I'd like to acknowledge my Grade 1-6 students who energized my most exhausting days with their banter, reminding me that the most important thing is to show up every day and do a little bit, even though you're tired and would rather quit. Last but not least, special recognition goes to my departed Bun, the most commendable rodent and thesis writing companion who ever lived.

To God be the glory!

doi:10.6342/NTU202302118

摘要

飲食中的肉類攝取隨著全球經濟與人口的成長成指數性的增幅，在東亞國家特別顯著，如中國。現今肉類產業的不當土地利用與管理，與高度溫室氣體排放導致氣候變遷。個人減少肉類攝取是受到世界上關注的氣候變遷調適策略，但需要大規模、集體的國際參與才能發揮作用。

在西方研究中有關減少肉類攝取的阻礙被廣泛討論與研讀。然而在東亞方面，相關降低肉類攝取的阻撓研究相較稀少。本研究旨在了解國立臺灣大學 (NTU) 學生減少攝取肉類之阻礙，他們是台灣受高等教育的青年族群，推測應有很高的環保意識。與此同時，台灣因佛教傳統而盛行著吃素食的風氣。選擇這個樣本族群將有助於鑑別除明顯阻礙之外的障礙，例如人們普遍缺乏對先前研究中廣泛報導的食用肉類對環境影響的認識。

我們製作線上問卷調查，分發給在校的臺灣大學學生，調查他們的飲食習慣，並確定哪些因素讓他們減少肉類攝取影響最大。這些阻礙分為外部因素，包括價格、取得容易程度和來自社會壓力；內部因素則包括有：口味、飲食限制、環境知識、道德、健康知識、自我認知、控制點和情感左右。在確定好所有外部因素與內部因素的影響參數後，進行定性訪談。獲得更細緻的見解後，補充定量結果，並利用它們提出克服障礙的干預措施。問卷調查顯示，大多數台灣大學學生，即使是那些吃肉最多的學生，也對肉類生產與攝食肉類對環境的影響有很高的認識，但大多不願意減少肉類消費。本研究發現：健康知識、社會壓力、口味與取得容易程度成為臺灣大學學生減少肉類消費的最主要的阻礙。文化、價值觀、身分認同與外部

doi:10.6342/NTU202302118

控制點等在西方研究中出現的情形在本研究並沒有出現。潛在輔導，讓台灣人降低肉類攝取的方法：包含在家庭教育與學校教育裡教導減少肉類攝食的重要性、增加餐廳素食菜單選擇、增加素食風味、口感，與降低素肉的價格。本研究為討論降低肉類攝取之阻礙新興領域中最早的東亞研究之一 ，研究特定族群因環境原因減少食用肉類的阻礙，以便按照之前的研究要求制定獨特的影響方法與措施。

關鍵字：降低肉類攝取、降低肉類攝取之阻礙、半素食主義、永續飲食

doi:10.6342/NTU202302118

Abstract

Meat consumption has increased exponentially as global economies and populations continue to grow, particularly in East Asian nations like China. Modern meat production has been linked to climate change as it results in high greenhouse gas emissions and unsustainable land management. Reducing individual meat consumption is a climate change mitigation strategy gaining traction worldwide, but it would require large-scale, collective international participation to be effective.

Meat consumption reduction has mostly been studied in western contexts, and various barriers have been identified. However, barriers have been underexplored in East Asia due to the scarcity of studies. This study aims to understand the barriers to the pro-environmental behavior of reducing meat consumption for National Taiwan University (NTU) students, a highly educated youth demographic with presumably high environmental awareness in Taiwan, a country with prevalent vegetarian cuisine due to Buddhist religious tradition. Choosing this sample group would allow for the identification of barriers other than the obvious ones such as a general lack of awareness of the impacts of meat consumption on the environment reported widely in previous studies.

An online questionnaire was created and distributed to current Taiwanese NTU students to identify their dietary habits and determine which barrier was the most influential in preventing them from reducing their meat consumption. The barriers were categorized into external factors, including price, access, and social pressure, and internal factors, including taste, dietary restrictions, knowledge of environmental impacts, morality, health knowledge, self-construal, locus of control, and emotional involvement. Subsequent qualitative interviews were conducted to gain more nuanced insights to supplement the

doi:10.6342/NTU202302118

quantitative results and use them to propose interventions to overcome the barriers. Questionnaire responses demonstrated that most NTU students, even those who consumed the most meat, had high awareness of the environmental impacts of meat production, but mostly were unwilling to reduce their meat consumption. Health knowledge, social pressure, taste, and access emerged as the most significant barriers to reducing meat consumption for NTU students. Taste was the only influential barrier in common with western studies since the nature of the social pressure and health knowledge barriers differed slightly. The culture, value, and identity-related barriers and external locus of control found in western studies were absent here. Potential interventions include encouraging families and schools to teach children the importance of limiting their meat consumption, increasing the availability of vegetarian options in restaurants, and improving the taste, texture, and price of meat substitutes. This is one of the first East Asian studies in an emerging field studying the barriers to reducing meat consumption for environmental reasons. It studies a very specific demographic in order to develop distinct targeted interventions as previous studies have called for.

Keywords: Reducing meat consumption, Barriers, Flexitarianism, Sustainable diets

doi:10.6342/NTU202302118

Table of Contents

Certificate of Thesis Approval from the Oral Defense Committee……..……..i
Acknowledgments.....ii
摘要.....iv
Abstract vi
Table of Contents viii
List of Tables.....ix
List of Figures.....x
1. Introduction.....1
1.1 Background.....1
1.2 Research Motivations, Questions, and Objectives.....3
2. Literature Review.....5
2.1 Overview of meat consumption reduction studies.....5
2.2 Studies on the barriers to reducing meat consumption.....8
2.3 Existing Taiwanese studies and cases 13
3. Research Methods.....16
3.1 Theoretical Framework.....16
3.2 Questionnaire.....18
3.3 Interviews.....24
4. Results 28
4.1 Quantitative Results 28
4.2 Qualitative Results 40
5. Discussion.....47
5.1 Barriers.....47
5.2 Interventions.....50
6. Conclusion.....53
6.1 Limitations.....53
References.....57
Appendix.....65

doi:10.6342/NTU202302118

List of Tables

Table 1. Existing studies about the barriers to reducing meat consumption

Table 2. Internal and external factors addressed in questionnaire

Table 3. Statements used to determine students' barriers to reducing meat consumption (English version)

Table 4. Statements used to determine students' barriers to reducing meat consumption (Chinese version)

Table 5. Interviewee profiles and barriers

Table 6. Interview guide questions (English version)

Table 7. Interview guide questions (Chinese version)

Table 8. NTU student profiles

Table 9. Dietary habits of NTU students

Table 10. Students' knowledge of the environmental impacts of meat consumption

Table 11. Barriers to reducing meat consumption

doi:10.6342/NTU202302118

List of Figures

Figure 1. Model of pro-environmental behaviour (Kollmuss & Agyeman, 2002)

Figure 2: Pie charts showing group responses regarding the barrier of Price

Figure 3. Meat or animal products that NTU students want to consume less of

Figure 4. Bar graphs showing group estimates of the total percentage of greenhouse gases that global meat production is responsible for

Figure 5. Pie charts showing group responses ranking the comparative carbon footprint-reducing impact of eating a plant-based diet

Figure 6. Pie charts showing group responses reporting their own awareness of the environmental impacts of meat production

doi:10.6342/NTU202302118

1. Introduction

1.1 Background

Global meat production and consumption have increased exponentially from the 1960s onwards, and this trend is expected to continue as economies and populations grow (Gonzales, 2020). The detrimental effects of meat production on the environment have moved toward the forefront of sustainability discourse in recent years. The production of meat and animal products has a significantly higher environmental impact than vegetable proteins, exacerbating the issues of unsustainable land use, excessive freshwater withdrawal, greenhouse gas (GHG) emissions, eutrophication, and acidification (Poore and Nemecek, 2018)[1]. While transitioning to more sustainable production methods is part of the solution, altering individual diets to reduce consumption of meat and dairy products can have an even greater positive effect, particularly in societies with the highest per capita meat consumption (Ibid). A significant reduction in meat production and consumption stands to help mitigate climate change, ameliorate land degradation and water pollution, conserve resources, and benefit public health (Gonzales, 2020). As such, this study considers meat consumption reduction to be a pro-environmental behavior, defined by Kollmuss and Agyeman (2002) as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world." The term "reduction" as it is used throughout this study refers to lessening rather than fully eliminating meat from

[1] This study acknowledges that meat production is actually a complex, multistage process with diverse methods and scales that vary across different countries. The term "meat production" that is used throughout this study mainly refers to large-scale industrial animal agriculture that is notorious for its unsustainable practices rather than independent local farmers.

doi:10.6342/NTU202302118

one's diet, which is a much more attainable goal for most of society. It encapsulates any means of reducing an individual's existing levels of meat consumption including, for example: avoiding certain types of meat, lessening the portions of meat consumed in each meal, or even simply increasing the frequency of eating plant-based meals. The term "plant-based" in the context of this study assumes the general definition of a diet that is primarily made up of plants with little meat.

Historically, Asian nations have not consumed much meat per capita, especially in comparison to wealthier western nations. However, particularly in East Asian nations like China, meat consumption is growing at an unprecedented rate (Godfray et al., 2018). Taiwan is one of the countries that has exhibited this trend, with not only an increase in the quantity of meat consumed but also types of more prevalent meats due to both economic and health factors (Hsu, 2001). The ecological footprint of Taiwan has increased alongside its GDP, and grazing land for meat and fat production was a large contributor, even more than fishing and farmland (Wang, 2012). This drastic increase in the meat consumption of middle and lower-income nations in East Asia is set to have profound environmental implications. Despite this development, there are few East Asian studies that specifically address the deliberate reduction of individual meat consumption, likely indicating that efforts to curb the upward trend have not yet succeeded on a significant scale in this region. Studies conducted on western populations, particularly European, have increasingly explored this issue within the last decade; in these high-income nations, meat consumption, though high, has shown signs of reaching a plateau (Ibid). Before the East Asian appetite for meat reaches the levels of developed nations, it is important to investigate the specific enablers and barriers to reducing meat consumption in this cultural context.

doi:10.6342/NTU202302118

1.2 Research Motivation, Questions, and Objectives

National Taiwan University (NTU) is Taiwan's premier university, located in the capital city of Taipei. It is a public research university that is currently ranked #69th worldwide (QS World University Rankings, 2024). The university has been placing greater emphasis on sustainability in recent years, boasting 20+ sustainability-related programs, 780 sustainability-related research projects, and 88 sustainability-related student clubs (National Taiwan University, 2023). As a highly educated East Asian population, NTU students are likely to be more knowledgeable about environmental issues than the average person. Furthermore, living in Taiwan, they have access to a wide variety of affordable plant-based food options due to the prevalent Buddhist vegetarian culture. Nearly all existing studies that investigate people's perceptions of the link between meat consumption and environmental destruction report that most of them exhibited low knowledge and awareness of the issue (Hartmann and Siegrist, 2017; Vanhonacker et al., 2013; Macdiarmid et al., 2016; Hoek et al., 2017; Tobler et al., 2011). While knowledge of environmental impacts is inadequate to catalyze pro-environmental behavior on its own, it is crucial for people to fully understand and acknowledge the detrimental consequences of their behavior; they must at the very least be aware of the problem before committing to the process of behavioral change (Truelove and Parks, 2012). Studying NTU students would hypothetically eliminate the factor of low awareness and subsequently reveal the other underlying barriers to reducing meat consumption that prevent this knowledgeable population from making the behavioral changes they know are necessary. When juxtaposed with the barriers of western populations, the results will provide insight into the different cultural perspectives of meat consumption and pro-environmental behavior.

doi:10.6342/NTU202302118

Thus, this research investigates the question: What are the most influential barriers to reducing meat consumption for Taiwanese university students? The first objective of this study is to investigate the meat consumption habits of NTU students. Then, it will ascertain whether Taiwanese students adequately understand the magnitude of the environmental impacts of meat production and consumption. Finally, this study will test several internal and external factors to determine which ones students consider to have the greatest impact on their meat consumption behavior. The findings will then be used to suggest some potential interventions that can help reduce meat consumption.

The aim of this study is not to overemphasize personal responsibility for environmental issues or suggest that adjusting consumer choices is the single most effective way to curb emissions. However, the advantages of promoting a low carbon footprint lifestyle are not insignificant, and the benefits are not merely environmental. Increased meat consumption per capita and the proliferation of meat consumers worldwide are trends that are worth studying mainly because of how quickly the shift towards meat-intensive diets has occurred and how if left unchecked, the emissions and impact on land and water will be immense. A deeper, more culturally specific understanding of meat consumption behavior will be beneficial for informing future interventions that encourage people to reduce meat consumption.

doi:10.6342/NTU202302118

2. Literature Review

2.1 Overview of meat consumption reduction studies

Meat consumption reduction as a pro-environmental behavior is a relatively new topic that started to emerge in sustainability discourse approximately around the 2010s and has proliferated as evidenced by the popularization of meat consumption reduction initiatives like Meatless Mondays. The knowledge that an individual's diet can have a significant impact on the environment has become more pervasive in the last decade (de Boer and Aiking, 2022). While many studies investigate vegan/vegetarian dietary choices, there are merely a few existing studies that analyze the various factors that cause people to eat different amounts of meat or become more or less willing to reduce their meat consumption (Cheah et al., 2020). The gray areas between vegetarianism and meat-eating such as flexitarian (plant-based diet with little meat) and pescatarian (vegetarian except for seafood) diets are similarly under-explored. Hardly any East Asian studies focusing on reducing individual meat consumption for environmental reasons were found, which is the primary gap this study intends to fill. Meanwhile, this issue has almost exclusively been studied in western contexts, such as Europe and Australia, in high-income nations that consume a lot of meat per capita. There were studies from the United Kingdom (Whittall et al., 2023; Macdiarmid et al., 2016; Povey et al., 2001; Clonan et al., 2015), Flanders (Vanhonacker et al., 2013), Australia (Hoek et al., 2017; Lea and Worsley, 2008; Cheah et al., 2020), Sweden (Collier et al., 2021), Denmark (Hielkema and Lund, 2021), Norway (Austgulen et al., 2018), the Netherlands (van den Berg et al., 2022), and Switzerland (Tobler et al., 2011). The primary methodologies included survey questionnaires, interviews, qualitative systematic reviews/syntheses, and focus groups with thematic

doi:10.6342/NTU202302118

analyses. Some studies focused exclusively on the issue of meat consumption reduction while others studied it as one of several pro-environmental behaviors to gauge their perspective on its relative importance (Truelove and Parks, 2012; Tobler et al., 2011; Lea and Worsley, 2008; Vanhonacker et al., 2013; Whittall et al., 2023). Participants in these studies largely regarded reducing meat consumption to be among the lowest-priority pro-environmental behaviors, mistaking less impactful issues such as excessive packaging (Tobler et al., 2011) to be more important. They were more receptive to performing pro-environmental behaviors like composting, shopping local, and ensuring environmentally friendly farming practices, which didn't require major changes to their diet (Lea and Worsley, 2008).

