

Article

A Novel Model to Predict Plant-Based Food Choice-Empirical Study in Southern Vietnam

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Abstract: The beneficial advantages of plant-based diets towards human beings have been well addressed over the last few decades. More and more people are now enjoying plant-based diets for their physical health, psychological health, animal rights, environment protection, etc. However, there are still many stereotypes about the lifestyle. Hence, this study aims at identifying key factors affecting the plant-based food choices so that we can propose feasible implications to widely promote plant-based diets across communities for their better health, eudemonic well-being and life satisfaction as well as the sustainable survival of our beloved planet—“Mother Earth”. Based on statistical analysis results of data collected from 1477 participants in 10 out of 19 provinces/cities in Southern Vietnam, the plant-based food choice is found significantly affected by not only gender and marriage status but also by a so-called *SHOULD* Model, where: (1) *S* refers to Spirituality and Social relationships; (2) *H* refers to Health concerns; (3) *O* refers to Opulence of plant-based foods and Outlook on life; (4) *U* refers to Understanding of human body structures; (5) *L* refers to Love towards animals; and (6) *D* refers to Diet knowledge. Among the identified factors, “understanding of human body structures” and “outlook on life” are two new factors proposed in this study, fulfilling the existing literature about the determinants of plant-based food choice. From such findings, some managerial implications are proposed to not only promote plant-based lifestyle but also help to develop plant-based food business in practice.

Keywords: plant-based food; plant-based diet; food choice; veganism; vegetarianism; *SHOULD* Model; Southern Vietnam

1. Introduction

In the past few decades, plant-based (PB) diet has become more and more popular as people take more concerns on their health, environment protection, animal rights, ethics, spiritual beliefs, among others [1–5]. Many scholars worldwide show special interest in discovering several aspects of such lifestyle in terms of nutrition, health benefits, impacts on human daily activities, etc. [6–11] to explain why PB diet has been prevalently recognized as a nutritional and remedial dietary profile [12]; for example, PB diet helps to prevent cancers [13]. Existing literatures clearly confirm that PB diets fully provide enough energy and nutrients for a healthful eating [3,12,14,15], and consuming vegetable protein, fat as well as fiber is effective in preventing some cancers, diseases, and other risk factors [16] and treating several diseases [12,17]. However, many people are still misunderstanding that such diet

leads to poor nutrition, negative effects on health for long-term consumptions, among others [18,19]. In Vietnam, due to cultural beliefs and traditional stereotypes about this diet [18], more than 99% of the population prefer to have meat in their meals [20].

From a thorough review of existing literature, PB diet has brought several benefits in improving human well-being, ethics, health, spirituality, quality of life [10,14,21–23], supporting the rapid growth and expansion of food industries [16] as shown in the recent report by Food Revolution Network [24]. The review by Graça et al. [25] showed that the transition towards PB foods results in sustainable food systems. The PB diet has been formally approved in Senate Bill 1138 by the California State Governor on 18 September 2018 [26].

In Vietnam, more and more Vietnamese are taking PB diet because they are trying to follow Buddhist teachings in the abstinence from killing animals and eating meat to foster human mercy and philanthropy [27]. Besides regular vegan and vegetarian, many Vietnamese flexitarian have PB diets exclusively on the 1st and 15th lunar calendar every month, or 4 days/month (on 1st, 14th, 15th and 29th/30th of every Lunar calendar month), 10 days/month, etc. as their Buddhism practice. And PB diets are more and more popular in Vietnam, especially in the Southern region where people can easily find good dishes of PB foods in luxury restaurants, family restaurants, common inns and even in sidewalk booths. It is because the rainy and sunny seasons in the Southern Vietnam offer favorable conditions for the growth of various vegetables, fruits and plants. Thus, PB foods are prevalent in the region. That's why Ho Chi Minh City, the largest and most crowded city in Southern Vietnam with the current population of more than 8.5 million people [28], was voted as one of the top 10-vegan-friendly cities in Asia [29]. What are the key factors affecting their decision in choosing their PB foods? This is the key question urging us to conduct this study.

To achieve the above objectives, this paper is organized as follows. Section 2 briefly presents literature reviews about the PB diet, some most studied benefits of the diet and some factors affecting the PB food choice while research method used in this study is presented in Section 3. Section 4 displays the empirical results which are critical for our last section, Section 5 containing practical discussions and managerial implications to promote PB diets across communities as well as develop PB foods business in practice.

2. Literature Reviews

2.1. Plant-Based Diet

Literally, PB diet refers to a diet with foods mostly derived from plants. However, an exact definition of PB diet is still a controversial issue. While it is commonly agreed that PB diet may have few animal products, several scholars, such as Jenkins et al. [30] and Graça et al. [25], exclude animal products (butter, milk, and eggs, etc.) from PB diet. Moreover, according to Tusso et al. [31], although “plant-based” is sometimes used interchangeably with vegetarian or vegan which are usually adopted for ethical or religious reasons, physicians should use the term “plant-based” instead; and Christopher et al. [8] pointed that “*plant-based diet is a less value-laden and more nutrition-oriented term, defined as it is by what one eats rather than who one is*”. Hence, “plant-based diet” is preferably used in practice to bypass identity issues. Among several types of vegetarian defined by Craig and Mangels [14] and Willet et al. [32], the term “plant-based diet” used in this study is referred to as lacto-ovo vegetarian diet which includes grains, vegetables, fruits, legumes, seeds, nuts, dairy products, and eggs. Guillemette and Cranfield [33] found that organic foods labelled with vegetarian/vegan are most preferred in supermarkets while Le and Sabate [16] and Mann [21] pointed that vegetarian/vegan diets positively support the development of food industries. Also, young people are more likely to take PB diets in today's green society [3]. Therefore, PB lifestyle is still an interesting and enticing research topic to be further explored.

However, there are still several stereotypes about this type of diet as reviewed by Funk et al. [34], Potts and Parry [35], Cole and Morgan [36], Wright [37], Earle and Hodson [38], such as: insufficient

energy, nutrients and vitamins [18,39–47]; incomplete and unsatisfactory meals [48–63]; and negative effects on social interpersonal associations and social belonging [64–67], or Loeb [68] even considered vegan “lack of intelligence”; or Minson and Monin [69] and Burgess et al. [70] found that many of their participants considered vegetarians arrogant, stupid, weird, self-righteous, crazy, radical, unhealthy, weak, insane, and freak. And, many Vietnamese even reckon that enjoying meat is to support stockmen business or help the slain animals to be swiftly reincarnated. These believes are obviously counter-intuitive because there are various nutritional substitute sources of proteins, such as nuts, peas, beans, etc. and many sources of vegetable oils, consequently, vegetarians can have sufficient nutrients and vigor for their regular activities and even apex rivalries [39,71,72]. So, clearly understanding the real benefits and having a good knowledge of PB diets will significantly affect their food choice.

