Smaratungga: Journal of Education and Buddhist Studies
2024, Vol. 5, No. 1, 17-34
https://www.smaratungga.ac.id/journal/index.php/sjbse

Faith-Based Environmental Action: The Role of Han Buddhist Dietary Practices in Reducing Food-Related GHG Emissions in Malaysia

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ABSTRACT

This study aims to quantify the reduction in greenhouse gas emissions (GHGEs) resulting from the adoption of vegetarian and vegan diets among Malaysian Chinese adherents of Han Buddhism in 2023. Given that meat production is a major contributor to global GHGEs, this research examines the environmental benefits of dietary practices shaped by Han Buddhist teachings. Employing a quantitative methodology, the study utilizes Malaysia's 2010 census and historical immigration records to estimate the 2023 Han Buddhist population. It then applies data from prior studies to determine the proportions of vegetarians and vegans within this group, followed by the calculation of associated GHGEs using international dietary datasets and a regression-based diet-emission formula. The findings reveal that in 2023, approximately 4.98 million Han Buddhists resided in Malaysia, of whom 1.02 million adhered to vegetarian or vegan diets. This dietary shift resulted in an annual reduction of 1.08 million metric tons of CO_2 equivalent—comparable to the emissions from one million gasoline-powered vehicles each traveling 4,211 kilometers. These findings underscore the considerable environmental impact of plant-based diets and highlight the potential role of culturally and religiously influenced dietary practices in mitigating climate change.

ARTICLE INFO

Keywords:
Greenhouse Gas Emissions, Han Buddhism, Vegetarian and Vegan Diets.

Article History:
Received 18th Sept, 2024
Revised 15th, Apr 2025
Accepted 23rd Apr, 2025
Published 25th Apr, 2025

How to Cite in APA Style:
Tseng, A.T. (2025). Faith-Based Environmental Action: The Role of Han Buddhist Dietary Practices in Reducing Food-Related GHG Emissions in Malaysia. *Smaratungga: Journal of Education and Buddhist Studies, 5*(1), 17-34. doi: 10.53417/sjebs.v5i1.140

Intoduction

Climate change is one of the most pressing issues facing humanity today. One of the main contributors to climate change is food production, especially meat consumption, which produces large amounts of greenhouse gas emissions (GHGE) (Hyland, Henchion, McCarthy, & McCarthy, 2017). According to the Intergovernmental Panel on Climate Change (IPCC), the global food system accounts for between 21 and 37% of the world's total greenhouse gas emissions (Mbow, Rosenzweig, Contreras, Pereira, & Blanchard, 2024). Meanwhile, livestock production, which includes cattle, goats and chickens, was reported by Steinfeld et

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Published by Center of Research and Publication of Smaratungga Buddhist Collage

https://doi.org/10.53417/sjebs.v5i1.140

al., (2006) to contribute up to 18% of total global GHG emissions. These data suggest that diet, particularly in terms of meat consumption, has a significant impact on global warming (N. González, Marquès, Nadal, & Domingo, 2020). Therefore, efforts to reduce meat consumption through dietary changes, such as switching to a vegetarian or vegan diet, could be an effective strategy to reduce GHGEs emissions and slow the rate of climate change. This phenomenon is increasingly important to study because people's diets are increasingly influenced by social, cultural and religious factors, which can have a major impact on people's decisions to choose a more environmentally friendly diet.

In many cultures and religions, a vegetarian or vegan diet is not only a lifestyle choice, but also part of religious teachings and philosophy of life (McKeown & Dunn, 2021). One significant example is Han Buddhism, which is practised by most Chinese communities in Malaysia (Islam, 2018). In this teaching, vegetarianism is not only seen as a health choice, but also as a way to reduce the suffering of living beings and maintain the balance of nature. Hence, Han Buddhists in Malaysia, who are the second largest ethnic group in the country (Tseng, 2020b), often adopt a vegetarian or vegan diet (Nor & Suriya, 2016). Given the significant impact these diets can have on reducing greenhouse gas emissions, it is important to explore how diets influenced by these religious teachings can contribute to climate change mitigation.

While there are studies showing the relationship between vegetarian diets and GHGEs emission reductions in Western countries, there is limited research focusing on specific religious groups, especially in the Southeast Asian region. Malaysia, as a country with a large population of Han Buddhists, provides an opportunity to explore the potential contribution of vegetarian and vegan diets adopted by this community to the reduction of greenhouse gas emissions at the national level. Therefore, it is important to conduct more in-depth research on the environmental impacts of these religiously-rooted dietary choices, particularly among the Han Buddhist community in Malaysia, in order to understand the extent to which these dietary changes contribute to climate change.

This research is also relevant given the increasing public awareness of the importance of environmental sustainability. Given that most of the Han Buddhist community in Malaysia still adhere to vegetarian and vegan teachings (Lew, 2024), this diet could be one of the significant factors in reducing GHGEs emissions if adopted more widely. As a country with a large contribution to global emissions, adopting this diet could have a positive impact, both in terms of environmental policy and social and cultural sustainability.