The existing meat consumption reduction studies highlighted different aspects of the issue and used different approaches in their investigations. A majority focused on people's general willingness and attitudes toward reducing their meat consumption and adopting a more sustainable diet (Hartmann and Siegrist, 2017; Vanhonacker et al., 2013; Tobler et al., 2011; Whittall et al., 2023, Hoek et al., 2017; Macdiarmid et al., 2016; Sanchez-Sabate and Sabate, 2019). They almost unanimously indicated that most people were still extremely reluctant to reduce their meat consumption despite growing concerns about the sustainability of the meat production process. In fact, environmental sustainability was generally not shown to be a primary consideration when determining one's food choices (Clonan et al., 2015; Hoek et al., 2017). People's general lack of awareness of the environmental impacts of meat production was a finding that was frequently emphasized, demonstrated not only by their aforementioned underestimation of environmental impacts, but also by their skepticism to scientific evidence and dietary advice (Macdiarmid et al., 2016; Whittall et al., 2023). Correlations between certain demographic characteristics and

doi:10.6342/NTU202302118

meat consumption behaviors or attitudes were also investigated, such as age, gender, education, and socio-economic circumstances (Clonan et al., 2015; Sanchez-Sabate and Sabate, 2019; Lea and Worsley, 2003; Lea et al., 2006; de Boer and Aiking, 2022; Tobler et al., 2011; Chan et al., 2023).

Other studies tested the effectiveness of certain factors in motivating consumers to reduce their meat consumption. Some East Asian studies of this type were found, mostly conducted in Mainland China. Taufik (2018) is one such study that was conducted on 610 Chinese participants. It investigated "warm-glow," or the positive emotion that follows after one performs a good deed, as a motivation for Chinese people to reduce meat consumption, revealing a link between the emotion and the intention. Similarly, there were the studies that investigated consumer willingness to eat plant-based meat alternatives in order to reduce their meat consumption, and these were done both in China (Ortega et al., 2022) and western nations (Collier et al., 2021; Hartmann and Siegrist, 2017; Vanhonacker et al., 2013). Other studies likewise sought out enablers for pro-environmental behavior, and sometimes they simultaneously found both enablers and barriers to reducing meat consumption (Cheah et al., 2020; Lea et al., 2006; Clonan et al., 2015; de Boer and Aiking, 2022). In other words, this "positive" approach was used in much of the relevant literature to identify various correlated factors such as attitudes or social norms that were shown to motivate people to perform pro-environmental behavior. The underlying question was, "What factors cause people to reduce their meat consumption?" This approach was useful for proposing strategies to encourage people to reduce their meat consumption, but the following section will elaborate on the benefits of approaching the issue from the opposite side.

doi:10.6342/NTU202302118

2.2 Studies on the barriers to reducing meat consumption

This study's objective to identify the barriers to reducing consumption stemmed intuitively from the Kollmuss and Agyeman (2002) model, which will be discussed in further detail in the theoretical framework section. The model was developed with the central goal of analyzing the gap between environmental knowledge/awareness and pro-environmental behavior by examining individual factors. Kollmuss and Agyeman (2002) acknowledge that models that utilize different approaches, such as altruism, empathy, and prosocial behavior models and psychological attitude-behavior models, are still valid depending on the context; not one model can fully encapsulate the complexities of pro-environmental behavior. However, approaching the issue of pro-environmental behavior by deeply examining the gap reveals results that differ from those found by the "positive" approach. This method conversely answers the question, "What factors prevent people from reducing their meat consumption?" Addressing the barriers that contribute to this rift between knowledge and rational behavior is crucial because it completes the whole picture of the issue; no matter how many positive influential factors the former approach finds, the strategies for encouraging pro-environmental behavior will be ineffectual as long as there are barriers that counteract or eclipse them. Thus, this study intends to use the "negative" approach to identify the barriers and analyze how to surmount them. This will help clear the way, so to speak, for the targeted strategies found by the "positive" approach.

Table 1. Existing studies about the barriers to reducing meat consumption

Study	Location	Methodology/ Subjects	Barriers identified

doi:10.6342/NTU202302118

Lea and Worsley (2003) *Benefits and barriers to the consumption of a vegetarian diet in Australia*	South Australia	Postal survey questionnaire sent to 601 randomly selected South Australians	Enjoyment of eating meat, unwillingness to alter dietary habits. For women, family food preferences. For older people, the belief that humans were "meant" to eat meat
Lea et al. (2006) *Public views of the benefits and barriers to the consumption of a plant-based diet*	Victoria, Australia	Postal survey questionnaire sent to 415 randomly selected Victorian adults	Lack of information about plant-based diets. Older and non-university-educated people were more unwilling to change dietary habits. (More benefits than barriers were found, mostly health related)
Clonan et al. (2015) *Red and processed meat consumption and purchasing behaviours and attitudes: impacts for human health, animal welfare and environmental sustainability*	East Midland, UK	Postal survey questionnaire sent to 2500 randomly selected UK adults, 842 responses received	Masculinity, young generation took meat for granted, low-income people had price concerns, and people's education level in terms of learning conscious consumption
Macdiarmid et al. (2016) *Eating like there's no tomorrow: Public awareness of the environmental impact of food and reluctance to eat less meat as part of a sustainable diet*	Scotland	12 focus groups, 4 individual interviews on urban and rural Scottish adults	Lack of awareness of the link between meat and climate change, perception that individual meat consumption doesn't make a difference (external locus of control), taste/pleasure, social/personal/cultural values
Stoll-Kleeman and Schmidt (2017) *Reducing meat consumption in developed and transition countries to counter climate change and*	Developed countries (e.g. USA and European nations) and transition countries	Meta-analysis	Low knowledge, lack of practical skills, denial mechanisms, cognitive dissonance, habits, taste, production and supply system, masculinity, old age, lower socio-economic class/income/education, extroverted personality, external locus of control, symbolic value of

doi:10.6342/NTU202302118

biodiversity loss: a review of influence factors	(e.g. China and Brazil)		meat, self-construal, culture, association of meat with prosperity, social norms, lack of political will, lobbies and subsidies, low prices of meat/animal products, access
Austgulen et al. (2018) *Consumer Readiness to Reduce Meat Consumption for the Purpose of Environmental Sustainability: Insights from Norway*	Norway	Consumer survey, focus groups, and in-store experiment on Norwegian participants	Low awareness, uncertainty, low willingness to change habitual consumption patterns, value orientation, and partially an external locus of control because consumers
Sanchez-Sabate et al. (2019) *Understanding Attitudes towards Reducing Meat Consumption for Environmental Reasons. A Qualitative Synthesis Review*	N/A	Qualitative synthesis	Lack of awareness of the environmental impacts of meat, external locus of control, sociocultural/culinary/physiological (taste) reasons, health knowledge, lack of cooking knowledge
Cheah et al. (2020) *Drivers and barriers toward reducing meat consumption*	Australia	Online survey of 298 Australians	Existing meat consumption habits
Collier et al. (2021) *Identifying barriers to decreasing meat consumption and increasing acceptance of meat substitutes among Swedish consumers*	Sweden	Focus group discussion with 33 Swedish participants	Uncertainty, skepticism, health, and identity
Hielkema and Lund (2021) *Reducing meat consumption in meat-*	Denmark	Online survey of 1005 randomly selected Danish people	Food neophobia, identity incongruence, habitual behavior, and practical difficulties

doi:10.6342/NTU202302118

loving Denmark: Exploring willingness, behavior, barriers and drivers			
de Boer and Aiking (2022) *How meat reduction differs from other personal climate actions: Distinct concerns and cultural barriers among EU consumers*	EU countries	Survey questionnaire and interviews 26,669 European citizens	Culture and identity (right-wing political views, masculinity, social class)
van den Berg et al. (2022) *Reducing meat consumption: The influence of life course transitions, barriers and enablers, and effective strategies according to young Dutch adults*	Netherlands	Online survey of 1806 young Dutch adults	Taste, price, habits

Table 1 lists the existing studies that aimed to investigate people's barriers to reducing meat consumption. No studies of this nature were found to have been conducted specifically in East Asia, only Europe or Australia. These studies also did not exclusively search for barriers, rather they simultaneously identified enablers and barriers. Stoll-Kleeman and Schmidt (2017) is a very similar study to this one, having incorporated the Kollmuss and Agyeman (2002) framework to find the barriers and enablers to reducing meat consumption, and it did include data about transition countries like China in the meta-analysis. However, it differed greatly in methodology and sample size and did not attempt

doi:10.6342/NTU202302118

to determine the most influential barriers for individuals, instead it merely noted the factors that were most frequently mentioned.

One common influential barrier identified in the existing studies was the sheer pleasure of eating meat (Lea and Worsley, 2003; Macdiarmid et al., 2016). Many people believed that meat had an irreplaceable filling quality to it when consumed and that they associated meat with positive feelings and memories. Next, there was the aforementioned low awareness or skepticism toward the idea that meat production is bad for the environment, which demotivated people from making the effort to change their meat consumption habits (Austgulen et al., 2018; Macdiarmid et al., 2016). People also expressed reluctance to change entrenched dietary habits as this would require a difficult and uncomfortable process or learning curve (Austgulen et al., 2018; Lea and Worsley, 2003). Cultural/social/personal values and identity were significant barriers for many western people, who indicated that their meat consumption was tied to very specific characteristics that made up who they were and how they were perceived socially; changing their consumption habits would mean subjecting themselves to judgment and creating an incompatibility with, for example, their gender, political views, culture, and social class (de Boer and Aiking, 2022; Macdiarmid et al., 2016; Clonan et al., 2015). External locus of control, or the belief that changing one's consumption behavior will not make a difference or is not an individual's responsibility, was another important barrier (Macdiarmid et al., 2016; Austgulen et al., 2018; Sanchez-Sabate and Sabate, 2019; Stoll-Kleeman and Schmidt, 2017). Finally, the idea that humans "need" meat to survive (Lea and Worsley, 2003; Macdiarmid et al., 2016) was widely accepted. As Hartmann and Siegrist (2017) point out, there is a dearth of research on motivations for people to decrease their meat consumption. Therefore, aside from identifying barriers, this study will use the data to

doi:10.6342/NTU202302118

develop potential interventions that can encourage meat consumers to transition toward more sustainable meat consumption habits.

2.3 Existing Taiwanese studies and cases

Although there were no known studies that investigated the barriers to reducing meat consumption in Taiwan, given the prevalence of vegetarianism in Buddhist tradition, Taiwanese vegetarian diet-related studies existed especially in religious and medical contexts. In modern-day Taiwan, vegetarianism has been described as a growing trend of the 21st century, lately not only adopted for religious reasons, but also for health, environmental protection, and animal welfare (Chen et al., 2014; Chan et al., 2023; Lin, 2013). The Taiwanese vegetarians that chose to adhere to this diet primarily for environmental reasons typically underwent a behavioral transformation led by their altruistic and socially conscious mindsets as a reaction to new information, and their dietary habits were described as more "free" than the typical religious vegetarian (Ong, 2011). There were various mentions of the development of flexitarianism and diversification of vegetarianism in certain Taiwanese studies (Lin, 2013; Zheng, 2022), but none specifically focusing on this topic were found.

While the most typical profile of a Taiwanese vegetarian was found to be an older married Buddhist (Yeh, 2014), the youth demographic has increasingly been the subject of recent vegetarian research. Sanchez-Sabate et al. (2019) found that the typical minority representative who reduced (but not totally abstained from) meat consumption for environmental reasons was a young, ecology-oriented female from Europe or Asia. There were several prior studies that focused on consumer behavior of plant-based meats as an

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important solution that help reduce meat consumption. In Taiwan, young people aged from 23 to 38 years old were the most active plant-based meat consumers (Yen, 2021). Such young consumers were motivated by environmental concern, sensory appeal, subjective norm, locus of control, and positive anticipated emotion to buy plant-based meats (Chen, 2022). The most similar study to this one investigated the pro-environmental behavioral intentions of Taiwanese students from different universities to eat a vegetarian diet, revealing that they were environmental perception, environmental attitude, and health risk perception (Fang, 2019). However, it once again identified enabling factors instead of barriers. All in all, the existing Taiwanese studies focus on vegetarians and what factors influence them to reduce their meat consumption, but not on the barriers that prevent every person from practicing this pro-environmental behavior. Instead of analyzing only the people who already eat less meat, it is even more useful to study those who either refuse to or feel incapable of doing so.