2.2. Most Studied Benefits of Plant-Based Diets

Many researches have confirmed that PB diets bring several benefits in terms of (1) improving personal health (lowered risk of obesity, diabetes, heart disease, and some types of cancer as well as improved longevity, etc.) [4,11,12,18,31,73–80]; (2) reducing death rates [5,78,81–84]; (3) protecting living environment [30,85–93]; (4) sustaining food systems [32,86,89,94–101]; among others. Besides, several researches find that PB diet helps to increase eudemonic well-being and life satisfaction, i.e., positively improves psychological health [102–108]. It's also considered as a therapeutic profile to treat Rheumatoid arthritis [109], gastrointestinal tract [110], prevent atherosclerosis, heart failure and cerebrovascular disease, etc. [111–114], prevent gout and its cardiometabolic comorbidities [115], improve immune systems [116–118], etc. Consequently, Gaek [119] concluded that vegetarians have a better state of health and suffer less from illnesses; similar conclusions can be found in Appleby et al. [120], Deriemaeker et al. [44,121] and Key et al. [76]. Especially, it is also found that PB diets help to protect the living environment against the climate change because animal husbandry consumes too much water, land, crops and energy [122,123], i.e., it negatively affects the environment with global warming and climate change [85,124,125]. Particularly, PB diets help to avoid negative consequences of animal husbandry in terms of the usage of energy, land and water resources [126], water pollution, soil corrosion, habitat deterioration [127,128], carbon dioxide (C₂O) emission [129–133], nitrous oxide (N₂O) emissions [90,130] and GHG emission [100,134].

2.3. Factors Affecting Plant-Based Food Choice and Proposed Hypothesis

Several researchers worldwide have paid special efforts in investigating the reasons for the switching and pursuing PB diets [4,135–141]. Several factors have been found; for example, in some regions, people choose PB diets due to their cheap prices [142], some due to their health problems, some due to animal welfare, environmental issues, some due to their beliefs/religions, etc. Among them, as reviewed by Wirnitzer [135] and Radnitz et al. [4], PB diets are chosen with two most popular reasons, including ethics (animal welfare, violent feeding, poor treatment to animals, etc.) and health/well-being. Previous studies by Hoffman et al. [142] and Ruby [143] also pointed that the so-called “motivations” in terms of ethical and health motivations are the dominant affecting factors. Besides, Hoffman et al. [142] claimed that religious and spiritual beliefs are also significant components of the ethical motivations though this classification was disagreed by Janssen et al. [144] and Radnitz et al. [4]. Rosenfeld and Burrow [145,146] claimed that the motivations significantly affect the food choice. In the light of this, besides the health factor, this paper divides the ethical motivation into two key factors, including Spirituality (religious and spiritual beliefs) and Love towards animals (animal rights, anti-violent behaviors towards animals). Shorrock [147] concluded that “regardless of the reasons for choosing this lifestyle, every vegan is driven by compassion”. Therefore, this study investigates the following hypothesis:

Hypothesis 1 (H1). *Health concerns positively affect PB food choice.*

Hypothesis 2 (H2). *Spirituality positively affects PB food choice.*

Hypothesis 3 (H3). *Love towards animals positively affects PB food choice.*

In addition, the recent movements in PB diets show that people are paying more attention to the protection of the climate and living environment [4,85,137,139,142,144] because grains, fruits and vegetables are environmentally friendly and sustainable compared to flesh products, i.e., PB diet is one of the most practical actions to make the Earth safer and greener [88,128]. Thus, the following hypothesis will be investigated in this study:

Hypothesis 4 (H4). *Environment concerns positively affect PB food choice.*

In addition, Craig [148], Key et al. [76], Le and Sabaté [16], McEvoy et al. [47], Waldmann et al. [141] pointed the important role of individual's knowledge of nutrition, the availability and choice of fortified foods to appropriately supplement one's diet; thus, unless a person has enough diet knowledge about PB foods and how to well prepare for an attractive and enough-nutrition meal, he/she fails to be deterministic to choose PB diets [16,45,76,142,149,150]. Hoffman et al. [151] pointed that nutrition knowledge is not limited to scientific facts about food but consists of three aspects, including: procedural, declarative, and social knowledge. From these concepts, the diet knowledge about PB foods used in this study refers to basic knowledge of: (1) how to identify PB foods among different foods provided; (2) which PB foods are good sources of protein, vitamins and minerals; (3) nutritional concepts relating to micro- and macro-nutrients; (4) how to prepare nutritional PB diets; and (5) common believes in the benefits of PB diets. Several researches, such as [57,152–154], have identified key barriers to the adoption of PB diet, including: lack of information about PB diets, lack of know-how to prepare PB meals, lack of knowing available PB foods in one's community, and misconceptions of health-related issues (or stereotypes of PB diets as mentioned in Section 2.1). We believe that one with good diet knowledge will preferably choose PB foods for their diets. Hence, this study will investigate the following hypothesis:

Hypothesis 5 (H5). *Diet knowledge positively affects PB food choice.*

Liem [155] found that food choice is significantly affected by not only human taste and smell system, the perception and liking of foods but also the labelling and packaging. Moreover, to serve different tastes and needs of different veggies, variety of PB foods and attractive dishes also significantly affect their willingness to have PB diets. Such availability and variety is mentioned in this study with a term of "Opulence of PB foods". Basically, foods can be classified into two categories: processed and unprocessed; thus, we accordingly have processed PB foods and unprocessed PB foods. From our practical observations, semi-vegetarian usually prefers processed foods in their PB meals while vegan and lacto-ovo vegetarian mostly consume unprocessed PB foods. Therefore, the opulence of PB foods provides more choices to satisfy their different needs. However, consuming processed foods is proved to have negative impacts on human health such as obesity [156,157], metabolic disorders [158], dyslipidaemia [159] and other chronic diseases. Thus, Monteiro et al. [160] suggested having natural or minimally processed foods for a good health. In an empirical study of selling organic food products in France, Desquilbet et al. [161] found that sales of more plant-based and less processed products are better than those of conventional ones and the former leads to a better overall sale. This implies that people tend to prefer PB and unprocessed foods. Thus, to improve the nutritional quality and engorgement of PB diets, we recommend PB diets rich in unprocessed and high-fiber plant foods with variety of dishes. This can be easy in the case of Southern Vietnam because it has humid tropical climate. The average temperatures around 27–32 °C and two distinct seasons including rainy season (also called monsoon season from May–November) and sunny season (rest of the year) greatly favor the biodiversity and growing of agricultural products whole year. Consequently, the abundance of

grains, fresh fruits, fresh vegetables, legumes, seeds and nuts ensures the opulence of PB foods in Southern Vietnam. We believe that the opulence is one of the determinants of PB diet. Hence, this study will investigate the following hypothesis:

Hypothesis 6 (H6). *Opulence of PB foods positively affects its choice.*

However, due to the stereotypes about the PB diets mentioned above, many people think that the diet is more suitable for females than for males [162,163], or eating meat is not only natural, necessary, normal but also nice [164], joyful and pleasant in taste [25]. The findings by The Vegetarian Resource Group [165], Leroy and Praet [166] and Wilk [167] show that the core component of Western culture and Western diet is the sharing of food, especially meat. Consequently, following PB diet will reduce their life satisfaction as well as perceived congeniality within a social group and even in a small family [7], and result in social isolation and disconnectedness in omnivorous groups [35–37,151,169,169–171]. Therefore, the following hypothesis will be investigated:

Hypothesis 7 (H7). *Social relationships negatively affect PB food choice.*

From our qualitative research presented in Section 3, two new factors were suggested to be further investigated in this study, including: (1) outlook on life, and (2) understanding of human body structure. The outlook on life of a person refers to his/her viewpoints about the purposes of life, the values of life, whether a hedonistic life or a simple life is meaningful, etc. i.e., it is wider and more unyielding than personal beliefs. It is said that people who follow simple life and concern more about the nature of life tend to choose PB foods. And, the understanding of human body structure refers to the recognition of the similarity between human body structure and those of herbivores in terms of teeth, stomach, salivary gland, nails, sweat gland, etc. which are significantly different from those of carnivores. Such understanding helps people to be deterministic in choosing PB foods to fit to the structure of human body. In light of these suggestions, the following hypothesis will be investigated in this study:

Hypothesis 8 (H8). *Outlooks on simple life and nature of life positively affect PB food choice.*

Hypothesis 9 (H9). *Understanding of human body structure positively affects PB food choice.*

Besides the just-mentioned factors, we will also investigate the impacts of demographic characteristics such as gender, age, marriage status, income and education, of the respondents on the PB food choice. Therefore, this study proposes a research model as shown in Figure 1.

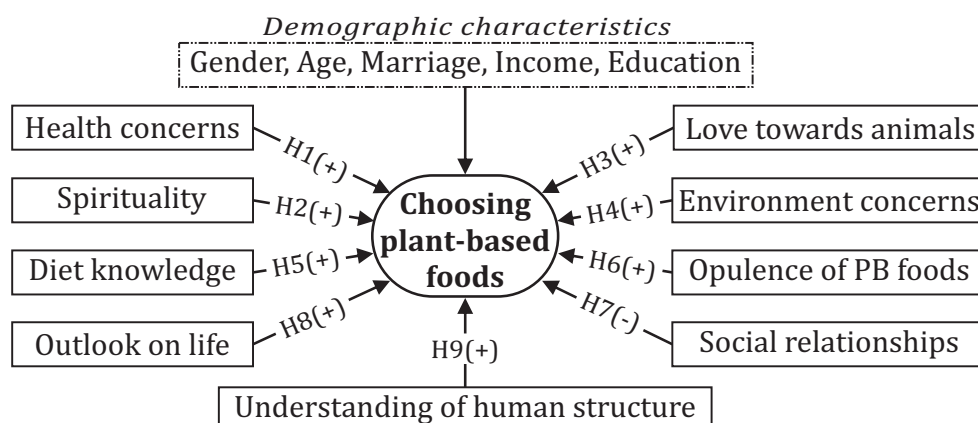


Figure 1. Proposed research model.

3. Research Method

This study used self-completed questionnaire for data collection; thus, it was conducted in three critical episodes, including: (1) questionnaire construction, (2) data collection, and (3) data analysis. Specific works in each episode include:

3.1. Questionnaire Construction

Firstly, we listed some factors obtained from the literature reviews, including: health, spirituality, diet knowledge, love towards animals, environment, social relationships and opulence of PB foods and conducted a qualitative research with people having their lunches at vegetarian restaurants and some visiting temples in August 2019 in order to validate the appropriateness of the factors and discover other potential ones in the current context of Vietnam. Specifically, there were 28 participants in Bien Hoa City, 43 in Ho Chi Minh City and 36 people visiting temples in Binh Duong province. The results from this qualitative research show that they agreed with listed factors. Besides, based on their personal experience in what urges them to choose PB foods, some participants suggested us to investigate some other possible factors such as the support from their relatives, the cuisine culture, etc. Their suggestions were carefully considered. Some of them were found included in some of the listed factors, for example, the support from relatives is a part of social relationships; and only two new factors named “Outlook on life” and “Understanding of human body structure” were believed to have significant impacts and worth further investigation in this study. Thus, these new factors are included in the proposed research model shown in Figure 1.

Secondly, we constructed a primary self-completed questionnaire consisting of 29 aspects for nine independent factors and three statements for the dependent factor “Choosing PB foods”. Specifically, each participant is asked to evaluate not only the current level of each aspect based on 5-point Likert scale (1-Really low/poor → 5-Really high/good) but also the impact level of each aspect on the choosing PB foods based on 5-points Likert scale (1-No impact → 5- Significant impact). For example, as the factor “Diet knowledge” has four aspects, including: (1) Knowledge of nutrients; (2) Knowledge of healthy foods; (3) Knowledge of the benefits of PB diets; and (4) Knowledge of how to prepare a healthy diet, each participant was asked to evaluate them in the 5-point scale if he/she has a good knowledge in those aspects and what impact level of each aspect on the choosing PB foods. Specifically, good knowledge of nutrients of a person may have significant impact or minor impact on his/her PB food choice. Meanwhile, the dependent factor “Choosing PB foods” is measured with three statements, including: (1) “I will usually choose PB foods in my daily life”; (2) “I will preferably choose PB foods despite the presence of attractive flesh products” and (3) “I will take long-term PB foods in the time being” which are evaluated with the agreement degree based on 5-point Likert scale (1-Strongly disagree → 5-Strongly agree).