Previous research has addressed various aspects of vegetarian and vegan diets in relation to reducing greenhouse gas emissions, but the majority of these studies were conducted in Western countries such as the United States (Conrad, Drewnowski, Belury, & Love, 2023; Jennings, Henderson, Phelps, Janda, & van den Berg, 2023), United Kingdom (Green et al., 2015; Rippin et al., 2021) and Denmark (Chai et al., 2019; Prag & Henriksen, 2020). Heller & Keoleian, (2015) and Bruno et al., (2019) found that vegetarian and vegan diets can significantly reduce CO_2e emissions compared to meat-based diets. On the other hand, research on the effects of vegetarian and vegan diets in specific cultural contexts, especially in Southeast Asia, is limited. Some studies have noted that in religious traditions such as Chinese

Buddhism, vegetarian practices are strongly encouraged (Tarocco, 2024; Tseng, 2019), but no studies have directly measured the greenhouse gas emission reduction impact of these diets outside of China, particularly in countries such as Malaysia which has a large Han Buddhist population.

While there have been several studies on the adoption of vegetarian diets among Han Buddhists in China and other countries, there is little research investigating how much of an impact it has on reducing greenhouse gas emissions in Southeast Asian countries, such as Malaysia. Tseng, (2017) noted that the percentage of vegetarians and vegans among Han Buddhists is significant, but their environmental impact has never been systematically quantified. Therefore, a research gap that needs to be filled is how these diets contribute to the reduction of GHGEs emissions in the context of Malaysia, a country with a strong tradition of Han Buddhism.

This study aims to fill the literature gap by quantifying the contribution of vegetarian and vegan diets adopted by Han Buddhist communities in Malaysia to GHGEs emission reductions in 2023. Drawing upon the 2010 national census and historical immigration records, the study estimates the current Han Buddhist population and identifies the proportion of individuals adhering to vegetarian or vegan diets. The associated GHGEs for these dietary patterns are then calculated and compared to those of non-vegetarian diets. The primary objective is to contribute novel insights into how religiously motivated dietary practices can support climate change mitigation, particularly within the Southeast Asian context.

This research is grounded in the hypothesis that vegetarian and vegan dietary practices within the Malaysian Han Buddhist community significantly contribute to national GHGE reductions. This assumption is based on the premise that religious teachings—particularly those of Han Buddhism—not only influence individual food choices, but also shape broader collective practices that impact the environment. From the perspective of social practice theory, food consumption is not merely an individual act, but part of a complex structure of shared values, cultural norms, and spiritual beliefs that are enacted through everyday practices (Shove, Watson, & Pantzar, 2012).

According to data from the Intergovernmental Panel on Climate Change (IPCC), the global food system accounts for approximately 21–37% of total greenhouse gas emissions, with the livestock sector alone contributing up to 18% (Masson-Delmotte, 2022; Steinfeld et al., 2006a). By contrast, numerous studies have shown that vegetarian and vegan diets can substantially reduce carbon emissions when compared to meat-based diets (A. D. González, Frostell, & Carlsson-Kanyama, 2011; Heller & Keoleian, 2015). This study proposes that Malaysian Han Buddhists, given their doctrinal and cultural similarities with their counterparts in China, may exhibit comparable environmental impacts through dietary choices. If a significant portion of the community adopts a plant-based diet, it could represent a meaningful contribution to Malaysia's overall emission reduction efforts. This study thus aims to empirically test this hypothesis by measuring the potential GHGE reductions linked to religious dietary practices and assessing their implications for broader climate change mitigation strategies in Southeast Asia.

Method

This study focuses on estimating the Han Buddhist population in Malaysia, particularly among Chinese Malaysians who adhere to Han Buddhism and practice vegetarian or vegan diets. The unit of analysis is the Han Buddhist population in Malaysia in 2023, with specific attention given to the proportion of individuals following plant-based diets. The primary objective is to analyze the impact of these dietary choices on greenhouse gas emission (GHGE) reduction within the Malaysian social and environmental context.

A quantitative research approach was employed to estimate the environmental impact of dietary behavior using the correlation method (Quick & Hall, 2015). This approach was selected to generate a precise numerical estimate of the reduction in greenhouse gas emissions associated with vegetarian and vegan diets among the Malaysian Han Buddhist community. The method allows for systematic data collection and statistical analysis to produce a robust estimation of dietary contributions to GHGE reductions.

The study utilized both primary and secondary data. The primary data comprised daily greenhouse gas emissions (GHGEd) values for vegetarian, vegan, and non-vegetarian diets, which were calculated using a regression model developed from dietary data provided by international agencies. The secondary data included demographic information on the Chinese population in Malaysia and the proportion identifying as Han Buddhists. These data were sourced from the Department of Statistics Malaysia (DOSM) and historical immigration records. The 2010 national census was used to determine the proportion of Chinese Malaysians who follow Han Buddhism, while 2023 population estimates were applied to project the total number of Han Buddhists in Malaysia.