Taiwanese consumer behavior with regard to environmental concerns and dietary choices has also been frequently studied. Ajzen's Theory of Planned Behavior (TPB) has often been used in Taiwanese studies, for example, to study environmental consumer behavior within Taiwan's "green restaurants" (Shen, 2017), where it was found that positive attitudes towards these restaurants impacted people's intentions to patronize them. A study on the pro-environmental behavior of Kaohsiung citizens revealed that convenience, clear indicators of usefulness, and strong incentives were the most effective factors that made people choose to engage in pro-environmental behaviors (Lin, 2013). In terms of purchasing organic food, consumers reported that health and environmental concern were their primary and secondary motivations respectively (Chen, 2009). For Taiwanese and Malaysian Chinese women alike, health, natural content, weight control,

doi:10.6342/NTU202302118

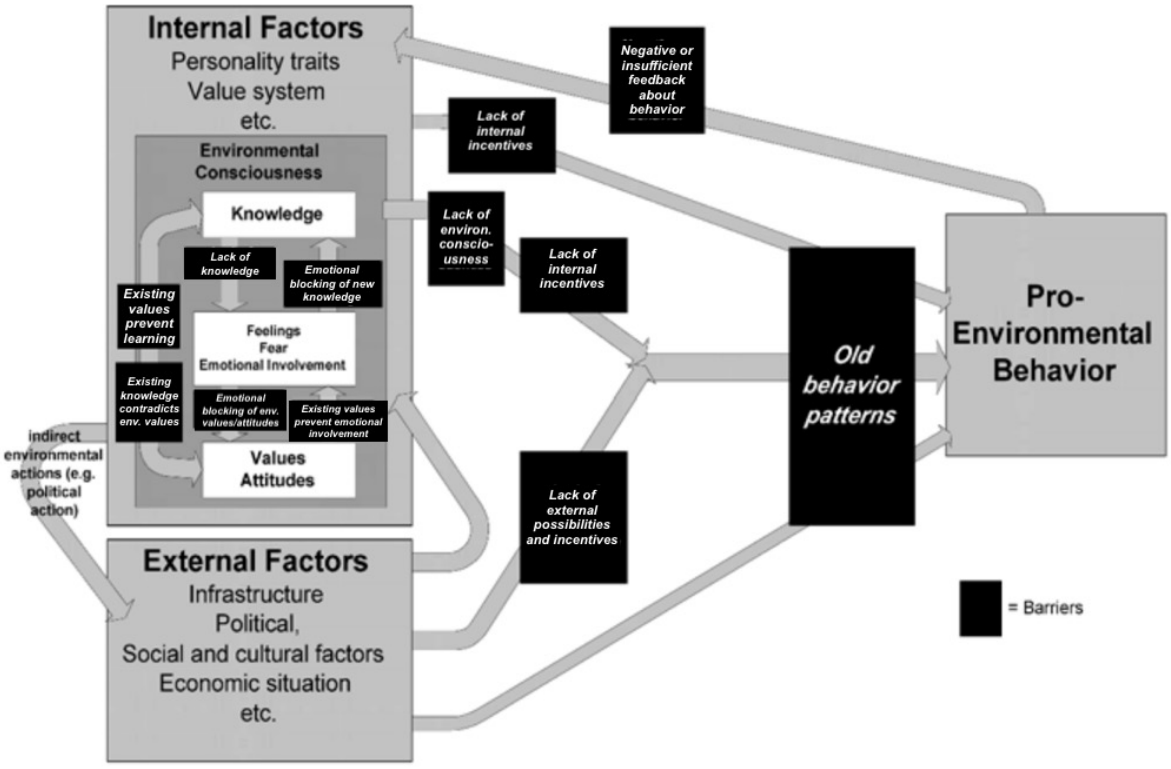
and convenience were the factors that influenced their food choices (Prescott et al., 2002). When studying the meat purchasing decisions of Taiwanese consumers, Jen and Wang (2015) found that sustainability considerations, including food security, animal welfare, and environmental impact, played a role in consumer behavior. However, consumers additionally revealed their own sets of personal, cultural, and socioeconomic motivations for their decisions. From these studies, it is clear that Taiwanese consumers generally do include environmental protection considerations when making their dietary choices, but in combination with other factors like health and convenience which frequently outweigh the former in importance. Thus, it is crucial to target and emphasize these factors when developing interventions or campaigns for dietary shifts like meat consumption reduction.

doi:10.6342/NTU202302118

3. Research Methods

3.1 Theoretical Framework

Figure 2: Model of pro-environmental behaviour (Kollmuss & Agyeman, 2002)



Kollmuss and Agyeman (2002) conceptualized a model of pro-environmental behavior that was based on a myriad of past models used to explain pro-environmental behavior and the underlying motivations. Their model features internal and external factors that influence pro-environmental behavior, all with corresponding barriers. It takes into account that these factors and barriers interact and subsequently act upon one another to either encourage or deter pro-environmental behavior instead of analyzing them independently. In so doing, it subverts rationalist logic by decoupling environmental knowledge from pro-environmental behavior just enough to allow other enablers and

doi:10.6342/NTU202302118

barriers to emerge as justifications. Multiple studies have utilized this model to study various environmental behaviors.

The model of pro-environmental behavior was used in this study to derive the internal and external factors in order to develop survey questions that would test which factor was the most influential. Internal factors encapsulate the personal inner rationales that are based on individual traits such as personalities, feelings, morality, etc. Kollmuss and Agyeman categorized "motivation, environmental knowledge, awareness, values, attitudes, emotion, locus of control, responsibilities, and priorities" as the internal factors. On the other hand, external factors can be understood as established conditions that are largely out of an individual's control. These are listed as "institutional, economic, social, and cultural factors," such as infrastructure, for example.

Table 2. Internal and external factors addressed in questionnaire

Internal Factors	External Factors
Taste	Price
Dietary Restrictions	Access
Knowledge (Environmental Impact)	Social Pressure
Morality	Culture
Health Knowledge	
Self-construal	
Locus of Control	
Emotional Involvement	

This study initially selected the external factors of Price, Taste, Choice, Availability, and Culture, and the internal factors of Knowledge, Morality, Locus of

doi:10.6342/NTU202302118

Control, and Emotion to test using the questionnaire. The factors were edited according to the findings in the literature review and additional considerations to include Taste, Dietary Restrictions, Knowledge of Environmental Impact, Morality, Health Knowledge, Self-construal, Locus of Control, and Emotional Involvement as internal factors and Price, Access, Social Pressure, and Culture as external factors. The "Dietary Restrictions" factor was added due to the possibility that people could have certain medical conditions that require them to eat meat. The factor of "Health Knowledge" refers not to a clear-cut, accurate factual comprehension of what is healthy or unhealthy, but rather to a person's general notion of a healthy diet. It was added because health is typically an important consideration when people make decisions on what foods to eat. "Self-construal" refers to a person's own self-perception of their place within and relationship to nature, and it was added based on the results from Komatsu et al. (2020). This study, also conducted on NTU students, revealed a correlation between the behavior of eating less than three meat meals a day and whether students regarded themselves to be equal to or dominant over non-human living beings.

3.2 Questionnaire

The primary method of data collection was a Google Forms questionnaire distributed to current NTU students via NTU Facebook Message Board (NTU 台大學生交流板), the NTU International Degree Program in Climate Change and Sustainable Development Department's community Facebook group (IPCS Community), and the NTU International Students Open Space 臺大國際生交流版. Respondents were eligible to enter a raffle to win Apple AirPods or online coupons for either 7-11 or CoCo bubble

doi:10.6342/NTU202302118

tea. Responses were collected for a month-long survey period from November 17-December 18, 2022. A total of 232 valid responses were collected at the end of the survey period. 88.8% of the students were Taiwanese, with the rest being international students. Ultimately, it was decided that only the Taiwanese student data would be used in this study for the purpose of uniformity, leaving 206 total responses.

The bilingual questionnaire was written in both English and Mandarin Chinese. It was divided into three main sections: Basic information, Dietary and meat consumption habits, and Barriers to reducing meat consumption. The first section asked for year of birth, gender, major, level and year of study, nationality, and whether the participant had ever taken an environmental sustainability class at NTU. It also asked if respondents were willing to participate in the follow-up interview. The second section had respondents identify their type of diet (vegan, vegetarian, pescatarian, flexitarian, omnivore/meat-eater, or high-protein) and self-report both the estimated amount and number of meals per week that they ate meat[2]. It then inquired about their willingness to change their meat consumption habits, including what types of meat they were willing to reduce and the level of commitment they had to actively changing their diets. The final section had two purposes: to gauge the relevance of each barrier to the respondent and to test their knowledge of the environmental impacts of meat production/consumption. For the former, a Likert scale was used, allowing respondents to choose if they strongly agreed, agreed, felt neutral, disagreed, or strongly disagreed with several statements related to each barrier that

[2] In this study, the term "meat" is used to encapsulate red meat, poultry, seafood, and any other food made from animal flesh. It is true that the production of each type of meat results in a different amount of GHG emissions. However, these differences are beyond the scope of this study, as the factor being investigated is simply meat consumption as a whole.

doi:10.6342/NTU202302118

are shown in the tables below. Questions 11 and 12 related to Self-construal were taken from the questions measuring Connectedness to Nature designed by Mayer and Frantz (2004). For the latter purpose, two added questions constituted a simple environmental knowledge test. The first asked participants to estimate the percentage of anthropogenic global greenhouse gas emissions that the meat industry contributes to each year, which according to the UN's Food and Agricultural Organization is around 14.5% (Gerber et al., 2013). The second question asked participants to numerically rank four different pro-environmental behaviors that had the potential to reduce their carbon footprints from most to least impactful. These four behaviors: Eating a vegetarian diet, using low-carbon transportation, reducing domestic food waste, and reducing domestic hot water usage were derived from Koide et al. (2021) because this study had calculated an approximate carbon footprint reduction impact for each of these behaviors. Besides these, all the other statements were formulated by the author.

Table 3. Statements used to determine students' barriers to reducing meat consumption (English version)

Questions
1. Eating a plant-based diet is too expensive for my budget.
2. I enjoy the taste of meat too much to reduce my meat consumption significantly.
3. I have dietary restrictions or other external limitations that prevent me from being able to reduce my meat consumption.
4. I have convenient access to a wide variety of plant-based food options.
5. Most of the people in my social circle (friends, family, etc.) eat meat, and it would be inconvenient for us to eat together if I stopped.
6. Meat eating is very important in my culture, and it carries a deeper symbolic, religious, or historical significance.
7. I am aware of the harmful environmental impacts of meat production.
8. I estimate that the meat industry contributes to _____% of global greenhouse gas emissions

doi:10.6342/NTU202302118

9. Rank the following four ways to reduce your carbon footprint from the order of most impactful (1) to the least impactful (4) (Assuming that these measures are implemented at a societal scale)
    [Vegetarian diet (no fish and meat)]
    [Low-carbon transportation]
    [Reducing domestic food waste]
    [Reducing domestic hot water usage]
10. I believe it is immoral to kill animals for human benefit.
11. I think of the natural world as a community to which I belong.
12. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees
13. If enough individuals like myself decided to stop eating meat, I believe our collective action could significantly reduce global carbon emissions.
14. I feel very strongly about the issue of meat consumption and its environmental impact.
15. I often think about my own carbon footprint and actively consider ways that I can lessen my personal environmental impact.
16. I believe meat is a crucial part of a healthy, balanced diet.
17. I believe that humans are omnivores by nature, and therefore, meat-eating is a vital part of the human experience.

Table 4. Statements used to determine students' barriers to reducing meat consumption (Chinese version)

Questions
1. 吃全素對我經濟壓力太大了。
2. 我實在太喜歡吃肉了，所以不想減少吃的比例。
3. 因為健康因素，我有飲食相關限制或是其他外在限制，讓我無法減少食肉比例。
4. 我有很多素食的選擇。
5. 我大部分的家人與朋友都吃肉，減少吃肉會給大家帶來不便。
6. 吃肉在我的文化、宗教或歷史中有深厚的意義，所以我不想減少吃肉。
7. 我有意識到肉類行業對於環境造成龐大的負擔。
8. 我覺得全球肉類生產佔全球的溫室氣體排放的 _____%。
9. 請從最高到最低排序出以下四種行為的碳排放量
a. 改為素食飲食
b. 以步行或腳踏車代替開車
c. 減少家庭食物浪費

doi:10.6342/NTU202302118

d. 減少家庭熱水使用量

10. 我認為人類為了食用肉類而屠殺動物是不道德的。
11. 我把自然世界看作是我所歸屬的社群。
12. 我經常覺得自己只是周遭自然世界的一小部分，而且我也沒有比地上的草或樹上的鳥來得重要。
13. 如果更多人願意跟我一樣吃素，我相信這樣的集體行動能夠大量減少溫室氣體的排放。
14. 我深信吃肉會對環境造成重大的負面影響。
15. 我很常思考我的日常行為會如何製造碳排放，並且會主動思考自己如何在生活中減少對環境的負面影響。
16. 我認為吃肉是健康、均衡飲食很重要的一部分。
17. 我認為人類是雜食性動物，所以吃肉本來就是生活的一部分。

In order to analyze the questionnaire data, participants were classified into three major dietary types. Vegans, vegetarians, and pescatarians were classified into one group that consumed little to no meat, abbreviated to VVP. Flexitarians constituted their own Flexitarian group (F) with reduced meat consumption. Meat-eaters and high-protein diet respondents were sorted into the Meat-eaters (ME) group. An 81.6% majority of participants were ME, while 10.6% were F and 7.7% were VVP. Dividing them in this manner allowed for the analysis of how the barriers correlated to the amount of meat each student consumed. Next, pie charts were generated for each barrier to determine whether or not it was influential for a certain group. Each barrier thus had three corresponding pie charts, with an example shown below for the barrier of Price.