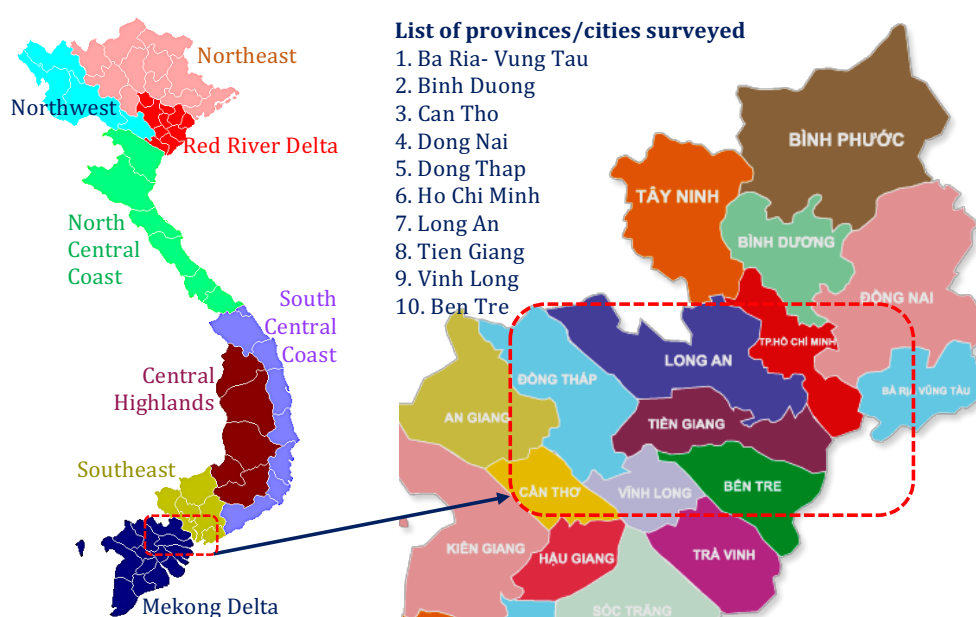
Thirdly, the primary questionnaire was used in a pilot test to assess the clarity of the meaning and word usage in the investigated aspects and statements. The results and feedbacks from 47 participants in Long Thanh district, Dong Nai province were carefully considered to refine our final questionnaire before it was used in our official survey in two months, September–October 2019. In the final version, besides some demographic characteristics such as gender, age, marriage status, income and education, each participant was asked to evaluate all of the 32 listed aspects and statements which are briefly presented in Table 1. It takes about 5 min for a normal person to read through the contents and complete their responses. For the brevity of this paper, full version of the questionnaire will be provided on request.

Table 1. Brief information of the final questionnaire and coding.

No.	Factor (Code)	No. of Variables	Codes for Current Status	Codes for Impact Measures
1	Health concerns (HEAL)	4	HEA1 → HEA4	HEAL1 → HEAL4
2	Spirituality (SPIR)	3	SPI1 → SPI3	SPIR1 → SPIR3
3	Love towards animals (LOVE)	3	LOV1 → LOV3	LOVE1 → LOVE3
4	Environment concerns (ENV1)	3	ENV1 → ENV3	ENV1 → ENV3
5	Diet knowledge (DKNO)	4	DKN1 → DKN4	DKNO1 → DKNO4
6	Opulence of PB foods (OPUL)	3	OPU1 → OPU3	OPUL1 → OPUL3
7	Social relationships (SOCR)	3	SOC1 → SOC3	SOCR1 → SCOR3
8	Outlook on life (OUTL)	3	OUT1 → OUT3	OUTL1 → OUTL3
9	Understanding of human structure (UNDS)	3	UND1 → UND3	UNDS1 → UNDS3
10	Choosing PB foods (CHOI)	3		CHOI1 → CHOI3

3.2. Data Collection

Practically, Southern Vietnam consists of 19 provinces/cities, including: 6 provinces (Binh Phuoc, Binh Duong, Dong Nai, Tay Ninh, Ba Ria-Vung Tau) and Ho Chi Minh City in Southeast region; 12 provinces (Long An, Dong Thap, Tien Giang, An Giang, Ben Tre, Vinh Long, Tra Vinh, Hau Giang, Kien Giang, Soc Trang, Bac Lieu, Ca Mau) and Can Tho City in Mekong Delta region. Due to limited resources, this study can only cover 10 out of the 19 provinces/cities as shown in Figure 2.

**Figure 2.** List of provinces/cities covered in this study.

The official survey was conducted in September–October 2019. Hard copies of the questionnaire were directly delivered to those having their lunches at vegetarian restaurants, vegetarian inns and some during their visit temples. Before delivering our questionnaires, we always informed the participants about the nature of this study and their rights as participants. Only voluntary participants were provided the hard copies of questionnaires. After completing a questionnaire, each participant was offered with a small pack of roasted cashew kernel or mix-nuts as our thanks for their active participation. Totally, there were 2156 hard copies delivered; however, there were only 1793 pieces collected; among them, 316 pieces appeared invalid because several important measures were left unchecked. Consequently, 1477 valid observations were used in the next episode. Data from the valid observations were recorded in a computational software SPSS V.22.

3.3. Data Analysis

In this stage, we employed some analysis approaches, including: (1) exploratory factor analysis (EFA), (2) scale reliability with Cronbach's Alpha coefficient, (3) confirmatory factor analysis (CFA), (4) structural equation modeling (SEM), and (5) *t*-test/ANOVA test. Literally, the appropriateness of EFA requires the following criteria to be satisfied: Eigenvalue ≥ 1.00 ; Total variance explained $\geq 50\%$; KMO ≥ 0.5 ; Significance (Sig.) coefficient of KMO test ≤ 0.05 ; factor loadings of all observed variables are ≥ 0.35 ; and weight difference between the loadings of two factors > 0.3 [172]. And, in social science researches, a scale is considered reliable if its observed variables have a corrected item-total correlation greater than 0.3 and a Cronbach's Alpha coefficient greater than 0.6 [173]. CFA is used to further confirm the uni-directionality, scale reliability, convergence value and distinctive value of the extracted scales obtained from EFA while SEM is used to provide numerical results to test the proposed hypothesis. According to Hair et al. [174] and Steenkamp and Trijp [175], a model is considered suitable if the significance value (*p*-value) of the Chi-square test is no more than 5%; CMIN/df ≤ 2 (in some cases, CMIN/df ≤ 3 is also acceptable) where CMIN and df stand for chi-square value and the degrees of freedom, respectively; the goodness of fit index (GFI), Tucker–Lewis index (TLI) and comparative fit index (CFI) ≥ 0.9 . Besides these criteria, it is also suggested that GFI be greater than 0.8; root mean square error of approximation (RMSEA) ≤ 0.08 ; overall reliability be greater than 0.6; and the extracted variance be greater than 0.5 [174].

4. Empirical Results

4.1. Descriptive Statistics

4.1.1. Demographic Profiles

Table 2 briefly presents the descriptive statistics of the 1477 participants. Among them, males account for less than 29% because it is commonly believed that PB diet fails to provide enough nutrition and energy, especially for male; about 70% of the participants are more than 30 years old and 50% of them are married. These figures well represent the reality of PB diets in Southern Vietnam. Our practical observations show that nowadays more people in Vietnam, especially those with high income and/or higher education, choose PB diets as their alimentary therapeutics to improve their health.

Table 2. Demographic profiles of participants.