The data collection process involved three main components: estimating the Han Buddhist population, calculating the dietary population proportions, and evaluating the potential GHGE reductions. The estimated proportion of Han Buddhists among Chinese Malaysians in 2010 (72.59%) was applied to the 2023 Chinese Malaysian population (6.8624 million), resulting in an estimated Han Buddhist population of 4.9814 million. Based on prior studies, 16.44% of Han Buddhists were assumed to follow a vegetarian diet, while 4.11% were identified as vegans. GHGE reductions were estimated using a regression formula based on meat consumption to determine daily emissions in kilograms of CO_2 equivalent ($kgCO_2e$) per capita for each dietary category. These figures were then used to compute the equivalent annual GHGE reductions by comparing plant-based diets with non-vegetarian dietary emissions.

The data were analyzed using regression techniques (Kafle, 2019; Sarstedt & Mooi, 2019) to calculate daily GHGEd values and estimate the corresponding annual reductions. The analysis began by multiplying the daily GHGEd values by the number of individuals adhering to each dietary practice. These figures were then extrapolated to determine the total annual GHGE reductions, expressed in metric tonnes of CO_2 equivalent. Finally, the results were contextualized by comparing them to the annual emissions of a typical gasoline-powered vehicle, thereby illustrating the environmental significance of plant-based dietary choices. This quantitative analysis provides a clear assessment of the potential environmental benefits of vegetarian and vegan diets among Han Buddhists in Malaysia.

Findings

The Beliefs of Chinese Immigrants in Malaysia from a Historical and Demographic Perspective

The majority of Chinese immigrants who settled in Malaysia originated from the southern coastal provinces of Guangdong and Fujian in China (Poston & Zhang, 2021). hese provinces are among the top five in China with the highest concentration of Han Buddhist temples (or monasteries), suggesting that they also host some of the largest Han Buddhist populations. Typically, the number of temples in a region correlates with the number of adherents, as temples function as the primary centers of religious practice. This demographic correlation indicates that Guangdong and Fujian likely exerted a strong cultural and religious influence on the Han Buddhist practices brought by Chinese immigrants to Malaysia.

According to data published in 2023 by China's National Religious Affairs Administration (NRAA), Han Buddhist temples are most prevalent in the southern and eastern provinces of China. Zhejiang Province has the highest percentage of Han Buddhist temples (14%), followed by Fujian (12%), Hunan (11%), and Hubei (7%). Guangdong and Anhui rank fifth and sixth respectively, each accounting for 5% of the national total (Pew, 2023). Given the high concentration of temples in Fujian and Guangdong, individuals from these provinces are considered among the most devout Han Buddhists in China. Consequently, Malaysian Chinese who trace their ancestry to these provinces are often viewed as particularly committed practitioners of Han Buddhism and are more likely to adopt vegetarian diets rooted in Buddhist principles.

A survey conducted as part of the 2018 China Family Panel Study reported that 33% of adults in China identified as believers in the Buddha and/or bodhisattvas, thereby qualifying as Buddhists (Pew, 2023). Based on China's estimated population of 1.40967 billion in 2023, and assuming that over 90% of the population is ethnically Han, the Han Buddhist population is estimated at approximately 418.672 million (calculated as 1.40967 billion × 33% × 90%) (NBSC, 2024). This makes Han Buddhists the largest Buddhist subgroup globally. For context, the Pew Foundation reported a global Buddhist population of 487.54 million in 2010 (Hackett et al., 2012), underscoring the centrality of Han Buddhists within the global Buddhist demographic. Given that the majority of the Han ethnic group in China adheres to Han Buddhism, these religious traditions continue to resonate with many Chinese Malaysians.

By the time Malaysia achieved independence in 1957, most Chinese Malaysians were already locally born. In this context, the term "Malaysian Chinese" refers to individuals of full or partial Chinese descent who were either born in Malaysia or migrated there. An official survey conducted in 1957 reported a Malaysian Chinese population of 2.3338 million, comprising 37.2% of the total national population of 6.2788 million (Dodge, 1980). According to the 2010 census, Malaysia's total population (citizens only) was 26.013 million, with 6.393 million identifying as Chinese (Department of Statistics Malaysia DOSM, 2022). By January 2023, the national population had increased to 33.3795 million, with the Chinese Malaysian population rising to 6.8624 million, accounting for 20.6% of the total (Department of Statics Malaysia DOSM, 2024).

Since independence, the Chinese share of Malaysia's population has declined in percentage terms—from 37.2% in 1957 to 24.6% in 2010, and further to 20.6% in 2023 (Department of Statics Malaysia DOSM, 2024; Department of Statistics Malaysia DOSM, 2022). Despite this relative decline, the absolute number of Chinese Malaysians continues to grow, reflecting the community's enduring contributions to the country's cultural, social, and religious landscape.

Accordingly, the Malaysian Chinese community—particularly those with ancestral ties to Fujian and Guangdong—continues to play a vital role in shaping the nation's religious and cultural identity. The strong Han Buddhist traditions brought by early immigrants remain influential, deeply embedded in the religious identity and cultural practices of contemporary Malaysian Chinese communities.