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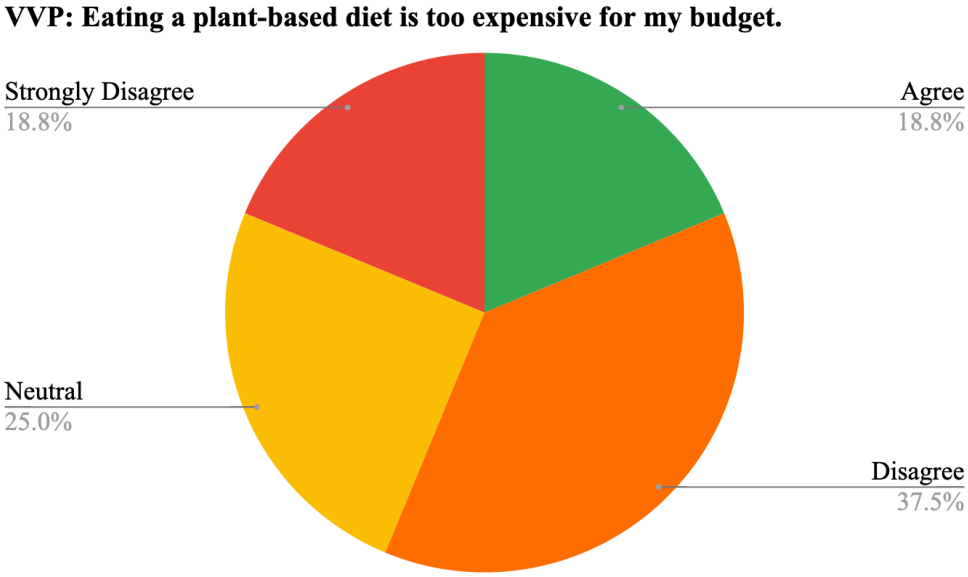
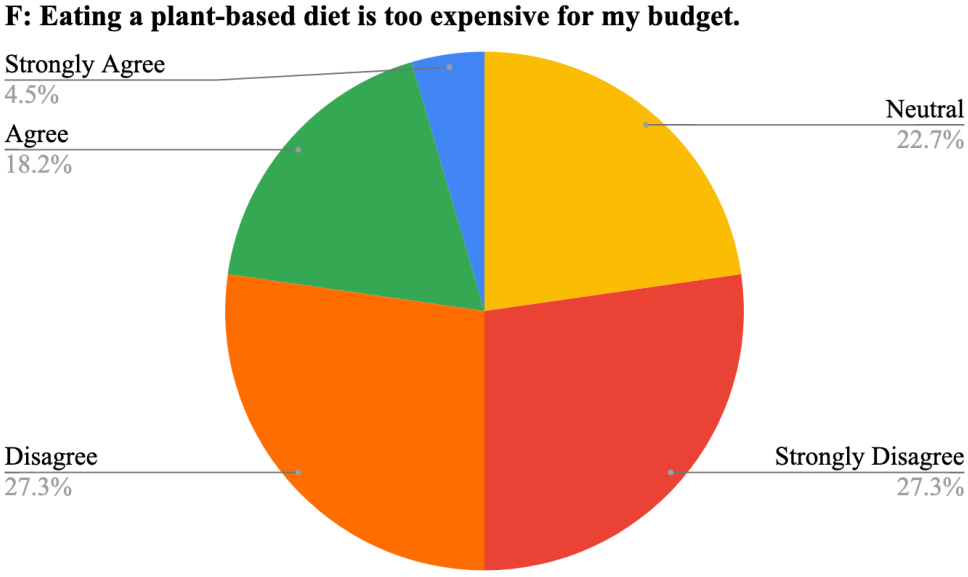
Figure 2: Pie charts showing group responses regarding the barrier of Price





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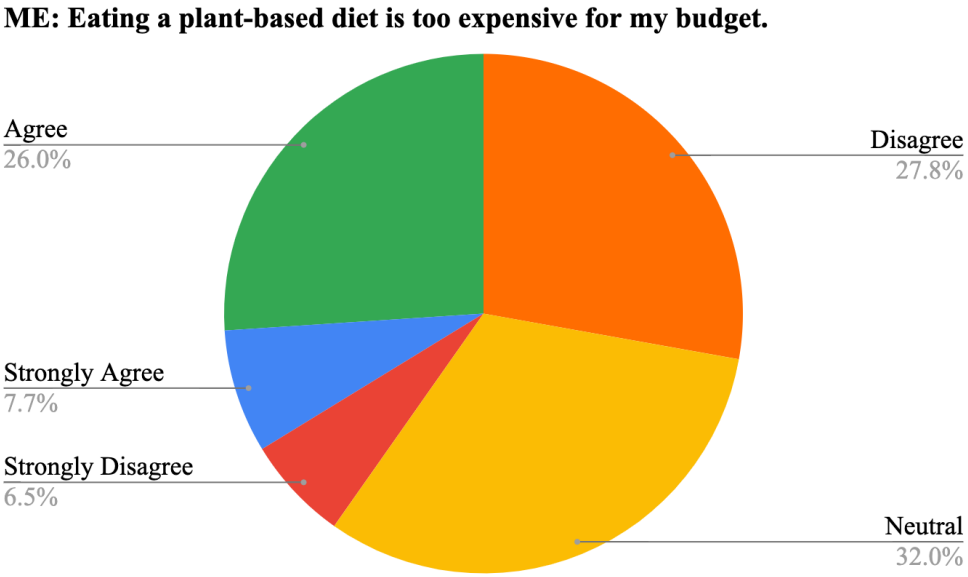


3.3 Interviews

After the results from the questionnaire were collected, ten participants (five male and five female) were selected to do follow-up interviews. The selection was done on a voluntary basis, and efforts were made to represent a variety of dietary habits and willingness to change them. The purpose of these qualitative interviews was to obtain more nuanced responses in order to substantiate the quantitative results gained from the survey, and then propose interventions based on these responses.

Table 5. Interviewee profiles and barriers

Number	Interviewee Profile	Barriers
1	28-year-old female IPCS student, a meat-eater who wants to reduce her meat consumption.	Taste, social pressure

doi:10.6342/NTU202302118

2	33-year-old female IPCS student, a flexitarian who doesn't want to reduce her meat consumption. Her barriers are dietary restrictions, social pressure, culture, and health knowledge.	Dietary restrictions, social pressure, culture, health knowledge
3	33-year-old female IPCS student who identifies her diet as lacto-vegetarian (奶素), which is closest to vegan.	N/A
4	26-year-old female IPCS student, a flexitarian who wants to decrease her meat consumption.	Taste, social pressure, health knowledge
5	23-year-old female biochemistry student, a meat-eater who wants to decrease her meat consumption.	Access, social pressure, health knowledge
6	25-year-old male animal science student, a meat-eater who doesn't want to decrease his meat consumption.	Taste, social pressure
7	22-year-old male biomechatronics student, a meat-eater who doesn't want to change his meat consumption.	Health knowledge, taste, dietary restrictions, access, low environmental awareness
8	21-year-old male agricultural economics student, a meat-eater who doesn't want to decrease his meat consumption.	Taste, access, social pressure, culture, health knowledge
9	20-year-old male biomedical engineering student who doesn't want to decrease his meat consumption.	Taste, self-construal, health knowledge
10	21-year-old male electrical engineering student who wants to reduce his meat consumption.	Taste, access, social pressure

All but one of the interviews were conducted online using Google Meet. Four of the interviews were conducted in English, and six in Mandarin Chinese. A semi-structured interview guide approach was utilized, in which the previously determined main topics were the barriers identified by the quantitative survey. Questions corresponding to the

doi:10.6342/NTU202302118

barriers were developed and translated prior to the interviews, but depending on their own specific barriers, interviewees were asked a slightly different set of questions in varying order. Generally, if the barrier did not apply to the participant, the question was omitted. Some additional questions and discussions came up spontaneously during some of the interviews. It must be noted that the first three interviews were conducted in early March 2023 while the remaining seven were conducted in mid-June 2023. Since the barriers had not yet been fully analyzed at the time, the initial interviews were longer, taking from 30 minutes to an hour and broader, though they contained many of the same questions and topics as the later interviews, which only lasted 10-15 minutes long.

Table 6. Interview guide questions (English version)

Questions
• Do you believe that significantly reducing your meat consumption will positively or negatively affect your health? • From which sources did you get your notion of a healthy diet? Is it from a food pyramid that you learned in school, from personal experience, from a doctor/dietician, from word of mouth, etc? • Do you have total control over your dietary choices, or are you limited by, for example, what your family has cooked? • Do you have any vegans/vegetarians/pescatarians in your social circle? Have they influenced your diet at all? • Would increasing the availability of plant-based options in restaurants help alleviate some of the social pressure by allowing meat-eaters and TVVP/TF to dine together seamlessly? • Do you like meat substitutes like Omnipork, Beyond Meat, Impossible Meat, etc.? If they were more readily available and affordable, would you sometimes eat meat substitutes instead of real meat? • What is your biggest issue with the available plant-based options? Is it physical convenience (availability on food delivery platforms or nearby restaurants), lack of variety (which would make eating plant-based very monotonous), or just a lack of options that you enjoy?

doi:10.6342/NTU202302118

- Are you interested in learning more information about plant-based food such as the best places to find it, easy cooking techniques, etc.? Would this information help you reduce your meat consumption?
- Would you reduce your meat consumption if you had a better idea of how much each serving of meat impacts the environment (e.g. amounts of water usage, land usage, greenhouse gas emissions, etc.)

Table 7. Interview guide questions (Chinese version)

Questions
• 你認為大量減少肉類的攝取會對你的健康產生正面或負面的影響嗎?
• 你是從哪裡得知健康飲食的相關知識呢? 是學校裡教的食物金字塔嗎? 還是個人經驗?還是從醫生/營養師那裡，還是口耳相傳得來的呢?
• 你能夠完全控制你的飲食選擇嗎?還是說其實你的選擇是有限的? 例如你只能吃家裡提供的食物?
• 你身邊有吃全素/蛋奶素/魚素的人嗎?他們有影響或改變你的飲食習慣嗎?
• 你覺得餐廳如果能增加他們的素食選項，讓吃素的人跟吃肉的人可以很方便的一起用餐，會不會減少吃素者的社交或是同儕壓力?
• 你喜歡素肉嗎? 例如新豬肉純植物肉碎(Omnipork)、未來肉(Beyond Meat)、不可能食品（Impossible Food）等不同類型的素肉嗎? 如果它們價錢合理又容易取得，你會考慮偶爾拿它們代替肉類食品嗎?
• 針對目前市上既有的素食選項，你覺得最大的問題或是最需要被改善的地方是什麼?是方便性嗎?例如找不到素食外送平台或是附近素食餐廳?還是說是素食的選項不夠，讓你覺得吃素一成不變，還是你找不到喜歡的素食選項呢?
• 您會有興趣了解更多關於植物肉的資訊嗎(例如您可以到哪取得或是料理植物肉)?您覺得這些資訊會幫助您降低對肉類的消費嗎?
• 如果您能更了解自己食用一份肉類蛋白質會對環境造成什麼影響（例如用了多少水分、土地資源、溫室氣體排放)，您會願意減少對肉類的消費嗎?

doi:10.6342/NTU202302118

4. Results

4.1 Quantitative Results

Table 8. NTU student profiles

Questionnaire respondents (n = 206)

Characteristics	% of total
Gender	
Male	44.7
Female	55.3
Age	
18-21	45.1
22-25	45.1
26-29	5.8
30-33	2.5
Did not disclose	1.5
Level of study	
Undergraduate	80.5
Master's	19
Ph.D.	0.5

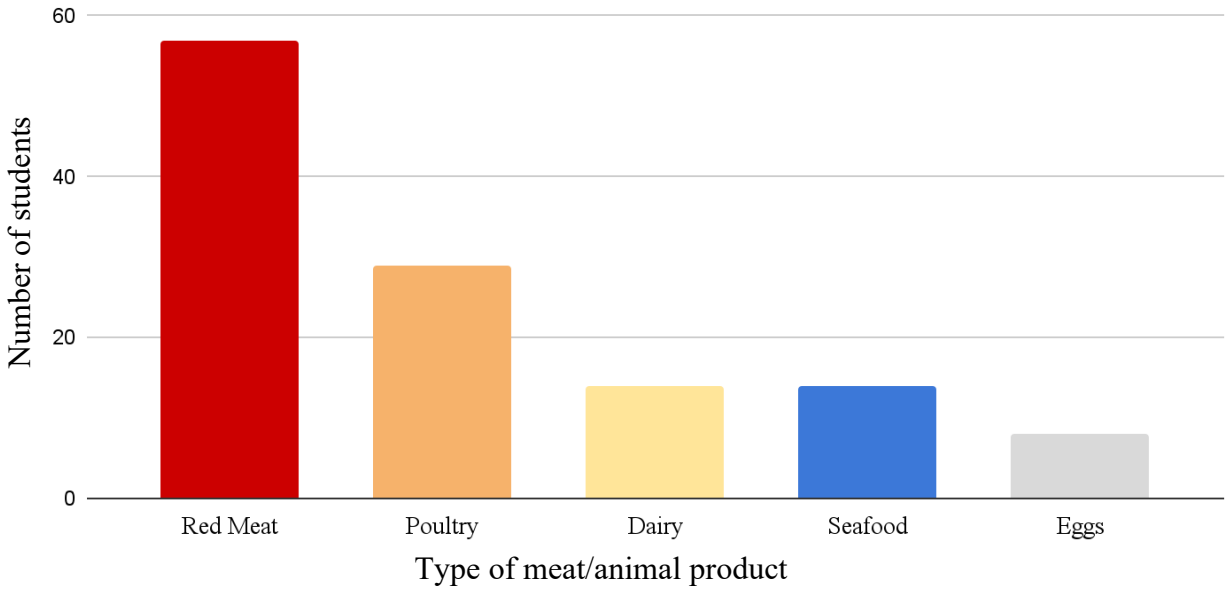
Table 9. Dietary habits of NTU students

(n = 206)	% of total (* = % of those willing to reduce meat consumption)
Type of diet	
Meat-eater/Omnivore (both plants and meat equally)	79.1
Flexitarian (mostly plants, little meat)	10.7
Vegetarian (including lacto-ovo)	5.8
High-protein/Meat-heavy (carnivore, ketogenic, etc.)	2.4
Vegan	1
Pescatarian (plants and seafood but no meat)	1
Number of meat meals per week	
15-18	26.7
11-14	25.2
19-21	20.4

doi:10.6342/NTU202302118

6-10	13.1
0	6.8
Did not disclose	4.4
1-5	3.4
Amount of meat on typical plate	
1/3 or 1/2 of the plate	47.6
Just a few small pieces	39.8
N/A (vegan/vegetarian)	6.8
Meat is the majority of the meal	5.8
Willingness to reduce consumption of meat or animal products in the future	
Unwilling, would like to keep meat consumption the same	63.2
Willing to reduce meat consumption	27
Unwilling, would actually like to increase meat consumption	9.8
*Plans to take active measures to reduce consumption of meat or animal products in the future**	
Agree/Strongly Agree	74.5
Neutral	25.5

Figure 3. Meat or animal products that NTU students want to consume less of



The survey respondents were 44.7% male and 55.3% female, studying a wide variety of disciplines. Respondents were predominantly undergraduate students, so a

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majority of them ranged from the ages of 18-25. As expected, a 79.1% majority were meat eaters, followed by a significant 10.7% percentage of flexitarians, and 5.8% were vegetarians. Students most commonly ate between 11-18 meat meals per week, and most reported that meat comprised 1/3 or 1/2 of their typical plate. 73% of students were unwilling to reduce their meat consumption, but among the 27% who were willing, 74.5% committed to taking active measures to reduce their consumption of various animal products in the future. The type of meat students wanted to reduce their consumption of the most was red meat; even some of the students who were unwilling to reduce their overall meat consumption said they wanted to consume less red meat.