Characteristics		Frequency	Percentage (%)
Gender	Female	1055	71.43
	Male	422	28.57
Age range	≤ 18	140	9.48
	18–30	338	22.88
	30–45	401	27.15
	45–55	372	25.19
	> 55	226	15.30
Marriage	Single/Divorced	428	28.98
	Married	737	49.90
	Window/Widower	312	21.12
Monthly Income (USD/month)	≤ 200	452	30.60
	200–500	476	32.23
	500–1000	376	25.46
	> 1000	173	11.71
Education	High school	620	41.98
	University	472	31.96
	Others	385	26.06

4.1.2. Mean Values of the Investigated Factors

Table 3 briefly presents the mean values of the nine investigated aspects in terms of their current statuses and impact levels. Specifically, it is found that the Southerners highly appreciate the opulence of PB foods available on the vegetarian market (Mean = 4.17). Most of them have positive outlook on their lives (Mean = 4.14), good knowledge about PB diet (Mean = 4.12), good health (Mean = 4.07) and love towards animals (Mean = 4.02). However, most of them fail to fully recognize that human body structures in terms of teeth, stomach, salivary gland, nails, sweat gland, etc. are suitable for PB foods (Mean = 2.93). Besides, they think that their social relationships are fairly poor (Mean = 3.34) but they have positive concerns about the environment (Mean = 3.88) as well as their spirituality (Mean = 3.90).

Table 3. Mean values of the investigated factors.

No.	Factor (Code)	No. of Variables	Mean of Current Status	Mean of Impact Level
1	Health concerns (HEAL)	4	4.07	4.15
2	Spirituality (SPIR)	3	3.90	4.06
3	Love towards animals (LOVE)	3	4.02	4.21
4	Environment concerns (ENVT)	3	3.88	3.59
5	Diet knowledge (DKNO)	4	4.12	4.28
6	Opulence of PB foods (OPUL)	3	4.17	4.19
7	Social relationships (SOCR)	3	3.34	4.11
8	Outlook on life (OUTL)	3	4.14	4.25
9	Understanding of human structure (UNDS)	3	2.93	4.36

Moreover, the last column in Table 3 clearly shows that the understanding of human body structure has the greatest impact on the choice of PB foods (Mean = 4.36). Other factors are ranked in descending impact levels include diet knowledge (Mean = 4.28), outlook on life (Mean = 4.25), love towards animals (Mean = 4.21), etc. However, as these are just simple arithmetic means, their actual impacts should be further tested and validated with more advanced approaches which are presented in the following sections.

4.2. Exploratory Factor Analysis of Independent Factors

In the final version of the survey questionnaire, 29 observed variables used to measure the nine independent factors mentioned in Table 1 were stated in a list instead in groups. Therefore, EFA is needed in this study to explore the underlying structure as well as the relationships among the 29 items. In the first results of EFA with the extraction method Principal Axis Factoring and rotation method Promax, it was found that 3 out of the 29 items, including OPUL3, SOCR2 and LOVE2, failed to satisfy the requirement of discriminant power, i.e., they appeared in two different extracted factors but the differences of their factor loadings are less than 0.3. Hence, the 3 items were gradually removed in the sequence that item with the lowest value of the difference should be removed first and another EFA starts once an item is removed until all observed items meet the required criteria for EFA. After such removals, the remained 26 items are categorized into nine groups, with the total variance explained 57.30%; KMO = 0.764 with the significance value less than 0.001; consequently, using EFA in this study is considered appropriate. Moreover, all factor loadings are greater than 0.5, and the weight differences among the loadings are greater than 0.3, indicating that these factors can be used for further analysis. Table 4 briefly presents the EFA results.

Table 4. Pattern matrix of EFA of independent factors.

	Factor									α	CITC ^a	α If Del ^b
	1	2	3	4	5	6	7	8	9			
DKNO4	0.829									0.834	0.808	0.836
DKNO1	0.788										0.778	0.850
DKNO2	0.752										0.743	0.866
DKNO3	0.620										0.726	0.907
SPIR1		0.940								0.860	0.886	0.813
SPIR3		0.767									0.782	0.911
SPIR2		0.761									0.781	0.911
HEAL1			0.724							0.794	0.695	0.813
HEAL4			0.724								0.706	0.807
HEAL3			0.701								0.688	0.816
HEAL2			0.660								0.665	0.837
ENVT1				0.934						0.771	0.790	0.644
ENVT3				0.647							0.724	0.812
ENVT2				0.623							0.708	0.829
OUTL1					0.811					0.752	0.717	0.678
OUTL3					0.748						0.684	0.717
OUTL2					0.581						0.664	0.830
OPUL1						0.847				0.815	0.795	
OPUL2						0.846					0.795	
UNDS1							0.830			0.708	0.681	0.598
UNDS3							0.648				0.633	0.698
UNDS2							0.548				0.618	0.775
LOVE3								0.811		0.768	0.703	
LOVE1								0.770			0.703	
SOCR1									0.795	0.755	0.687	
SOCR3									0.766		0.687	
Eigen ^c	2.833	2.548	2.329	2.076	2.036	1.832	1.729	1.616	1.485			
KMO						0.764						
Barlett's	Approx. Chi-square				12,218.655							
Test of	Freedom degree (df.)				325.000							
Sphericity	Significance level (Sig.)				0.000							

Extraction Method: Principle axis factoring; Rotation Method: Promax with Kaiser Normalization.

Notes: ^a Corrected item-total correlation; ^b Cronbach's Alpha if item deleted; ^c Eigenvalues.

From these EFA results, we then conducted scale reliability tests for the nine extracted factors. The test results are shown in the last three columns of Table 4 where we can conclude that the extracted factors are reliable for further analysis.

In the same token, we also used EFA for the three items in the dependent scale “Choosing PB foods (CHOI)”. Table 5 shows that EFA for the scale is appropriate and the factor is also reliable for further analysis in this study.

Table 5. EFA results of dependent factor.

Component	Factor Loading	Cronbach's Alpha	Corrected Item-Total Correlation	Alpha If Item Deleted
CHOI1	0.975	0.853	0.830	0.841
CHOI2	0.932		0.796	0.849
CHOI3	0.889		0.768	0.862
Eigenvalue	2.738			
KMO			0.756	
Barlett's Test of Sphericity	Approx. Chi-square		4706.329	
	Freedom degree (df.)		3.000	
	Significance level (Sig.)		0.000	

4.3. Confirmatory Factor Analysis

Table 6 briefly shows the composite reliability of the nine investigated factors and the dependent scale “Choosing PB foods (CHOI)”. Additionally, Figure 3 displays estimated standardized results of saturated model in CFA, including CMIN = 453.638, $df = 332$, $p\text{-value} \leq 0.001$, CMIN/df = 1.366 < 2.00, GFI = 0.924, TLI = 0.933, CFI = 0.938, RMSEA = 0.016 < 0.08. As these figures well satisfy the required criteria for CFA in terms of (1) unidimensionality, (2) scale reliability, (3) convergent validity, and (4) discriminant validity presented in Section 3.3, it can be concluded that the research model fits the actual data. However, it is noteworthy that some correlations are found insignificant at the level of 10% as marked in red X in Figure 3.