Han Buddhism among Malaysian Chinese

Han Buddhism was introduced to Malaysia by Chinese immigrants (Zakaria & Ibrahim, 2022), marking the religion's longstanding presence in the region's religious landscape. The first known major Buddhist temple in Malaysia, Cheng Hoon Teng (青雲亭 in Chinese), was established in 1673 in Malacca during the Dutch occupation (Hue & Choo, 2022; Tseng, 2020). The temple is dedicated to Avalokiteśvara, one of the main deities in Han Buddhism, and plays an important role in the spiritual lives of many ethnic Chinese in Malaysia. Although Avalokiteśvara is worshipped in the Main Hall of the temple, Cheng Hoon Teng also honours deities from other traditional Chinese religions, such as Taoism and Confucianism, highlighting the syncretic nature of Chinese religious practices in Malaysia. The establishment of Cheng Hoon Teng shows that Han Buddhism has been present in Malaysia for more than three centuries (Chee-Beng, 2022).

Tan (2015), in his study on Chinese religious practices in Malaysia, further observes that many Buddhist temples in the country house both Buddhist and traditional Chinese deities, similar to Cheng Hoon Teng. In addition to syncretic temples, there are also numerous "pure" Han Buddhist temples, which exclusively enshrine Buddhist deities and maintain a distinct Han Buddhist identity. Unlike Theravada Buddhist temples, which typically feature a prominent Buddha statue on the main altar, Han Buddhist temples often do not place such figures at the forefront. These temples reflect a strong Chinese cultural heritage, as many Chinese Malaysians continue to uphold their traditional religious beliefs alongside Buddhist teachings.

Tan also notes the presence of Theravada Buddhism in Malaysia, primarily among ethnic Thai, Sinhalese (from Sri Lanka), and Burmese communities (MalaysiaTraveller, 2024). These communities follow a distinct form of Buddhism from that practiced by Han Chinese Buddhists, with differing temple architecture and religious customs. Tseng (2021) highlights that Han Buddhists include both those who openly identify as Buddhists and those he terms "hidden Buddhists." The former group tends to worship the Buddha along with various bodhisattvas, while the latter—though less explicit in their religious identification—venerate a combination of Buddhist figures and traditional Chinese deities such as Mazu (媽祖), Guandi (關帝), the God of Wealth, and the God of the Land. This illustrates the deeply syncretic character of Han Buddhism, wherein Buddhist and non-Buddhist deities are revered within a shared religious framework intrinsic to Chinese culture.

It is therefore unsurprising that many Han Buddhist temples in Malaysia also honor deities significant in traditional Chinese religion.

In both Malaysia and China, Buddhism is represented by three major schools: Han (*Mahāyāna*), *Theravāda*, and Tibetan. Since *Theravāda* and Tibetan Buddhist traditions do not typically mandate vegetarianism, their adherents are generally excluded from estimates of the Han Buddhist population (Tseng, 2024). According to Bai, (2008) and MalaysiaTraveller, (2024), Malaysia is home to approximately 750 Buddhist temples, of which 78 are Theravada temples—representing about 10.4% of the total. Tseng, (2017) estimates that Tibetan Buddhists constitute approximately 4.6% of the overall Buddhist population in China, a figure that can be extrapolated to estimate the number of Tibetan temples in Malaysia. Excluding these groups, it is estimated that Han Buddhist temples account for approximately 85% of all Buddhist temples in Malaysia, or about 637 temples (calculated as 750 × (100% − 10.4% − 4.6%)).

Han Buddhist temples are found in many major Malaysian cities, including Penang, Kuala Lumpur, Selangor, Malacca, and Johor (Bai, 2008). In contrast, most Theravada temples are concentrated in northern states such as Kelantan, Kedah, and Perak, which are geographically closer to Thailand—the heartland of Theravada Buddhism (MalaysiaTraveller, 2024). Since the arrival of Chinese immigrants, Han Buddhist temples have been established across the country. Initially, their primary functions were conducting religious rituals and preserving traditional Han Buddhist teachings. Over time, their roles expanded to include humanitarian initiatives, social welfare programs, and meditation activities—often carried out in collaboration with Han Buddhist clergy from China and Taiwan (Madsen, 2007). These efforts have been instrumental in advancing both humanitarian values and the spread of Buddhist teachings in Malaysia (Madsen, 2007; Tan, 2015). Today, the Han Buddhist community in Malaysia remains a significant force in promoting Buddhism and charitable initiatives, with Mandarin Chinese serving as the predominant language in temple activities and instruction.

In sum, Han Buddhism has had a profound influence on the religious and cultural life of Chinese Malaysians. Temples established by early immigrants continue to function not only as places of worship, but also as vital institutions for cultural preservation and community service—ensuring the continuity of Han Buddhist traditions in Malaysia.

Han Buddhism population in Malaysia in 2010 and 2023

Han Buddhism has been a significant religious influence among Chinese Malaysians, introduced by early immigrants from southern China (Awang, Ramli, & Ab Rahman, 2022). As part of a broader spectrum of Chinese religious traditions, many Chinese Malaysians adhere to a syncretic belief system that integrates Han Buddhism, Taoism, Confucianism, and ancestor worship. Nevertheless, when asked to declare their primary religion, a substantial number identify themselves as Buddhists. This trend underscores the central role of Buddhism in shaping religious identity within the Chinese Malaysian community, as reflected in data from the 2010 national census (Department of Statistics Malaysia DOSM, 2022; Tseng, 2021).