Table 10. Students' knowledge of the environmental impacts of meat consumption

Participant group	Average estimate and standard deviation of the percentage of GHG emissions caused by the global meat industry **(Correct answer: 14.5%)**
All participants (n=206)	24.17% ± 16.03
VVP (n=16)	31.72% ± 22.53
F (n=22)	24.57% ± 16.68
ME (n=168)	23.39% ± 15.14

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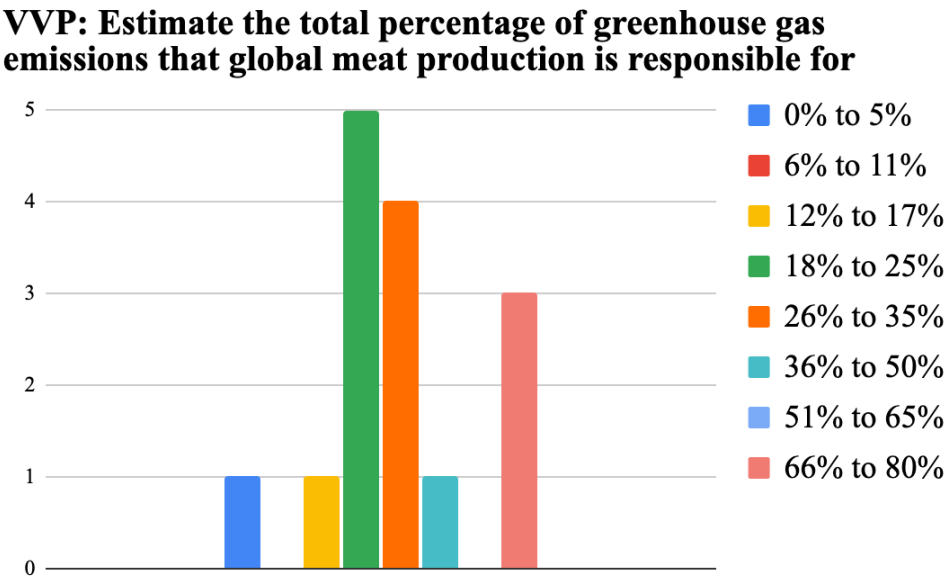
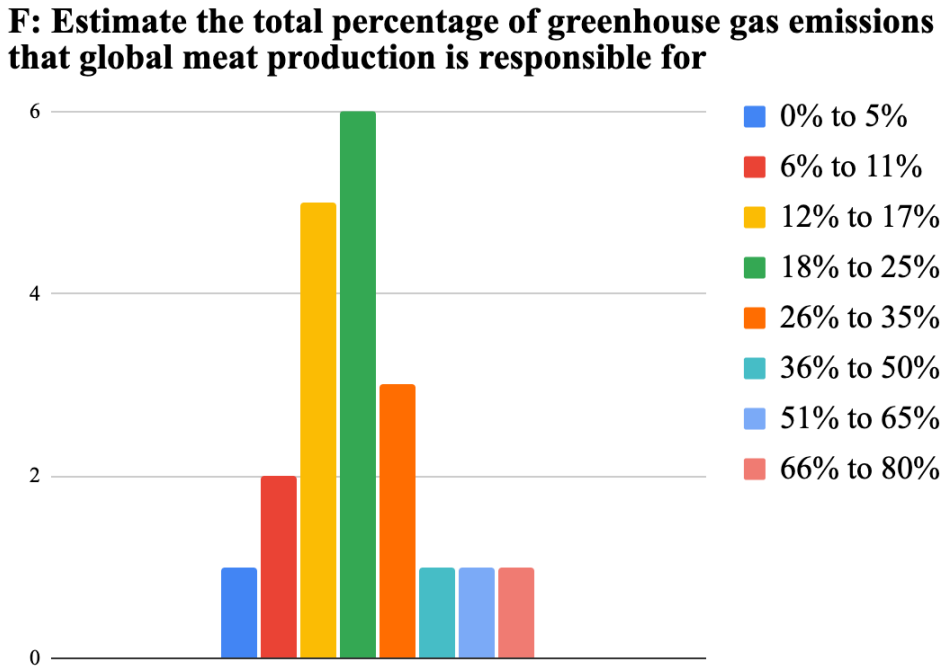
Figure 4. Bar graphs showing group estimates of the total percentage of greenhouse gases that global meat production is responsible for





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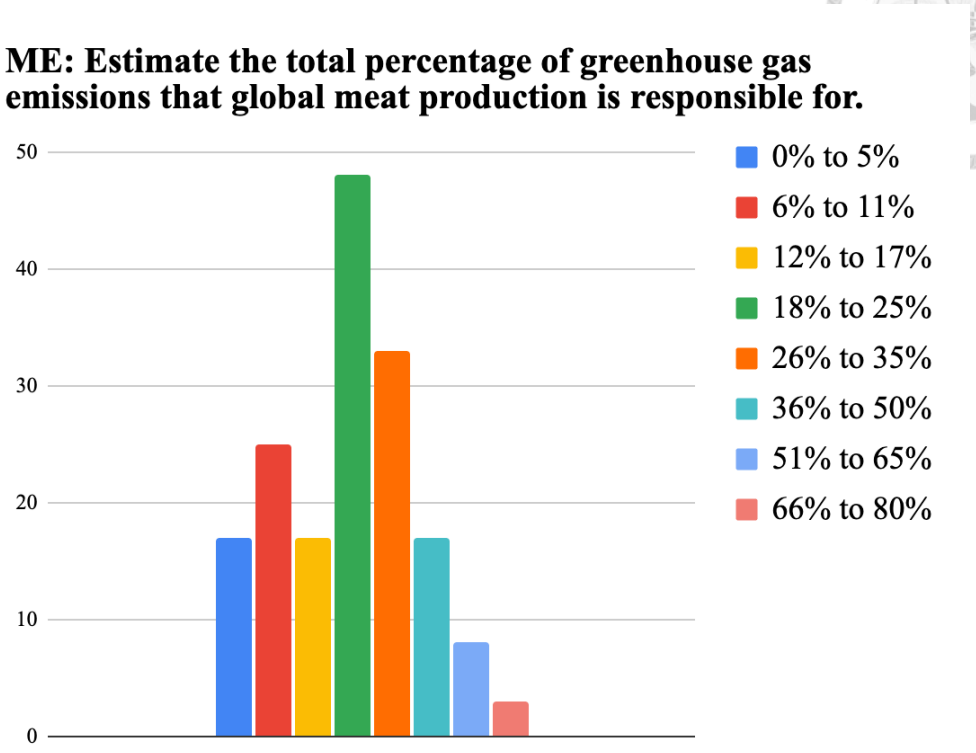

The graphs above show that the VVP, F, and ME groups all had a majority of respondents selecting the 18-25% range, whereas the correct answer was that meat production creates 14.5% of anthropogenic global GHG emissions. The mean percentages for ME and F were closer to the correct answer than those for VVP. This percentage figure is certainly not common knowledge, even for students in environmental fields, so the ultimate value of this question was not so much in evaluating students' environmental knowledge based on how accurately they guessed the percentage. Rather, the given estimates provided some quantitative insight into students' perceptions of how detrimental meat production/consumption is to the environment as a whole. In fact, an overestimation of the percentage can be construed as a positive thing in this context because it suggests that students consider meat consumption to be a significant GHG-emitting behavior.

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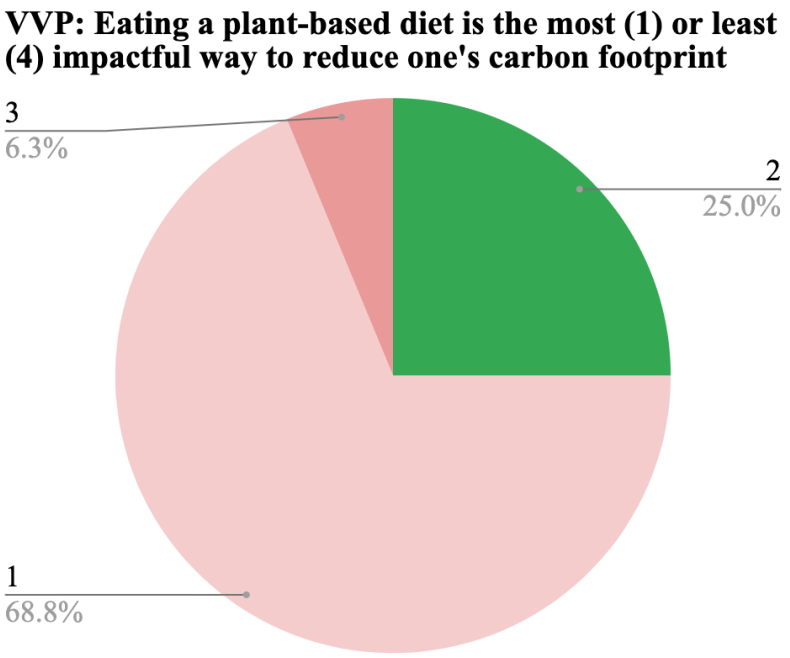
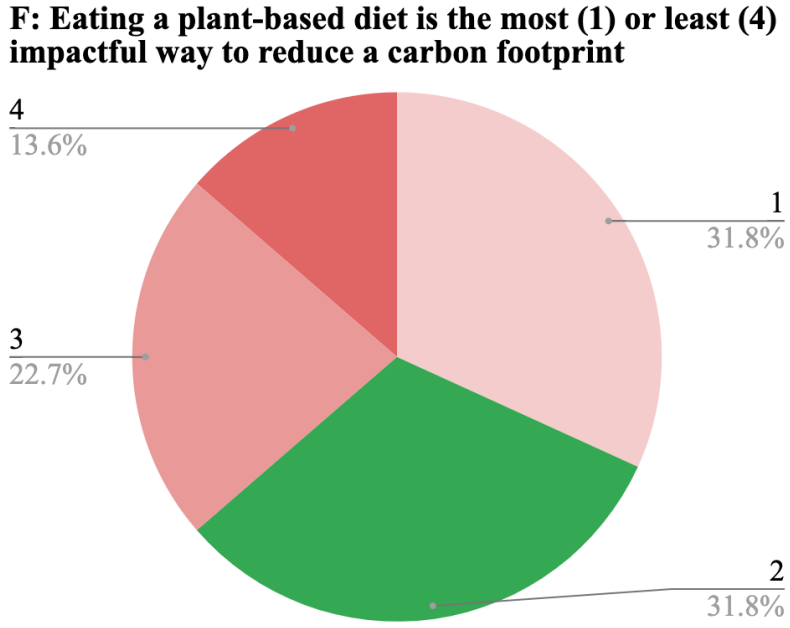
Figure 5. Pie charts showing group responses ranking the comparative carbon footprint-reducing impact of eating a plant-based diet





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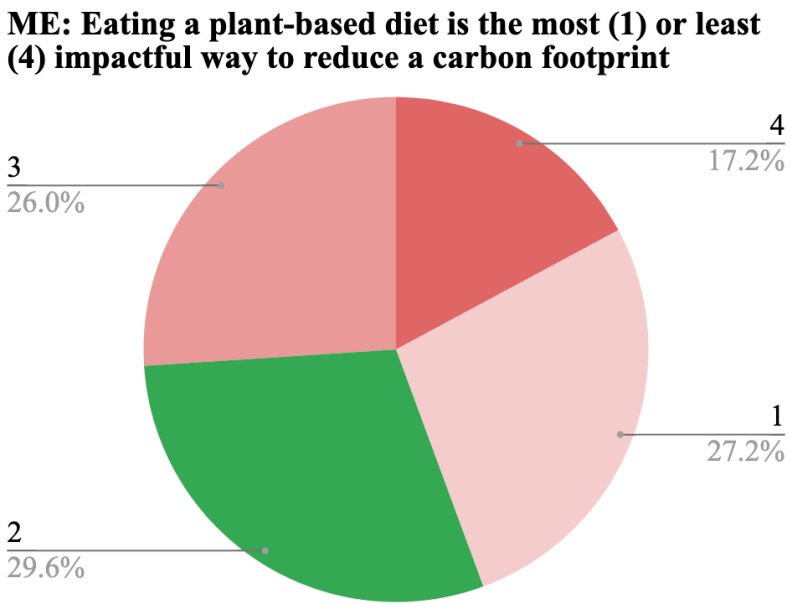
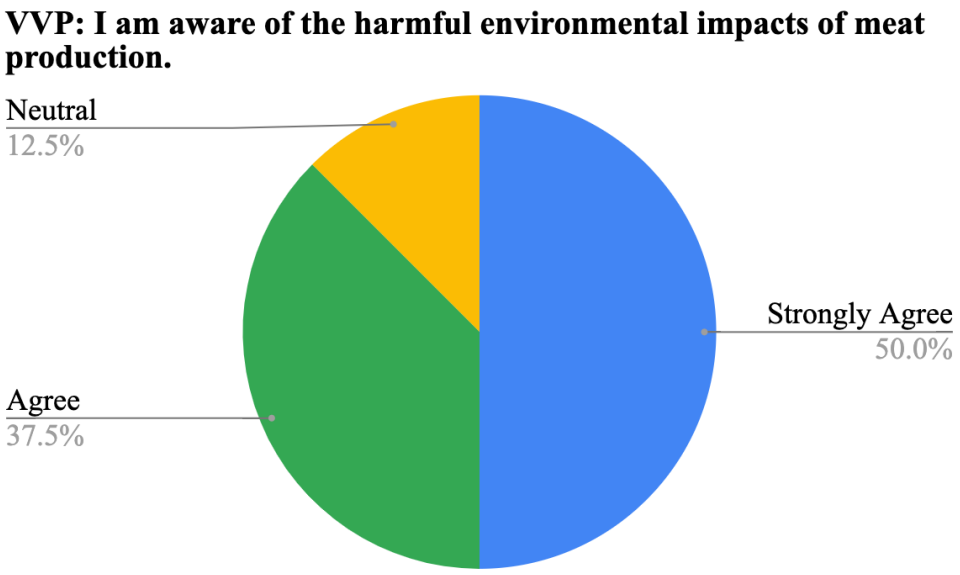