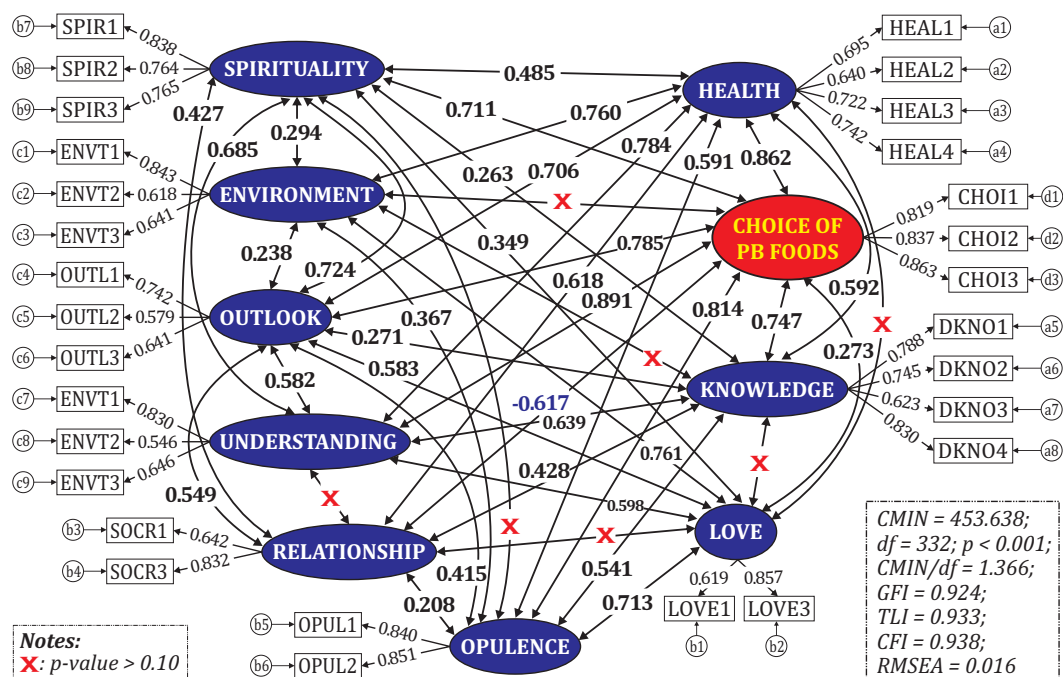


Figure 3. Confirmatory Factor Analysis.

Table 6. Confirmatory factor analysis.

Term	Scale	No. of Observed Variables	Reliability Test	
			Cronbach's α	Composite α
Determinants in PB Food Choice	Health concerns (HEAL)	4	0.794	0.794
	Spirituality (SPIR)	3	0.86	0.832
	Love towards animals (LOVE)	2	0.768	0.712
	Environment concerns (ENVT)	3	0.771	0.747
	Diet knowledge (DKNO)	4	0.834	0.836
	Opulence of PB foods (OPUL)	2	0.815	0.834
	Social relationships (SOCR)	2	0.755	0.708
	Outlook on life (OUTL)	3	0.752	0.759
	Understanding of human structure (UNDS)	3	0.708	0.719
	Choosing PB foods (CHOI)	3	0.853	0.878

4.4. Structural Equation Modelling

From the CFA results, we conducted further tests on the impacts of the nine factors on CHOI (Choice of PB foods) with structural equation modelling (SEM). The results from the first analysis showed that ENVT (environment concerns) failed to have significant impacts on CHOI; thus, it was then omitted from the model. The results in the second analysis are briefly shown in Figure 4.

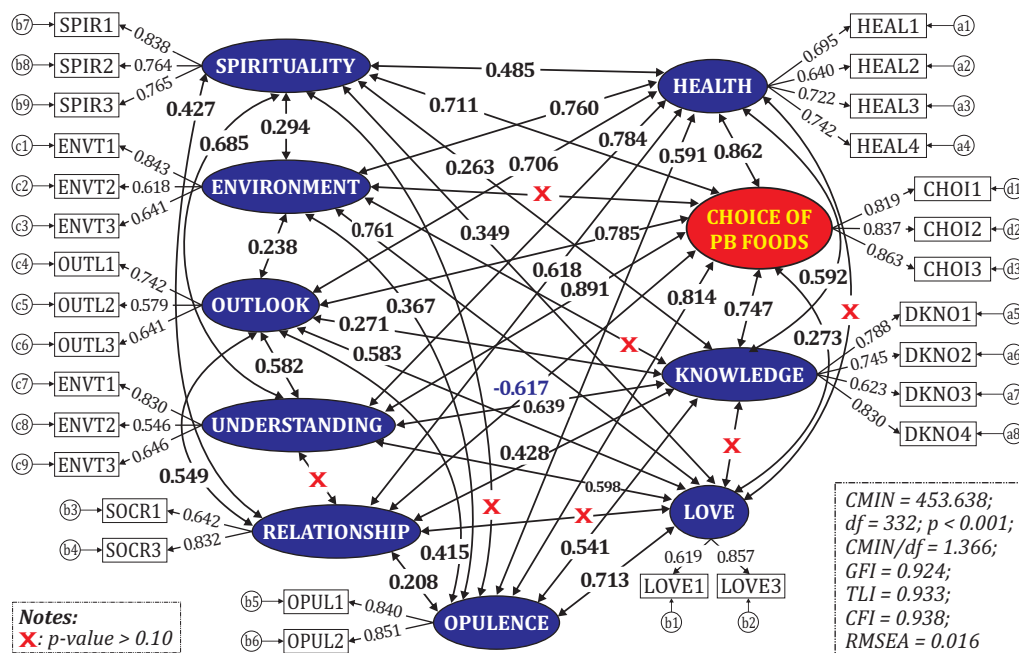


Figure 4. Standardized SEM model of choice of PB foods.

The estimated standardized parameters of the saturated model, such as CMIN = 367.648, $df = 263$, $p\text{-value} \leq 0.001$, $CMIN/df = 1.398 < 2.00$, $GFI = 0.927$, $TLI = 0.935$, $CFI = 0.940$, $RMSEA = 0.016 < 0.08$, well satisfy the required criteria for SEM as presented in Section 3.3; thus, the proposed model is considered fit for the actual data. In addition, by using bootstrapping technique for 1000 samples, we found that the bias of the model estimation was found less than 0.002 which is considered insignificant. Therefore, it can be concluded that the estimates obtained in the model are reliable.

4.5. Hypothesis Tests with SEM

The results of the model estimation and bootstrapping in SEM shown in Table 7 clearly indicate that 8/9 of the proposed hypothesis (H1 → H3, H5 → H9), except H4, are statistically supported as the *p*-values of related coefficients are all less than 0.05.

Table 7. Coefficients from the second analysis of SEM model.