Table 1. Malaysian population by religion and race in 2010

Religion	Malay	Chinese	Indigenous	Indian	Other[3]	Total
Islam	14,191,720	42,048	1,347,208	78,702	102,334	15,762,012
Buddhism	0	5,341,687	33,663	32,441	51,247	5,459,065
Christianity	0	706,479	1,549,193	114,281	22,870	2,392,823
Hinduism	0	14,878	2,941	1,644,072	4,474	1,666,365
Taoism etc[1]	0	218,261	131,407	716	689	351,073
Other[2]	0	69,283	267,376	37615	7744	382057
Total	14,191,720	6,392,636	3,331,788	1,907,827	189,385	26,013,356

According to the 2010 Census, as presented in Table 1, the total Malaysian Chinese population was recorded at 6,392,636. Of this number, 5,341,687 individuals (83.6%) identified themselves as Buddhists. Smaller proportions of the Chinese population adhered to Taoism (218,261 or 3.41%), Christianity (706,479 or 11.1%), Islam (0.66%), and Hinduism (0.23%). In addition, other ethnic groups in Malaysia also practiced Buddhism, including 33,663 Indigenous people (1.01%), 32,441 Indians (1.70%), and 51,247 individuals from other ethnic groups (27.06%). The total Buddhist population in Malaysia in 2010, encompassing all ethnic groups, stood at 5,459,065—representing 20.99% of the national population of 26,013,356.

To estimate the number of Han Buddhists in Malaysia, it is necessary to exclude adherents of other major Buddhist traditions, namely Theravada and Vajrayana. Based on previous estimates, 87.36% of Buddhist temples in Malaysia are identified as Han Buddhist temples. Assuming that the number of adherents is proportional to the distribution of temples, Han Buddhists would comprise approximately 85% of the total Buddhist population. This yields an estimated Han Buddhist population of approximately 4.64 million in 2010, equivalent to 17.78% of the national population (calculated as 85% of 5.459 million).

Given that the total Malaysian Chinese population in 2010 was 6,392,636, it can be inferred that approximately 72.59% of Chinese Malaysians—equivalent to around 4.64 million individuals—identified as Han Buddhists. This percentage, derived from historical immigration patterns and religious affiliations, serves as the basis for estimating the Han Buddhist population within the broader Chinese Malaysian demographic.

By 2023, the Chinese Malaysian population had increased to 6,862,400, representing 20.6% of Malaysia's total population of 33,379,500 (Department of Statics Malaysia DOSM, 2024). Although the 2020 census does not provide a religious breakdown, the Han Buddhist population in 2023 can be estimated by applying the same percentage (72.59%) derived from the 2010 data. This results in an estimated Han Buddhist population of approximately 4,981,400 in 2023, which corresponds to 14.92% of the national population.

Overall, the Han Buddhist community among Chinese Malaysians continues to constitute a significant religious and cultural group. While its relative share of the national population has declined slightly over time, the absolute number has continued to grow—from an estimated 4.64 million in 2010 to 4.98 million in 2023. These figures underscore the enduring presence and influence of Han Buddhism within Malaysia's Chinese community and highlight its ongoing role in the country's religious and cultural landscape.

Han Buddhists' Contribution to Greenhouse Gas Emission Reduction through Vegan and Vegetarian Diets in Malaysia

This section utilizes population data derived from the previous analysis to estimate the number of vegans and vegetarians within the Malaysian Han Buddhist community. This demographic information, when combined with national meat consumption statistics, is used to evaluate greenhouse gas emissions from daily diets (GHGEd) through a correlation formula developed using regression analysis. The outcome is an estimation of the total greenhouse gas emission (GHGE) reductions attributable to plant-based dietary practices among Han Buddhists in Malaysia.

As previously discussed, in China, approximately 4.11% and 16.44% of Han Buddhists were identified as vegan and vegetarian, respectively, as of 2015. These figures are based on Tseng, (2017) assessment of both ordained and lay Buddhist populations. Ordained monastics are generally committed to strict vegetarian or vegan diets, whereas lay Buddhists tend to observe vegetarian practices during specific fasting periods or designated vegetarian months (斋期) as outlined in Buddhist scriptures.

Given the doctrinal and cultural continuity between Han Buddhists in China and Malaysia, it is reasonable to apply these percentages to the Malaysian context. Accordingly, the estimated vegan and vegetarian populations among Malaysian Han Buddhists in 2023 are 0.2047 million (calculated as 4.9814 million × 4.11%) and 0.8189 million (4.9814 million × 16.44%), respectively. This yields a combined total of approximately 1.0236 million individuals adhering to plant-based diets.

Tseng also developed a correlation model linking per capita daily meat consumption (MCd) with per capita daily greenhouse gas emissions (GHGEd), based on dietary data from Scarborough et al. (2014). The dataset includes dietary profiles from 2,041 vegans, 15,751 vegetarians, 8,123 fish-eaters, and 29,589 meat-eaters. A polynomial regression analysis was conducted to establish the relationship between meat consumption and GHGE.