For the next question in which participants were asked to rank four different pro-environmental behaviors from most to least impactful for reducing one's carbon footprint, the correct order was: (1) low-carbon transportation, (2) eating a vegetarian diet, (3) reducing domestic hot water usage, and (4) reducing domestic food waste. The charts above show how the respondents in each group ranked eating a vegetarian diet, with (2) as the correct answer. It is apparent that no group emerged with distinctly better knowledge than another. Remarkably, only the ME group had a very slight majority of students within the group guess the correct answer, but for the most part, they were divided between all four answers. F respondents were divided on whether eating a vegetarian diet was the first or second most impactful behavior, and VVP once again ranked it too high. These responses indicate that students were uncertain of the benefits of eating a plant-based diet in comparison to other pro-environmental behaviors.

doi:10.6342/NTU202302118

In the survey, students were also asked to self-report their own awareness of the harmful environmental impacts of meat production using the Likert scale. While this is technically one of the barrier-related statements, students' own perceived awareness of the meat consumption issue made for an interesting juxtaposition with the empirical measurement of their environmental impact knowledge. The charts below show that a majority of students across all groups were confident in their own awareness of the environmental impacts of meat production.

Figure 6. Pie charts showing group responses reporting their own awareness of the environmental impacts of meat production



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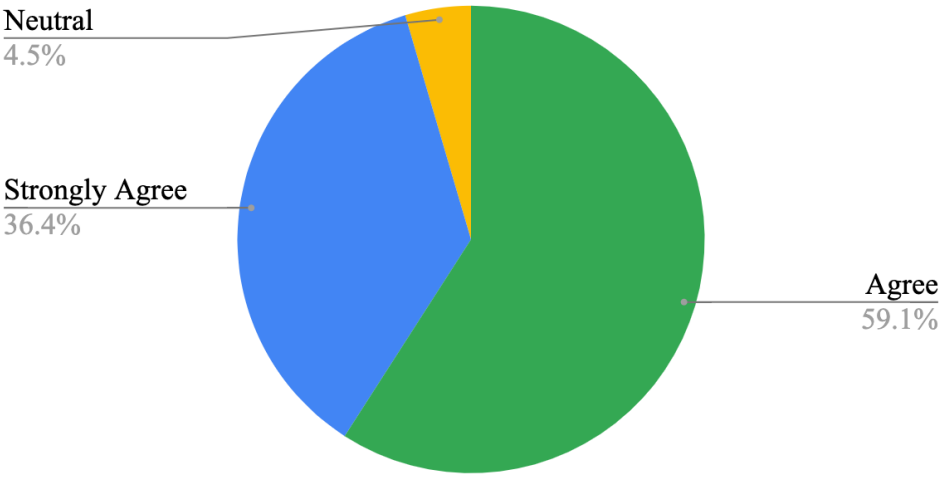
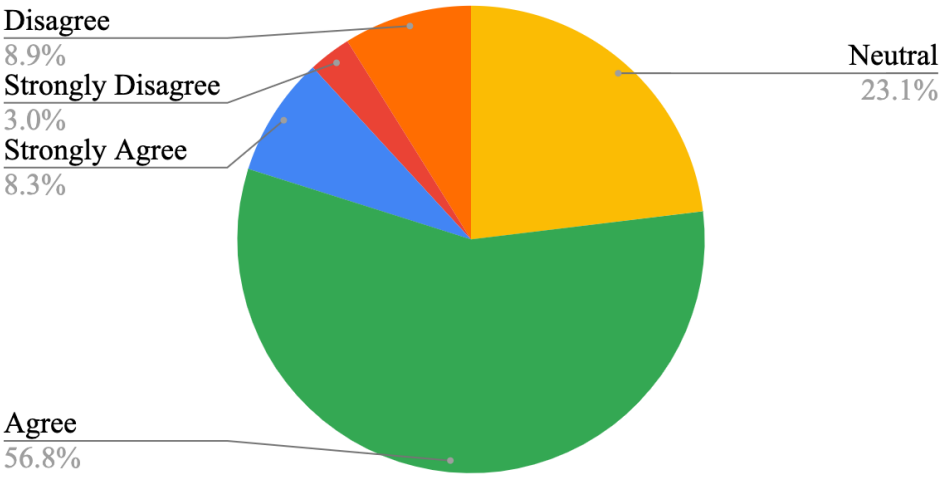
F: I am aware of the harmful environmental impacts of meat production.



ME: I am aware of the harmful environmental impacts of meat production.



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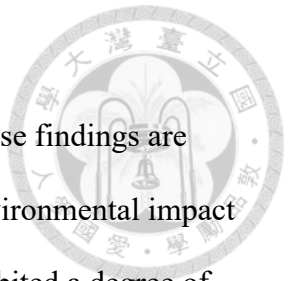

Ultimately, the central conclusions that can be drawn from all these findings are twofold. Firstly, non-meat-eating students did not demonstrate better environmental impact knowledge than meat-eating students. Participants across all groups exhibited a degree of knowledge and awareness that was not necessarily proportionate to their meat consumption. Secondly, NTU students overall perceived meat consumption to be an even more consequential environmental issue than it actually is (perhaps indicating higher awareness than knowledge). This was especially true for the VVP group; it is highly likely that the students in this group chose their virtually meat-free dietary habits for reasons unrelated to empirical environmental knowledge. Despite this perception, a majority of students continue to consume meat. All of these conclusions corroborate the idea that higher environmental knowledge does not necessarily lead to pro-environmental behavior (Kollmuss and Agyeman, 2002).

Table 11. Barriers to reducing NTU students' meat consumption

	n=206	% of agree/strongly agree (* = % of disagree/strongly disagree)		
Barrier	Total	VVP	F	ME
Health Knowledge				
I believe meat is a crucial part of a healthy, balanced diet.	77.7	37.5	54.5	85.1
I believe that humans are omnivores by nature, and therefore, meat-eating is a vital part of the human experience.	73.3	12.5	40.9	83.9

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Social Pressure Most of the people in my social circle (friends, family, etc.) eat meat, and it would be inconvenient for us to eat together if I stopped.	61.7	37.5	36.4	67.3
Taste I enjoy the taste of meat too much to reduce my meat consumption significantly.	54.9	0	18.2	65.5
*Access** I have convenient access to a wide variety of plant-based food options	49.5	12.5	18.2	57.7
*Morality** I believe it is immoral to kill animals for human benefit.	48.1	12.5	22.7	55.4
Price Eating a plant-based diet is too expensive for my budget.	31.6	18.8	22.7	33.9
*Locus of Control (individual carbon footprint)** I often think about my own carbon footprint and actively consider ways that I can lessen my personal environmental impact	30.6	6.3	9.1	36.3
*Self-Construal (equality)** I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.	27.2	0	22.7	31
Dietary Restrictions I have dietary restrictions or external limitations that prevent me from being able to reduce my meat consumption.	24.3	6.3	40.9	24.4
*Emotional Involvement** I feel very strongly about the issue of meat consumption and its environmental impact	23.3	0	9.1	27.4

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*Self-construal (interdependence)** I think of the natural world as a community to which I belong.	12.6	0	0	15.5
Culture Meat eating is very important in my culture.	9.7	6.3	9.1	8.3
*Awareness of environmental impact** I am aware of the harmful environmental impacts of meat production	9.7	0	0	11.9
*Locus of Control (meat consumption reduction)** If enough individuals like myself decided to stop eating meat, I believe our collective action could significantly reduce global carbon emissions.	8.7	0	0	10.7

Table 11 displays the barriers to reducing NTU students' meat consumption in order from most to least influential. These were organized in descending order according to the number shown in the first column, which was the percentage of total students across all groups that either agreed or strongly agreed that the corresponding statement applied to them. For barriers marked with an asterisk (*), students indicated that they disagreed or strongly disagreed with the statement. A barrier was considered to be influential if around 50% or more of total student participants reported that they either agreed/strongly agreed (or disagreed/strongly disagreed for some factors) with the statement.

doi:10.6342/NTU202302118

Health Knowledge, Social Pressure, Taste, and Access emerged as the four most influential barriers to reducing meat consumption for NTU students[3]. The percentages for all these major barriers were markedly higher for ME than for the other categories. These barriers were not thus identified by respondents but explained the difference in percentages between different categories. Students also demonstrated a remarkably strong external locus of control, believing that individual actions like reducing meat consumption could make a difference to help the environment. The emergence of health knowledge as the most influential barrier implied that students believed that significantly reducing their meat consumption would create an imbalance in their established diet that could potentially lead to adverse health effects. Their strong agreement in the ideas that meat was necessary for a balanced diet and belief in the inherent identity of humans as omnivores suggested positive views of meat as an irreplaceable source of nutrition.

4.2 Qualitative Results

The following interview findings will be discussed in order of influential barriers. In terms of health knowledge, participants were equally divided on whether significantly reducing their meat consumption would have more positive or negative effects on their health or even whether it would have any effect at all. They reported several considerations for their ambivalence. Those who believed that reducing their meat consumption would

[3] While the barrier of Morality followed close behind Access, its usefulness as a barrier in the context of this study is limited in comparison. For one, a significant 32.5% of participants merely felt neutral about this barrier. Furthermore, a person's moral code is developed over a lifetime out of a myriad of intertwining factors; attempting to change that by trying to convince people that killing animals for human benefit is immoral is a futile undertaking. It is thus not included as an influential barrier.

doi:10.6342/NTU202302118

negatively affect their health thought they would be lacking in certain nutrients like protein. Interviewee #2 was justifiably concerned about her protein intake due to being anemic and maintaining a very athletic lifestyle. Multiple people brought up the issue of plant-based protein sources being limited to soy or protein shakes, which they believed to be less healthy than animal proteins. Those who believed it would have a positive impact presumed it would cause them to increase their consumption of vegetables and lower their cholesterol. Those with a positive perspective believed that they would not be missing any nutrients as long as they consumed a wide enough variety of plant-based foods and substitutes available to them. Interviewee #3 reported feeling very noticeable health benefits from her lacto-vegetarian diet. Those in the middle predicted that there would either be a mixture of both positive and negative effects or no significant changes at all. For some, it depended largely on how drastic the reduction would be. Interviewee #4 believed that going fully vegetarian would harm her health but also acknowledged that only a certain amount of animal protein was necessary for a healthy diet; anything beyond that she was willing to forgo. Interviewee #1 was concerned that adopting a more plant-based or vegan diet would cause her to consume more fried food and junk food. The prevalence of unhealthy processed food in vegetarian cuisine was also frequently brought up. Interviewees most commonly learned their health knowledge from school and by searching for their own health information on the internet or social media. Others reported learning from personal experience, from discussions with their peers, and from what their families instilled in them growing up. About half of the interviewees expressed that they were actively interested in seeking out health knowledge of their own volition.

Social pressure was a major theme of the interviews. This group of interviewees mostly had the freedom to make their own individual dietary choices. They primarily

doi:10.6342/NTU202302118

reported multi-person living situations such as family homes, dormitories, or shared flats (only one lived alone) which sometimes placed some limitations on their ability to cook or to eat something different than what their families were eating. However, they usually had the option to cook their own food, eat home-cooked family meals, order takeout, or go out to eat with friends. Interviewees explained the different ways in which their families and friends influenced their diets. Interviewees often mentioned that their families influenced their long-term dietary habits by cooking for them and guiding them on what to eat or avoid during their formative years. However, some revealed that the influence extended into adulthood. Interviewee #2 transitioned to a flexitarian diet after witnessing her sister go vegetarian just ten years before. Interviewee #3 said that she had been raised in a family that loved eating meat, but when her mom decided to reduce her meat consumption and become flexitarian due to animal welfare and environmental concerns, she followed along. On the other hand, Interviewee #7 said that his parents would "find it quite unnecessary" for him to go vegetarian and would still want him to eat the meat dishes that they bought. Sometimes, the interviewees themselves were able to influence their family's habits. Interviewee #1 did Meatless Mondays and her family would join her, albeit reluctantly, just so that they could eat together. The non-vegetarian family members of Interviewee #3 did the same and eventually got used to not eating meat for every meal.

Friends and social circles sometimes had a bit of power to impact interviewees' day-to-day food choices. This influence was mostly situational, though, and depended on the preferences of the friends. Sometimes, interviewees were influenced to eat more meat, such as Interviewee #5 whose friends liked to frequent all-you-can-eat BBQ restaurants. Interviewee #4's friends would express reluctance at the idea of going out to eat vegetarian food together, which she said was common for Taiwanese youth. Interviewee #8, on the

doi:10.6342/NTU202302118

other hand, had non-vegetarian friends that would sometimes choose to go out to eat vegetarian food and he would join them. Most interviewees reported having at least one vegetarian friend or family member. Interviewee #2 cited the new international friends she made later in life as inspiration for her flexitarian transition. For others, these vegetarian friends had a limited impact on the interviewees' own dietary habits. This is likely because they were the minority, and so aside from the times they were able to get their friend group to eat with them at vegetarian restaurants, they were mostly left to take care of their own individual dietary restrictions. Interviewee #3 tried to overcome her aversion to the smell of meat and ask permission from non-vegetarian restaurants to bring her own food just so she could eat out with friends.