Relationships	Std. Coefs. ^a	S.E. ^b	C.R. ^c	<i>p</i> -Value	Conclusion
CHOI ← HEAL	0.718	0.077	9.26	*	H1 supported
CHOI ← SPIR	0.482	0.076	6.171	*	H2 supported
CHOI ← LOVE	0.215	0.06	3.533	*	H3 supported
CHOI ← DKNO	0.692	0.059	11.254	*	H5 supported
CHOI ← OPUL	0.703	0.059	11.949	*	H6 supported
CHOI ← SOCR	−0.697	0.074	−9.23	*	H7 supported
CHOI ← OUTL	0.674	0.065	10.415	*	H8 supported
CHOI ← UNDS	0.751	0.08	9.313	*	H9 supported

Notes: ^a Standardized Coefficients; ^b Standard Error; ^c Critical ratio; * Less than 0.1%

Based on the values of standardized coefficients shown in Table 7, it is concluded that the understanding of human body structure (UNDS), health concerns (HEAL) and the opulence of PB foods are the top three factors affecting the PB food choice among Southerners. Other factors are ranked as social relationships (SOCR), diet knowledge (DKNO), outlook on life (OUTL), spirituality (SPIR) and love towards animals (LOVE). The ranking order from SEM further confirms that UNDS has the strongest impact on the PB food choice, similar to that from the arithmetic mean discussed in Section 4.1.2. However, the ranking of other factors is different; especially, the environment concerns (ENVT) are insignificant in the tests.

4.6. Tests of the Impacts of Demographic Characteristics

This study used One-way ANOVA test to investigate the impacts of demographic characteristics such as gender, age, marriage, income and education level on choice of PB foods. In order to achieve the objective, a new variable coded as “PBCH” was created by taking averages of its three components. Table 8 briefly presents the analysis results from tests of homogeneity of variances among the groups within each characteristic. With the given significance level of 5% used in this study, Table 8 clearly shows the different variances of PBCH among respondents’ groups based on the age range. The results shown in Table 8 provide important information to further test the equality of means of PBCH among the groups within each characteristic as shown in Table 9.

Table 8. Tests of homogeneity of variances of PBCH.

Characteristic	Levene Statistic	df1	df2	Sig.
Gender	0.951	1	1475	0.33
Age range	2.961	4	1472	0.019
Marriage	1.537	2	1474	0.215
Monthly income	0.836	3	1473	0.474
Education level	1.267	2	1474	0.282

Table 9. Results of ANOVA.

	Characteristic	Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	2.434	1	2.434	5.157	0.023
	Within Groups	696.743	1475	0.472		
	Total	699.177	1476			
Age range	Between Groups	1.845	4	0.461	0.973	0.421
	Within Groups	697.332	1472	0.474		
	Total	699.177	1476			
Marriage	Between Groups	3.985	2	1.993	4.222	0.015
	Within Groups	695.192	1474	0.472		
	Total	699.177	1476			
Monthly income	Between Groups	1.149	3	0.383	0.808	0.489
	Within Groups	698.028	1473	0.474		
	Total	699.177	1476			
Education level	Between Groups	0.063	2	0.032	0.068	0.934
	Within Groups	699.114	1474	0.474		
	Total	699.177	1476			

The figures in Table 9 show that there are certain differences in the evaluation of PBCH among groups based on the gender and marriage characteristics. From the results in Tables 8 and 9, further tests including independent sample *t*-test for the gender and post-hoc tests for the marriage characteristic were conducted to investigate which groups are different from others. Results of these tests show that: (1) In term of gender, females tend to choose PB foods more than males and (2) In term of marriage, widows/widowers tend to choose PB foods the most while single/divorced group takes the lowest rank. The first finding well matches with the existing stereotypes about PB foods as discussed in Section 2.1 whereas the second finding could be explained by the fact that people tend to take more and more PB diet after they get married because their family lives make them more stressed to earn a good living; especially, those as widows/widowers usually feel wretched in their soul; thus, PB diet works as their moral supports and good remedies for spiritual lives. Practically, in the Vietnamese traditional culture, PB diet can be effectively used as not only a psychological tool for everyone to improve their spiritual life but also a moral support for those in deep grief, emotional mournfulness and especially for those with serious diseases and/or later life. Thus, PB diets should be effectively and widely promoted not only in Southern Vietnam but also in other countries to make human societies better, safer, and more peaceful, to make the Earth greener and more sustainable.

5. Discussion and Conclusions

5.1. Discussion

Our finding of the larger number of females taking PB diet presented in Section 4.1 well agrees with those by Allès et al. [2], Hartmann and Siegrist [176], Barr [3], Schösler et al. [162], Ruby [143], Bedford and Barr [177]. There are several reasons to explain this phenomenon in the case of Vietnamese in general and Southerners in particular. Firstly, there is a common stereotype among Vietnamese, especially Vietnamese males, that PB diets fail to provide enough nutrition and energy for their daily activities. Our practical observation shows that they fail to pay enough attention to prepare good dishes for their PB meals; they only take some cucumbers, or salads, or okras or some simple PB foods with soya sauces because they are too busy to prepare proper PB foods for their meals; consequently, they quickly get hungry after their meals, making them sluggish and unhealthy. As such, many Vietnamese believe that PB diets make them emaciated and stuck in diseases that doctors usually reject for treatment. Secondly, the males also believe that PB diets seriously affect their masculinity; especially having tofu and soya milk in a long time will result in their sterility. Thirdly, it is a culture

that males usually invite their partners to have big meals and drinks to build their business and/or social relationships; thus, PB diets are not their favorite choices. These misconceptions have been completely toppled with the recent findings about the great benefits brought by PB diets as claimed by Matta et al. [178], Allès et al. [2], Dinu et al. [179], Gluba-Brzóška et al. [17], Melina et al. [12], Beezhold et al. [180], Clarys et al. [181], Turney et al. [182], Tonstad et al. [183], Appleby et al. [184], Crowe et al. [185], Beezhold et al. [186], Craig [148], Barnard et al. [187], Veer and Kampman [188], and Appleby et al. [189].

This study also finds insignificant relationship between PB diet and monthly income as shown in Table 9. It is found that age and education have insignificant impacts on PB diet, which further agree with Hartmann and Siegrist [176]. It is because in Southern Vietnam, there are many charity eateries offering cheap PB meals (about USD0.30-USD0.50/meal) so everyone can have a good PB diet regardless of their income. In addition, due to religion-related perspectives, older population tend to enjoy more PB diets but young people are now taking the diets due to their special concerns about their health, their food intakes and environment protection.

Importantly, it is found that though most people fail to fully understand that the human body structures well fit for the PB consumption, they believe that they tend to choose PB foods if they know more about them. A good understanding of the human body structure has the strongest impact on their PB food choice because the food intakes are suitable to body functions. This is one of the key contributions of this study. Therefore, to encourage more people taking PB diets, more scientific reports that clearly analyze the suitability of human body structures and PB foods should be well circulated for the sake of community health. More importantly, as health is found as the second determinant of PB choice, it is strongly recommended that the reports also present the explicit benefits of PB diets so that people will be more confident in choosing PB foods for their meals.