The resulting correlation equation from the polynomial regression is as follows:

for MCd > 0 (meat eaters):

$$GHGEd = - 2.0x10\text{-}5 (MCd + 41.73)2 + 0.0264 (MCd +41.73) + 2.8664 \quad (1a)$$

for MCd = 0 with vegetarian diet:

$$GHGEd = 3.81 \quad (1b)$$

and, for MCd = 0 with a vegan diet:

$$GHGEd = 2.89 \quad (1c)$$

where MCd denotes the retail weight of daily meat consumption per capita (in grams), and GHGEd represents the daily dietary greenhouse gas emissions per capita (in kilograms of CO_2 equivalent, $kgCO_2e$).

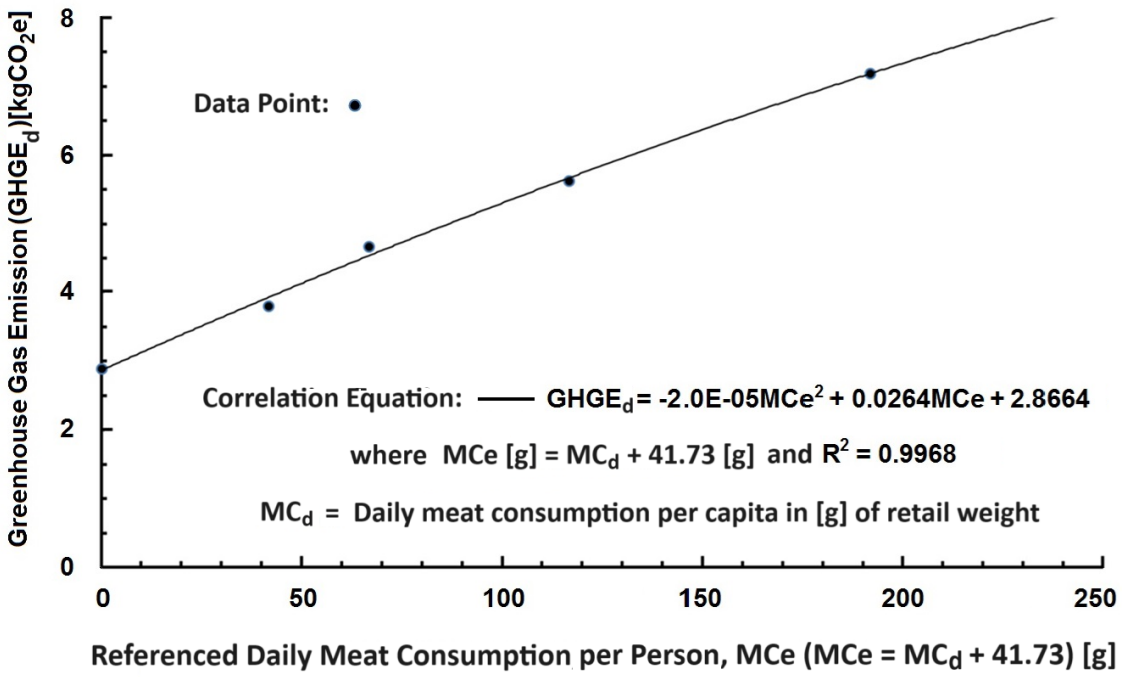

Figure 1. Relationship between daily food greenhouse gas emissions/capita (GHGEd) and daily meat consumption per capita (MCd) obtained from polynomial regression analysis

Figure 1 illustrates the results of the regression analysis, where the solid line represents the correlation curve derived from the analysis, and the five solid dots denote the data points corresponding to the surveyed groups. The associated correlation coefficient (R^2) is also displayed, with a value of 0.9968, indicating an excellent fit between the curve and the observed data. The R^2 coefficient is a statistical measure used to assess how well the correlation curve explains the variation in daily food-related greenhouse gas emissions per capita (GHGEd), the dependent variable, as influenced by changes in daily meat consumption per capita (MCd), the independent variable. An R^2 value of 1.0 signifies a perfect correlation, whereas a value of 0 indicates no correlation.

To estimate GHGEd, the per capita daily meat consumption (MCd), expressed in retail weight units, is required for use in Equation (1a). According to the Organisation for Economic Co-operation and Development (OECD), the annual per capita meat consumption in Malaysia in 2023—including beef, veal, pork, poultry, and lamb—was 41.83 kg in retail weight (OECD, 2024). This figure translates to an MCd of 114.60 grams per capita per day (i.e., 41.83 × 1000 ÷ 365).