Consequently, nearly all interviewees supported increasing the availability of plant-based options in restaurants to help alleviate the social pressure on both meat-eaters and vegetarians when they dine together. Many of them agreed that finding a restaurant with options for both meat-eaters and vegetarians was difficult. Interviewees #2 and #4 did not believe increasing plant-based options would have the desired effect, with #2 saying that there were too many strict Buddhist vegetarians like her aunt who could not even be in the same room as meat, and #4 saying that the real issue was not the dining environment, but the lackluster taste of vegetarian food.

To combat the barriers of taste and access, the interviewees offered a wealth of suggestions on how vegetarian restaurants, products, and culture can be improved to encourage more people to reduce their meat consumption. First, it is noteworthy that they were quite divided on how much they liked the taste of meat; while some really loved to eat it and needed it in their meals to feel satisfied, almost as many were very indifferent to the taste of meat and did not really feel the need to eat that much of it. Interviewees #5 and #10

doi:10.6342/NTU202302118

acknowledged the value of meat as a minor ingredient to add variety, flavor, and necessary nutrition to their diets but did not care too much for the taste of meat on its own. The dominant critique of vegetarian food in Taiwan was that although it was considered convenient, interviewees felt it was very much lacking in options for them to enjoy. Interviewees #2 and #3 were also concerned that too many of the available vegetarian products and options were carbohydrates and starches like rice and noodle dishes, and too few protein options. While even non-vegetarian interviewees said that they enjoyed eating plant-based food from time to time, it was the meat substitutes they found to have a lot of room for improvement. Interviewees, most of whom had tried at least one of the popular meat substitute brands, reported their taste as "not bad" at best. At worst, they found the taste to be bad due to having flavors of soy or sesame oil and the prices to be far too high. Texture was also an issue, with the available options not having a close enough mouthfeel to meat to fully replace it, and lack of substitutes for other types/cuts of meat such as plant-based seafood or steak. There were also nutritional concerns like these products being overly processed or not containing the nutrients that real meat has. Despite these concerns, interviewees were generally open to the idea of plant-based meat replacing real meat one day as long as these issues were addressed.

Some critiques related to the Buddhist influence on vegetarianism were also mentioned. Interviewee #1 said she enjoyed stronger flavors in her food, so it was to her detriment that Buddhist vegetarianism prohibits the use of garlic, onions, and other strong spices. Interviewee #3 was dissatisfied with the very early closing time of vegetarian restaurants according to the Buddhist lifestyle; finding a vegetarian restaurant to eat in after 7:00 PM would be quite difficult, and one would have to settle with convenience store food.

doi:10.6342/NTU202302118

A theme that was not addressed as a barrier in the survey but was mentioned in the interview was Habit. Interviewee #6 emphasized that although he was willing to occasionally choose to eat vegetarian food or try meat substitutes, he would not be open to making major changes to his diet at all unless something major happened that forced him to make such a change, such as a health issue. He made an insightful point that dietary habits are formed in childhood, so it is much more difficult to start a new diet than it is to be raised on a certain diet from childhood. Similarly, Interviewee #7 admitted that absorbing new information, looking for vegetarian restaurants, and increasing his environmental awareness in order to alter his diet would be too troublesome for him at this stage in his life, but he said he might change his mind when he got older. They both reported maintaining a consistent diet without major changes for most of their lives. Conversely, Interviewees #5 and #10 both reported that they developed greater environmental awareness recently which made them reduce their meat consumption, with the latter being influenced after joining NTU's Climate Action Club. The idea of environmental awareness directly applied as an intervention did not sound like an effective method to other interviewees, though, because they replied that receiving more statistical information on how much each serving of meat impacted the environment would not motivate them to significantly alter their dietary choices.

While it initially seemed that culture was an unimportant factor in determining meat consumption, the interviews revealed that the majority who disagreed with the statement that meat-eating was important to Taiwanese culture actually meant that the opposite, eating a vegetarian diet, was important to Taiwanese culture. Interviewee #8 talked about reducing his meat consumption due to his family's Taiwanese traditional religious beliefs which uphold vegetarianism as good. Furthermore, the catalyst for Interviewee #3

doi:10.6342/NTU202302118

becoming a lacto-vegetarian was the hundred days when her family ate vegetarian, an action to bless her newly-departed grandmother. She felt so many physical benefits that she decided to continue that diet. Indeed, there is sometimes a positive correlation between religion and environmental awareness (Chen et al., 2014) that can make culture serve not as a barrier but instead as an enabler for reducing one's meat consumption by influencing it in the direction of "spiritual environmentalism" (Zheng, 2022). However, this could also have limited effects because many interviewees did not personally identify as religious.

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5. Discussion

5.1 Barriers

The first quantitative finding that health knowledge is the most influential barrier to reducing meat consumption illustrates a key difference between western and East Asian perspectives. In most western studies, health knowledge served as an enabler rather than a barrier for eating a plant-based diet (Lea and Worsley, 2003; Lea et al., 2006; Clonan et al. 2015; Cheah et al., 2020). Godfray (2018) offers a logical explanation, writing, "In high-income western countries, a lower meat intake may be a marker of a health-conscious lifestyle, but in low-income countries, lower meat intakes are more likely to be markers of poverty and associated with other risk factors for poor health." Taiwan's transformation into a developed nation only took place in the late 20th century. This period saw a sharp increase in per capita meat consumption from the mid-century levels; 29 kg/capita in 1951 to 112 kg/capita in 1996, likely a result of shifting consumer preferences and higher real income (Hsu, 2001). The past during which malnutrition was commonplace, and people could not afford to eat much meat is not far behind, so it is possible this notion that lower meat intake negatively impacts health was perpetuated since then. In contrast, many westerners have become quite familiar with the detrimental effects eating too much meat has on health, so they now perceive a plant-based diet as being healthier.

The qualitative results showed a different angle of the health knowledge issue. While it is true that interviewees expressed concerns about getting enough nutrients from a plant-based diet, they did not unanimously believe that reducing their meat consumption would negatively impact their health. The two survey questions related to health knowledge were about whether participants thought it was necessary to eat any meat at all and their

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high rate of agreement implies that they would find a completely meat-free diet nutritionally incomplete. Thus, health knowledge was definitely shown to be a barrier to adopting a fully vegetarian diet. However, there were no health questions addressing a partial reduction of meat consumption, which may or may not have produced a less conclusive result about health knowledge as a barrier to reducing meat consumption.

The subsequent barriers of social pressure, taste, and access were primarily relevant to meat-eaters. Existing studies that were conducted on older adults in western countries reported more on family constraints and social norms as a barrier to reducing meat consumption (Verain et al., 2015; Macdiarmid et al., 2016; Whittall et al., 2023). These participants felt that their dietary choices were limited by the people they had to cook for and the dominant majority diet, which they felt obliged to conform to for fear of judgment. In contrast, the kind of social pressure that this study revealed to be the second most influential barrier was more related to students' desire to avoid causing their social circle inconvenience with their dietary restrictions. As university students tend to frequently eat meals together, their social circle plays an especially important role at this stage in their lives and can potentially impact their dietary habits. These findings demonstrate how certain barriers can affect different demographics in a variety of ways depending on their age and circumstances, emphasizing the importance of targeted interventions. Finally, with only meat-eaters expressing their attachment to the taste of meat and dissatisfaction with their access to plant-based food, there is an opportunity for information sharing between them and the vegetarians/flexitarians, who are already highly satisfied with the available options. These exchanges can help meat-eaters expand their preferences and introduce them to a new way of eating that does not center around meat.

doi:10.6342/NTU202302118

The implication of these influential barriers is not that once they are eliminated, people will stop eating meat altogether. Ultimately, despite identifying certain barriers, it remains that some students were able to reduce their meat consumption, and some were not. Rather, since the results indicate that these barriers are to some extent related to student meat consumption, tackling them can potentially help the meat eaters reduce the frequency and/or amount of meat they consume.

The influential barriers of culture/identity/values and external locus of control found in some of the western studies were mostly contradicted by this study. Taiwanese culture, despite the comparatively limited role it played as a factor, was found to have sometimes discouraged rather than reinforced meat consumption even in non-devout participants, guided by the Buddhist meat-avoiding traditions. There was no mention of identity as a factor that affected participants' diets, while in western nations these were found to be directly linked to demographic and personal characteristics. Furthermore, unlike western participants, NTU students almost unequivocally demonstrated a strong internal locus of control, believing that their individual efforts could make an impact.

Utilizing another framework most likely would have produced different results, or at least yielded alternative interpretations of barriers. For example, using a framework based on Ajzen's Theory of Planned Behavior that focuses on attitude and intention as Cheah et al. (2020) did might have similarly elicited and emphasized more personal internal barriers such as habit instead of external factors. Additionally, the barriers to reducing meat consumption could have been investigated using a framework that explicitly presented meat-eating as detrimental behavior and scrutinized the dissonance of justifying the continuation of this behavior despite being aware of its consequences. This kind of

doi:10.6342/NTU202302118

framework might have resulted in barriers that externalized blame or responsibility and overshadowed the more minute details of the individual's perspective in reality.

5.2 Interventions

Given the multifaceted, case-specific nature of the meat consumption issue, multiple studies call for interventions and approaches that target various groups of consumers according to their specific barriers (Vanhonacker et al., 2013; Hoek et al., 2017; Hielkema and Lund, 2021). This study found that health knowledge strongly impacted meat consumption, and students frequently cited both their families and mandatory health/nutrition classes at school during their formative years as important sources of their existing knowledge, which is similar to the findings of Whittall et al. (2023). The power of family members and nutrition classes in shaping Taiwanese students' long-term dietary health knowledge can be used to adjust the prevalent norms for meat consumption, including the amount and type consumed. The benefits of reducing meat consumption and clearly stated measures of the upper and lower limits of healthy meat consumption can be taught starting in elementary school, with added emphasis on the environmental benefits of a plant-based diet. One such initiative, the 週一無肉日施行 (Meatless Monday), has existed in Taiwanese elementary and middle schools for a little over a decade, but its implementation is decreasing rather than growing (Wang, 2020). As the issue of meat consumption increases in relevance, these types of initiatives should be updated and reinforced. Additional campaigns or initiatives to inform heads of families about ways that they can teach their children to limit their meat consumption at home while still consuming a nutrient-filled, balanced, and tasty diet can be created. In both cases, resources and

doi:10.6342/NTU202302118

recipes for a wide variety of plant-based or reduced-meat dishes that are based on local culture and ingredients can be disseminated as students did indicate some interest, but this information alone cannot incite behavioral change without the accompanying educational initiative. This kind of information that focuses on highlighting benefits, possibilities, and alternatives could be more effective in promoting pro-environmental behavior rather than belaboring the environmental consequences of the majority diet.

The type of social pressure that participants in this study reported has quite a straightforward solution that they agreed would help alleviate the issues of inconvenience faced by vegetarians and meat-eaters trying to dine together. For one, the addition of plant-based food options as a standard in the majority of Taiwanese restaurants will protect vegetarians from the unpleasant situations mentioned in the interviews such as getting excluded from group meals because there are no options for them at many restaurants, or having to bring their own meals to restaurants, or feeling like they have to force meat-eaters to go to specifically vegetarian restaurants in order to eat together. Additionally, meat-eaters will also have these plant-based options available to them, which can open their minds to trying meat-free meals from time to time, or directly meet their needs if they are already trying to reduce their meat consumption. Ideally, the added plant-based food options should have enough nutritional variety to constitute a balanced meal instead of merely being a random selection of starches. They should also be priced sensibly in a way that reflects the lack of meat, which usually raises the cost of meals in comparison. These adjustments can contribute to the integration of vegetarianism into mainstream culture, which Liu and Huang (2015) believe is inevitable for the restaurant industry and will expand customer bases to include even non-religious vegetarians and meat-eaters.

doi:10.6342/NTU202302118

Finally, one way the final barriers of Taste and Access can be surmounted is by improving plant-based meat substitutes and vegetarian products. Students provided constructive feedback on how they thought these products could better meet their needs. The incentive to address their concerns is that given their high environmental awareness, many of them expressed being open to replacing some of their animal protein sources with these alternatives if the taste, texture, and price could be improved.

doi:10.6342/NTU202302118

6. Conclusion

The purpose of this study was to identify the major barriers to reducing meat consumption for a population with high environmental awareness living in a place with convenient access to vegetarian food. This study is one of the first of its kind in an emerging field studying the barriers to incrementally reducing meat consumption for environmental reasons in an East Asian population sample. It preemptively identifies some of the challenges that will be faced when this region eventually confronts the escalating issue of high per capita meat consumption. Whether that will take place sooner or later is difficult to say since East Asians have not historically been able to enjoy the same access to affordable meat for as long as western nations; hopefully, East Asian meat consumption can be controlled before it rises to western levels and results in widespread health and environmental issues. It goes without saying that any efforts to curb meat consumption should simultaneously promote accessible alternatives to ensure adequate nutrition for all.

Since this study targets a small sample size, the results reveal several culturally and contextually specific findings that vary from those in western studies. Notably, it represents an educated demographic of university students with above average environmental awareness in order to highlight other underlying factors. Based on the findings in this study, new targeted interventions can be developed for specific groups of meat consumers, as suggested by Vanhonacker et al. (2013).