Additionally, this study found the significant impacts of diet knowledge, spirituality and love towards animals on the PB food choice. We suggest to have more talks and/or instructions on how to prepare proper PB diets for good health, how to maintain nutrients during cooking, more discussions about ethical concerns in terms of environment protection, animal rights, spirituality and human soul in taking PB diets, etc. during religious indoctrinations, public health-care consultations by health experts or by health practitioners, or even practical experiences shared by actual vegetarian/vegan who work as typical examples to prove the benefits brought by PB diets. These talks/presentations help to enrich their knowledge about PB diets, nutrition and nutrients to remedy the existing stereotypes mentioned in Sections 1 and 2.1. Doing this will help more people not only recognize the great benefits brought by PB diets but also foster their mercy, philanthropy and compassion. They will know that their PB diets will gradually shift stockmen from breeding to cultivating; thus, the stockmen can still survive and steadily grow on our beloved planet- “Mother Earth”. Nonetheless, living animals are too scared to be killed for a quicker reincarnation as mentioned previously. So, PB diet will not only make all creatures on the Earth enjoy their lives in accordance with the law of nature but also make the Earth greener, safer and more sustainable. The more knowledge of PB diet they obtain, the more PB diets they will have. In fact, as Vietnamese vegetarianism is closely motivated with religious reasons, PB diet can be a testament to individuals’ religious and spiritual dedication [190] as well as compassion [147]. Our practical experience shows that PB diet is the best way to foster human mercy and philanthropy towards all living creatures on the “Mother Earth”. Consequently, the acute awareness of certain religious, spiritual beliefs and diet knowledge will positively affect their dietary choices and help to effectively promote PB diets across human communities. Especially, the opulence of vegetables and fruits in Southern Vietnam is a favorable condition for such promotions to not only the local residents but also foreign visitors.

However, in this study, it is found that social relationships tend to negatively impact on the PB food choice, i.e., those focusing on building social relationships tend to refuse PB foods because few businessmen or businesswomen love to be offered or offer their partners with PB meals. This finding further agrees with Boldt [7], Schosler et al. [162], Sieverding [163] and Hendry

and Reid [171]. Therefore, it is important to create some groups of vegan/vegetarian, or even vegan/vegetarian societies in different places to strengthen and enrich the social relationships among the vegetarian/vegan so that they can do more things beneficial to the local society to earn the public awareness and recognition of PB diets. Such groups or societies should effectively promote PB diets with the key benefits in improving health, reducing risks of diseases, protecting living environment, enhancing humanity towards animals, fostering human mercy and philanthropy, etc. to make our beloved “Mother Earth” sustainably survived. Once more people choose PB foods, PB diets may be widely accepted in the community, resulting in a positive mitigation of its negative impacts on the social relationships.

Importantly, this study also found that the outlook on life has significant impact on the choice of PB foods. People with the viewpoints of a simple life with frugal meals as well as concerns about nature of life tend to choose PB lifestyles. As shown in Figure 3, the outlook on life has close relationships with other factors, such as spirituality, health, the love towards animals, social relationships as well as the understanding of human body structure, etc. Therefore, these factors have their mutual impacts on each other. Practically, it is believed that outlook on life is usually shaped from personal experiences and/or observations from the mentioned perspectives. This indicates that both negative and positive experiences/observations in life significantly impact on the choice of PB foods. It is noteworthy that the outlook on life is a newly proposed factor investigated in this study; hence, it is another key contribution highlighted in this paper.

In short, the choice of PB foods in the case of Southern Vietnam is affected by: (1) Understanding of human body structures; (2) Health concerns; (3) Opulence of PB foods; (4) Social relationships; (5) Diet knowledge; (6) Outlook on life; (7) Spirituality; and (8) Love towards animals. It is interesting that the first letters of the eight factors can be nicely arranged to form a word “**SHOULD**”; that’s why the identified factors are systemized and named as **SHOULD** Model as shown in the paper title. We believe that the **SHOULD** model is a typical model of the determinants of PB food choice not only in the case of Southern Vietnam but also in other regions/communities/countries. Our findings of such factors and the above managerial implications not only help to promote PB lifestyle but also provide rational insights to develop PB food business in practice.

5.2. Conclusions

This study aims at exploring the determinants of plant-based (PB) food choice to promote PB diets across communities because the diets have proved to bring several benefits in terms of human physical health, psychological health, animal rights, environment protection, etc. From an exhaustive literature review, there are seven factors affecting the PB food choice to be investigated in this study, including: health concerns, spirituality, love towards animals, environment concerns, diet knowledge, opulence of PB foods, and social relationships. Besides, in the empirical study in Southern Vietnam, there are other two newly proposed factors, including outlook on life and the understanding of human body structure. From these nine affecting factors, a self-completed questionnaire was created to conduct a formal survey in 10 out of 19 provinces/cities in Southern Vietnam. By using exploratory factor analysis, scale reliability analysis, confirmatory factor analysis, structural equation modelling and *t*-test/ANOVA tests, we found that: (1) among the nine independent factors, only the environment was found insignificant in this study while the other eight perfectly form a so-called **SHOULD** model; and (2) both gender and marriage status have significant impacts on the PB food choice. Importantly, two new factors proposed in this study further fulfill the existing literature about the determinants of PB food choice. From such findings, we proposed some managerial implications to promote PB diets across different regions/communities to make human societies better, safer, and more peaceful, to make the Earth greener and more sustainable.

In spite of the above achievements, future researches on larger population across different communities with similar cultures are encouraged to fully identify possible factors affecting PB food choice to provide a more comprehensive model of its determinants.

Author Contributions: T.-L.N. proposed the research idea and worked with D.H.T., L.T.H., and D.M.Q. to design the study and finalize the measures and analysis methods; T.-L.N. worked on literature reviews, drew the figures; D.H.T., L.T.H., P.N.S. and D.M.Q. took care of human resources for the survey and data collection. T.-L.N. and P.N.S. were in charge of data analysis and drafted their findings. D.H.T. and D.M.Q. wrote the introduction and a part of literature reviews while L.T.H. and P.N.S. focused on the discussion. D.H.T. and L.T.H. revised the manuscript. T.-L.N. double checked the manuscript and D.M.Q. wrote the conclusions as well as the abstract. D.H.T. generally supervised and partially supported this project. D.H.T., L.T.H., P.N.S. and D.M.Q. shared the research budget. All authors have read and agreed to the published version of the manuscript.

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Abbreviations

The following abbreviations are used in this manuscript:

CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CMIN	Chi-square
df	Degree freedom
EFA	Exploratory Factor Analysis
GFI	Goodness of Fit Index
KMO	Kaiser-Meyer-Olkin
PB	Plant-based
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modelling
Sig.	Significance
TLI	Tucker–Lewis Index

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