Using an MCd of 114.60 grams as input in Equation (1a), the corresponding GHGEd is calculated to be 6.50473 kg CO_2e. Based on Equations (1b) and (1c), the estimated GHGEd for vegetarian and vegan diets are 3.81 kg CO_2e and 2.89 kg CO_2e, respectively. This results in a personal GHGEd reduction of 2.69473 kg CO_2e (6.50473 – 3.81) for a vegetarian and 3.61473 kg CO_2e (6.50473 – 2.89) for a vegan. The total equivalent annual GHG reduction resulting from Han Buddhists in

Malaysia adopting vegetarian or vegan diets is estimated at 1.07553×10^9 kg CO_2e. This is based on the following calculation: $2.69473 \times 0.8189 \times 365 + 3.61473 \times 0.2047 \times 365$. As previously estimated, the vegetarian and vegan populations among Han Buddhists in Malaysia in 2023 were 0.8189 million and 0.2047 million, respectively.

This reduction equates to more than one million tons of carbon dioxide equivalent per year, underscoring the substantial impact that religiously motivated dietary practices can have on climate change mitigation and carbon footprint reduction. These findings highlight the potential of spiritually aligned plant-based diets to contribute meaningfully to environmental sustainability efforts.

Discussion

The results of this study indicate that the Han Buddhist community in Malaysia significantly contributes to the reduction of greenhouse gas emissions (GHGE) through plant-based dietary practices rooted in religious teachings. Historical accounts of Chinese migration from the Guangdong and Fujian provinces reveal that the majority of Malaysian Chinese communities have strongly inherited Han Buddhist religious traditions, including the adoption of vegetarian and vegan diets. In 2010, the Han Buddhist population in Malaysia was estimated at 4.64 million (17.78% of the national population and 72.59% of the Malaysian Chinese population). By 2023, this number had increased to approximately 4.98 million (14.92% of the national population, maintaining 72.59% of the Chinese population). Among them, around 1.02 million individuals adhere to vegetarian or vegan diets.

Based on regression analysis of meat consumption and carbon emissions, this dietary pattern is estimated to contribute to an annual reduction of 1.07553×10^9 kg CO_2e. These findings underscore that religious practices preserved across generations not only reinforce cultural and spiritual identity but also exert a measurable impact on climate change mitigation.

The study suggests that the vegetarian and vegan diets practiced by the Han Buddhist community in Malaysia have the potential to significantly reduce GHGE. This is primarily due to the substantial difference in emissions generated by meat-based versus plant-based diets, a phenomenon supported by numerous previous studies. However, beyond individual choices, the findings reflect how dietary practices are deeply embedded in the community's value systems and sustained through religious teachings. From the lens of social practice theory (Shove et al., 2012), dietary behavior is inseparable from the cultural and social contexts that shape it.

Han Buddhism, which promotes compassion, non-violence, and reverence for all sentient beings, provides a normative framework that encourages its adherents to adopt vegetarian or vegan diets (McKeown & Dunn, 2021). Consequently, the reduction in GHGE is not solely a result of decreased meat consumption but also an expression of social practices informed by belief systems that embody ecological values. Given the sizeable Han Buddhist population and the high prevalence of plant-based dietary adherence, these religiously guided diets emerge as a meaningful societal force in climate change mitigation efforts.

This study represents a novel contribution to the literature, as it is the first to specifically examine the role of the Han Buddhist community in Malaysia in

reducing GHGE through dietary practices. While no prior study in Malaysia has focused on this issue, the findings align with earlier research on dietary behaviors among Chinese Buddhist communities—particularly those adhering to Mahayana traditions—in other countries. Studies by Tseng (2017, 2020a) and Li et al. (2024) demonstrated that Chinese Buddhist vegetarian practices contribute significantly to emission reductions, with savings amounting to millions of metric tons of CO_2 equivalent annually. These studies emphasize the potential of religiously driven plant-based diets to positively impact the environment. Similar conclusions were drawn by Bayuseto (2023) in his study of *Eco-Dhamma*, where Buddhist environmental ethics were shown to foster concrete actions in local religious communities in Indonesia, reinforcing how Buddhist teachings can shape sustainable practices beyond individual dietary choices.

The current findings are also consistent with prior research highlighting the lower GHGE associated with vegetarian and vegan diets compared to meat-based diets. Heller & Keoleian (2015), Góralska-Walczak et al. (2023), and Bruno et al. (2019) reported that plant-based diets are significantly more sustainable in terms of carbon emissions. What distinguishes the present study is its unique approach, linking the ethical teachings of Han Buddhism in Malaysia—particularly the principle of *ahimsa* (non-violence)—to the environmental benefits of reduced GHGE. This connection is also reflected in the practices of Buddhist vegetarian restaurants in Malaysia (Yew, 2023), highlighting how religious values can influence environmentally responsible consumption behaviors.

Additionally, the findings contribute to Malaysia's broader efforts in climate change mitigation, as outlined in various national low-carbon strategies (Ho et al., 2013), climate action frameworks (Ho et al., 2013), responses to climate change (Ooi & Amran, 2019), and regional decarbonization pathways (Toh, Ling, Chau, Abdullah, & Lee, 2024). Encouraging plant-based diets among the Han Buddhist community thus aligns not only with ethical and health imperatives but also with national sustainable development objectives.