6.1 Limitations

The questions in the survey required participants to self-report their dietary habits, which could have contained possible inaccuracies that are typical when self-reporting one's

doi:10.6342/NTU202302118

own behavior. However, these inaccuracies are typically accepted as one of the drawbacks of this methodology, and studies incorporating self-reporting do not necessarily validate self-report responses. Those that did revealed that there was a "robust" relationship between actual behavior and self-reported behavior (Frantz, 2014). The drawbacks of self-reporting are outweighed by the major benefit of this methodology's capability to measure environmental behaviors, which are typically an "aggregate measure of multiple behaviors" (Ibid) that at the moment cannot be constantly monitored for a large group of people. Furthermore, this data was only used as supplementary information to provide an overall picture of the dietary habits of NTU students, with little impact on the conclusions drawn in this study. Regarding the Likert scale responses to determine barriers, it is common for this methodology to be susceptible to the social desirability bias, especially when related to frequently moralized topics such as environmental behavior. However, meat-eating is not considered a sensitive topic, thus social desirability bias should be minimal. At present, meat-eating is generally only moralized or even considered an environmental issue by a minority; the majority diet worldwide is still the omnivore diet, so there would be little reason for participants to feel pressured to answer the survey in a certain way. Additionally, unlike some existing studies (de Boer et al., 2014; Vanhonacker et al., 2013), this study did not provide participants with any environmental impact information beforehand.

Another social desirability concern is that it is possible that students could have emphasized certain factors over others to make their choice to continue eating meat in the context of an "environmental" survey seem more justified, especially since they reported high awareness of the environmental impacts of their consumption behavior. For example, they could have felt guilt about saying that above all, they loved the taste of meat too much to reduce their meat consumption, even if that was how they truly felt. In that case, they

doi:10.6342/NTU202302118

could have selected a barrier that would make their reasoning appear less selfish and more objective, such as that they believed it was necessary for their health or that they were hesitant to inconvenience their social circle. However, expressing one's attachment to the sensory pleasures of meat-eating is likewise not controversial or uncommon in a society where most people eat meat regularly. Indeed, the interviewees who expressed their love of eating meat were not hesitant to state it openly, while the ones who said they were unenthusiastic about it did not seem to be acting defensively.

As a cross-sectional study, this study was only designed to collect data about National Taiwan University students' dietary habits and environmental attitudes at present. A longitudinal study would be beneficial to determine if students' habits and attitudes transform over time, especially with the implementation of sustainability initiatives and the development of environmental education on campus. A larger sample size within the university would have also been advantageous given that the student population is around 35,000 total.

Some of the survey questions could also have been edited to use a scenario of a partial reduction of meat rather than giving up all meat. For example, the survey question that reads "If enough individuals like myself decided to stop eating meat, I believe our collective action could significantly reduce global carbon emissions" could have been edited to say "reduce our meat consumption" instead of "stop eating meat." This would have produced more accurate results on locus of control. The same goes for the questions about health knowledge. Adding a survey statement about whether students were eating meat just out of habit would have also provided useful data. Furthermore, a statement about social norms apart from social pressure would have been valuable to get an idea of

doi:10.6342/NTU202302118

students' perception of a "normal" diet and whether they felt any societal pressure to conform to these norms would have also been valuable.

During the course of this study, I became aware of the many different types of vegetarianism in Taiwan. For example, Participant 3 had to select that she was vegan on the survey even though she was technically a lacto-vegetarian. This study could have better acknowledged the diversity of diets. Additionally, some minor inconsistencies in the terminologies used to describe the different diets were found between the Chinese and English translations on the questionnaire. However, the classification of diets was only necessary to divide participants into categories based on the amount of meat they ate, so the more basic dietary types used in this study were adequate.

doi:10.6342/NTU202302118

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8. Appendix

Dietary Habits and Environmental Attitudes Questionnaire 飲食習慣與環境議題問卷

Dear Participant,

親愛的參與者，

Thank you very much for your willingness to participate in this Dietary Habits and Environmental Attitudes study. My name is Sophia Roces 羅素菲, and the following questionnaire is part of my master's thesis for the NTU International Degree Program in Climate Change and Sustainable Development. My research focuses on the issue of student meat consumption and the barriers to transitioning to a plant-based diet. This questionnaire will ask about participants' current meat-eating habits and specific factors that make reducing meat consumption for environmental reasons difficult.

非常感謝您願意參與這次飲食習慣與環境議題的問卷調查。我的名字是羅素菲。這個問卷是我在國立台灣大學氣候變遷與永續發展國際學位學程的碩士論文研究。我的研究主題是關於台大學選擇葷食與素食的原因、目前的飲食習慣、從葷食轉為素食者遇到困難，以及對飲食以及環境保護的觀點。

The questionnaire is being distributed to NTU students through the NTU Facebook message board, and should take only a few minutes to complete. This survey will be open from November 17 to December 18.

這個問卷的調查對象限於台大學生，且經由台大交流版管道宣傳。問卷需要幾分鐘的時間完成。這個問卷會從11月17日開放到12月18日。

NTU students who complete this questionnaire are eligible to participate in a raffle to win one of the following prizes: a pair of 2nd Generation Apple AirPods, a 200 NTD 7-11 LINE POINTS e-coupon (5 available), and a 100 NTD CoCo 都可 drink coupon (10 available). If you wish to participate in the draw, please make sure to leave your name and e-mail address so that we can notify the winners.

完成問卷的台大學生都可以參與抽獎活動。獎品是二代Apple AirPods，200元 7-11 LINE POINTS （共有5個），100元 CoCo都可飲料禮卷 （共有10個）。有興趣的朋友記得要留下姓名與電子信箱喔，我們會在活動結束後通知通知您！

doi:10.6342/NTU202302118

You have the right to withdraw anytime at your own discretion. Any data you provide will be used solely for research purposes and not shared with third parties. You may be asked to participate in a subsequent online or in-person interview at a later date, and you can give your consent in the section below. Interviewees will be eligible to win a separate prize from coco.Brownies.

您隨時可以暫停回答問卷。這次問卷調查所獲得的數據僅用於研究報告，也不會與第三方分享。我們後續可能會邀請您參與實體或線上的訪問。參與者有機會獲得可可布朗妮。

Your time, effort, and honesty in your responses are highly appreciated.

我們非常感謝您的時間與心力的參與。

* Indicates required question

1. **Name 姓名:**

2. **E-mail address 電子郵件:**

3. **Would you like to participate in the survey raffle? 您想要參加抽獎嗎？** *

Check all that apply.

- [ ] Yes 是
- [ ] No 否

4. **Are you willing to be contacted for a post-survey online or in-person interview? 您想要被告知並且參與後續的實體或線上的訪問嗎？** *

Check all that apply.

- [ ] Yes 是
- [ ] No 否

doi:10.6342/NTU202302118

5. **Year of birth 出生年份:** *

6. **Gender 性別:** *

Mark only one oval.

- Male 男
- Female 女
- Other 其他

7. **Major 系別:** *

8. **Level of study 年級:** *

Mark only one oval.

- Undergraduate 大學
- Master's
- PhD 博士
- Other 其他

doi:10.6342/NTU202302118

9. **Year of study 年級:** *

Mark only one oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8+

10. **Nationality 國籍:** *

_____

11. **Have you ever taken a class on environmental sustainability at NTU?** *

你在台大是否有上過關於永續環境的課程?

Mark only one oval.

- ◯ Yes 是
- ◯ No 否

Section 2 二段

doi:10.6342/NTU202302118

12. **1. How would you identify your current diet? 你會如何形容你目前的飲食狀況/型態?** *

Mark only one oval.

- ◯ a.) Vegan (please skip to Section 3) 全素 (請直接跳到問卷第三部分)
- ◯ b.) Vegetarian (lacto-ovo included) (please skip to Question 4) 蛋奶素 (請直接跳到問題4)
- ◯ c.) Pescatarian (plants and seafood, but no meat) 海鮮素 (食用海鮮，但不吃肉食)
- ◯ d.) Flexitarian (mostly plants, little meat) 彈性素食 (盡量食用素食，少肉)
- ◯ e.) Meat-eater/Omnivore (both plants and meat equally) 葷食/雜食 (蔬菜與肉食均食)
- ◯ f.) High protein, meat-heavy (carnivore, ketogenic, etc.) (高蛋白飲食)
- ◯ g.) Other: _____

13. **2. How many meals per week (0-21, assuming you eat 3 meals a day) do you eat meat? (This study defines meat as any animal flesh, including seafood, poultry, white meats, and red meats)**

您一週總共有幾餐會食用肉類? 所有動物的肉都算是肉類包含：海鮮、紅肉、白肉 (假設前提為一天三餐，共0-21次)

_____

14. **3. How much of your typical plate is made up of meat? 您一餐大約會有多少肉?**

Mark only one oval.

- ◯ a.) Just a few small pieces 只有少許一些
- ◯ b.) 1/3 or 1/2 of the plate 大約佔整餐的 1/3 到 1/2
- ◯ c.) Meat is the majority of the meal (vegetables and carbs are only side dishes) 以肉類為主 (蔬菜與澱粉僅為配菜)

doi:10.6342/NTU202302118

15. **4. Do you want to reduce your consumption of meats or animal products in the future? 您未來想要減少吃肉或是使用動物產品嗎?**

Mark only one oval.

- ◯ a.) Yes, I would like to reduce my consumption of animals and animal products (please answer Question 5 and 6) 是，我會想要減少吃肉或是使用動物產品 (請繼續回答問題5和6)
- ◯ b.) No, I would like to keep my meat consumption the same as it is currently (please skip Question 5 and 6 and move on to Section 3) 不，我會想維持跟現在相同的葷食習慣 (請直接跳到第三段)
- ◯ c.) No, I would actually like to increase my meat consumption (please skip Question 5 and 6 and move on to Section 3) 不，我想增加肉類蛋白質 (請直接跳到第三段)

16. **5. I want to reduce my consumption of (check all that apply):**

我想要減少食用:

Check all that apply.

- ☐ Eggs 蛋
- ☐ Dairy 乳製品
- ☐ Seafood 海鮮
- ☐ White Meat/Poultry 白肉
- ☐ Red Meat 紅肉

doi:10.6342/NTU202302118

17. **6. I plan to take active measures to reduce my consumption of animals or animal products in the future.**

我未來有主動規劃減少吃肉或是使用動物產品。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

Section 3 三段

18. **1. Eating a plant-based diet is too expensive for my budget.** *

吃全素對我經濟壓力太大了。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

doi:10.6342/NTU202302118

19. **2. I enjoy the taste of meat too much to reduce my meat consumption significantly.** *

我實在太喜歡吃肉了，所以不想減少吃的比例。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

20. **3. I have dietary restrictions or other external limitations that prevent me from being able to reduce my meat consumption.** *

因為健康因素，我有飲食相關限制或是其他外在限制，讓我無法減少食肉比例。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

doi:10.6342/NTU202302118

21. **4. I have convenient access to a wide variety of plant-based food options.** *

我有很多素食的選擇。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

22. **5. Most of the people in my social circle (friends, family, etc.) eat meat, and it would be inconvenient for us to eat together if I stopped.** *

我大部分的家人與朋友都吃肉，減少吃肉會給大家帶來不便。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

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23. **6. Meat eating is very important in my culture, and it carries a deeper symbolic, religious, or historical significance.** *

吃肉在我的文化、宗教或歷史中有深厚的意義，所以我不想減少吃肉。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

24. **7. I am aware of the harmful environmental impacts of meat production.** *

我有意識到肉類行業對於環境造成龐大的負擔。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

25. **8. Estimate the total percentage of greenhouse gas emissions that global meat production is responsible for.** *

我覺得全球肉類生產佔全球的溫室氣體排放的 _____%。

I estimate that the meat industry contributes to _____% of global greenhouse gas emissions

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26. **9. Rank the following four ways to reduce your carbon footprint from the order of most impactful (1) to the least impactful (4) (Assuming that these measures are implemented at a societal scale)** *

請從最高到最低排序出以下四種行為的碳排放量

Mark only one oval per row.

	1 (Most impactful) (1 是最有影響力)	2	3	4 (Least impactful) (4 是最不具影響力)
Vegetarian diet (no fish and meat) 改為素食飲食	◯	◯	◯	◯
Low-carbon transportation 以步行或腳踏車代替開車	◯	◯	◯	◯
Reducing domestic food waste 減少家庭食物浪費	◯	◯	◯	◯
Reducing domestic hot water usage 減少家庭熱水使用量	◯	◯	◯	◯

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27. **10. I believe it is immoral to kill animals for human benefit.** *

我認為人類為了食用肉類而屠殺動物是不道德的。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

28. **11. I think of the natural world as a community to which I belong.** *

我把自然世界看作是我所歸屬的社群。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

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29. **12. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.** *

我經常覺得自己只是周遭自然世界的一小部分，而且我也沒有比地上的草或樹上的鳥來得重要。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

30. **13. If enough individuals like myself decided to stop eating meat, I believe our collective action could significantly reduce global carbon emissions.** *

如果更多人願意跟我一樣吃素，我相信這樣的集體行動能夠大量減少溫室氣體的排放。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

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31. **14. I feel very strongly about the issue of meat consumption and its environmental impact.** *

我深信吃肉會對環境造成重大的負面影響。

Mark only one oval.

- Strongly Disagree 強烈反對
- Disagree 不同意
- Neutral 既不同意也不反對
- Agree 同意
- Strongly Agree 非常同意

32. **15. I often think about my own carbon footprint and actively consider ways that I can lessen my personal environmental impact.** *

我很常思考我的日常行為會如何製造碳排放，並且會主動思考自己如何在生活中減少對環境的負面影響。

Mark only one oval.

- Strongly Disagree 強烈反對
- Disagree 不同意
- Neutral 既不同意也不反對
- Agree 同意
- Strongly Agree 非常同意

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33. **16. I believe meat is a crucial part of a healthy, balanced diet.** *

我認為吃肉是健康、均衡飲食很重要的一部分。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

34. **17. I believe that humans are omnivores by nature, and therefore, meat-eating is a vital part of the human experience.** *

我認為人類是雜食性動物，所以吃肉本來就是生活的一部分。

Mark only one oval.

- ◯ Strongly Disagree 強烈反對
- ◯ Disagree 不同意
- ◯ Neutral 既不同意也不反對
- ◯ Agree 同意
- ◯ Strongly Agree 非常同意

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