The plant-based diets practiced by the Han Buddhist community in Malaysia carry profound social, historical, and ideological significance in the context of climate change. These dietary practices transcend individual lifestyle choices and are instead rooted in religious values transmitted through generations of Chinese migration from Guangdong and Fujian. The teachings of Han Buddhism—emphasizing *ahimsa*, compassion, and ecological harmony—serve as the moral foundation for dietary choices within this community (Harvey, 2000). Viewed through the framework of social practice theory (Shove et al., 2012), such diets reflect institutionalized practices shaped by cultural and spiritual norms. Thus, the annual GHGE reduction of approximately 1.07553×10^9 kg CO_2e demonstrated in this study represents not only a quantitative environmental benefit but also the potential of religious belief systems to drive transformative ecological behavior (Johnston, 2014; Tucker & Williams, 1997).

These findings contribute to the growing body of literature at the intersection of religion and ecology, and highlight the importance of transdisciplinary approaches that integrate perspectives from the sociology of religion, environmental ethics, and public policy (Jenkins, Tucker, & Grim, 2016;

Palmer & Finlay, 2003). In Malaysia's multicultural context, religiously guided diets strengthen both spiritual identity and collective ecological responsibility.

The study further illustrates that religious teachings can be a transformative force in promoting environmentally conscious behavior, as exemplified by the Han Buddhist community's adoption of plant-based diets and its associated contribution to GHGE reduction (Gohain, 2023; Tseng, 2019). This synergy between spirituality and sustainability demonstrates how values such as *ahimsa* and compassion are enacted in daily life, with tangible environmental benefits. This aligns with broader research indicating that religious traditions, including Buddhism and Islam, encourage environmental stewardship through their emphasis on human responsibility (Abdullah & Keshminder, 2020; Aung, 2016; Mohamad, Idris, & Mamat, 2012). David R. Loy, in *The Great Awakening: A Buddhist Social Theory*, posits that Buddhism offers insights into addressing systemic suffering caused by institutional greed, hatred, and delusion (Loy, 2003). However, potential drawbacks can arise when religious narratives of ethical diets become exclusionary or insensitive to broader socio-economic realities (Lee & Han, 2021). For instance, not all individuals or communities have equal access to healthy and sustainable plant-based food sources, which may create new inequalities or stigmatize groups that do not follow such diets (Gohain, 2023; Lee & Han, 2021). Moreover, in a multicultural society like Malaysia, caution is needed when positioning religious practices as universal models, given that each community has different value systems and food traditions.

Based on the findings of this study, the policy action recommended is to encourage the integration of faith-based sustainability values into climate change mitigation policies, particularly in the food consumption sector. The Malaysian government could design a national program that recognizes the contributions of religious communities, such as Han Buddhists, in reducing greenhouse gas emissions, while incorporating faith-based plant-based dietary practices into the national sustainability strategy. For example, public campaigns that highlight religious values related to caring for living beings and the environment could be developed in collaboration with religious leaders and organizations. Additionally, incentives or logistical support for providing plant-based foods in educational institutions, places of worship, and other public facilities could be expanded. This approach would strengthen the social changes already established within the community and make them an integral part of a more inclusive environmental policy, grounded in local religious wisdom.

Conclusion

This study provides the first estimate of the Han Buddhist population in Malaysia for the years 2010 and 2023 and examines the potential impact of dietary choices within this community on reducing greenhouse gas emissions (GHGE). The main findings indicate that the Han Buddhist population in Malaysia in 2023 is estimated at 4.98 million, with approximately 1.02 million individuals following a vegetarian or vegan diet. The estimated annual GHGE emission reduction of 1.0755×10^9 $kgCO_2e$, equivalent to the emissions produced by one million petrol-powered vehicles traveling approximately 4,211 km, highlights the significant environmental benefits of a plant-based diet within religious communities. These findings provide

new insights into the potential contributions of faith-based communities to climate change mitigation.

The primary contributions of this study are twofold. First, it is the first study to estimate the Han Buddhist population in Malaysia, providing baseline data that can be used for further research and policy development. Second, the study demonstrates that vegetarian and vegan dietary practices among Malaysian Han Buddhists contribute significantly to the reduction of greenhouse gas emissions, with results comparable to the environmental impact of one million petrol-powered vehicles. Additionally, the research offers a novel methodological approach in estimating dietary emission reductions based on specific religious populations, which can be applied to other religious and cultural groups. The methodology used, which incorporates the distribution of temples and the proportion of representation in relevant ethnic groups, sets the stage for future research on religious demography and dietary practices among minority groups.

While this study makes a significant contribution, there are several limitations that should be noted. The estimation of the Malaysian Han Buddhist population and its dietary habits relies on assumptions derived from data on Chinese Han Buddhists, given the limited demographic and dietary data available in Malaysia. Therefore, direct studies on the dietary habits of this community in Malaysia are necessary to validate the estimates. Moreover, the regression model used to calculate dietary GHGE does not account for variations in food production methods or supply chain emissions, which may influence the results. Future research should focus on collecting primary data on the dietary patterns of the Malaysian Han Buddhist community, including seasonal and regional variations, to enhance the accuracy of the GHGE estimates. Furthermore, research could be expanded to include other religious and cultural groups in Malaysia, providing a more comprehensive understanding of GHGE reduction nationwide.

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