

THE APPLICATION OF MODIFIED DELPHI METHOD AND AHP TO ANALYZE THE INFLUENTIAL FACTORS OF LEADING VEGETARIANISM TRENDS IN TAIWAN

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ABSTRACT

According to the statistics from Common Wealth Magazine, the populations of vegetarians in Taiwan were about ten percent of populations, which was ranked as the second place in the world. To follow the prosperous trend of vegetarianism, many restaurant enterprises tried to find new managing strategies and changed their model of management and ingredients according to the main factors which led to the trend of vegetarianism. The development of vegetarianism diet may possibly come from religious obedience, from health pursuing or from environmental protection or other various aspects of factors. Therefore, this research was eager to search for the influential factors of leading vegetarianism trends and the relative statistics about the possible factors. In addition, under all possible considerations of resulting in the vegetarianism trends, we tried to analyze the most important factors for people in Taiwan to choose to be vegetarians as a way for their daily eating habit.

To define the reasons to cause the trend of vegetarianism, this research collected both quality and quantity data from domestic and foreign essays and periodicals. Then we used the questionnaire of Modified Delphi Method to collect the opinions from experts to build the basic structure of analytical hierarchy. From the analytical hierarchy structure, we could learn the possible factors for leading the trend of vegetarianism. After finishing the questionnaire of Modified Delphi Method, Analytical Hierarchy Process was applied to find out the relative statistics between factors and finally did the consistency test and arrangement for the importance rank.

The research results showed that the possible factors for leading the trends of vegetarianism in Taiwan were religious factor, health factor, environmental protection factor, mental factor. The results of this research could offer government administration, school lunch nutrition management, vegetarian restaurant enterprises, and individual diet preference selection to use as reference resources for their policy advocacy, research resource, and for people getting to know the new eating life style in Taiwan.

Key words: *Vegetarian, The Trend of Vegetarianism, Analytical Hierarchy Process (AHP), Modified Delphi Method (MDM), statistics analysis.*

1. INTRODUCTION

From the history of biology, medical science, religion, it showed that vegetarianism was very important in human food culture. Nowadays, lots of people worked hard on pursuing the vegetarianism diet. According to the research from the Institute of Food Development Association in 2010, it showed that 10% of populations in Taiwan were vegetarians. The vegetarian populations included vegans, lacto vegetarians and other semi-vegetarians. And there were 2% of vegan populations which had a great proportion in Taiwan's vegetarianism percentage [1]. The vegetarianism diet was quite meaningful for human beings. It was not only a trend of new eating habit but also a brand new transformation of life attitude. However, it was a pity that people in Taiwan usually ignored the important factors and the development background behind the trends of vegetarianism diet. Therefore, this research was going to generalize the influential factors of the trends in vegetarianism diet and the related statistic data. The consequences of this research could provide the objective vegetarianism diet data for governmental health units, medical institutions, food and beverage industries. And it also made human beings introspect their decision towards their diet preferences and had great impact on personal new diet selections. Moreover, this research offered Taiwan government to consider the future advocacy of diet policy and also be an impersonal reference for restaurant management and personal diet decision-making.

2. LITERATURE REVIEW

2.1 Vegetarianism Issues

In the modern society, there were a great number of people choosing vegetarianism for their diet preference. Based on the eastern and western history development of vegetarianism, we could conclude the influential factors of vegetarianism diet preference as followed: religious factors, health factors, environmental protection factors, and mental factors.

2.1.1 Religious Factor

According to the historical records, there were many religious groups, such as Buddhism, Yi-Guan Dao, Taoism, the offshoots of Christianity, some asceticism in the Rome age etc. having the taboos of eating meat in their religious doctrines. People in eastern countries, such as Chinese, Taiwanese, Indians and so on used the way of abstaining from meat, wine, certain vegetables, or animal products to clarify their souls and used fasting ceremony to show their respect to the gods [2]. Nowadays, more and more people in Taiwan chose to be vegetarians because of the spread of religious doctrines. The personal explanation for certain religious principles or mental insights would have great influence on personal diet selection. In addition, the religious doctrines which were inherited from family were also likely to become the reason for people to be vegetarians. Since human beings were group animals, the religious enlightenment from others would possibly have great impact on personal diet selections [3].

2.1.2 Health Factor

As the advanced development of medical science, human beings started to do the research of disease reductions, immunity increasing and life extension. According to the medical study, diet treatments had obvious effects. Therefore, people started to change their diet preference. From the advertisement of restaurants, the slogans on the menu to the book publicized health, it was easy to notice the trends of refusing meat which would lead to cardiovascular diseases or reducing animals fat which would cause obesity[4]. Besides for reducing the incidence of diseases, having healthy appearance was also an important issue for people to concern. Animal fat could not be adequately used by human bodies and accumulated in the organs. Finally, it would gradually cause the inconvenience in actions, appearance change, and even obesity diseases. To prevent those situations, people tried to choose vegetables or fruits as their daily diet to cleanse their body of diseases [5].

2.1.3 Environmental Protection Factor

To avoid ecological catastrophe, people began to have the term “ecological diet” which meant to choose personal diet with the concerning about safety, health and environmental protection. Apparently, to protect the whole ecological system, “ecological diet” asked people to start from doing the correct selections from their daily food [6]. According to the study of International Panel on Climate Change, from industrial revolution until 2007, the concentration of carbon dioxide raised up to 380 ppm [7]. And the researcher, Lu Meng-ming mentioned that the emission of carbon dioxide concentration divided by the whole land area of Taiwan would be ranked the first place of carbon dioxide emission which was the third times of the world’s average [8]. The great amount of ecology and pollution reports made human beings show their consideration for the importance of natural environment. To extend the using period of the Earth and to protect the earth from man-made damage, abiding by vegetarianism was the key to the door of environmental protection. Therefore, it was the responsibilities for all the human beings to advocate maintaining the ecological balance, reducing the heavy burden of the lands and protecting the Earth.

2.1.4 Mental Factor

There were two basic principles, including “Ren” and “Yi” in China. “Ren” meant the benevolence in one’s heart and “Yi” meant mental justice. Those could be defined as the core of eastern morality. “Ren” and “Yi” had great power in the eastern culture. And eastern people put lots of effort on practicing “Ren” and “Yi” during their lifetime. As time went on, the way for people to practice “Ren” and “Yi” had been changed [9]. Some people who chose to obey the doctrines of vegetarianism found great violence and brutality in meat and animal products. The crucial treatment to the animals and the torture to the living creatures would make the dreadful thoughts and terrifying consciousness transform into the toxin in animal products. After people ate or used the animal products, the toxin inside them would hurt people. In addition, the consciousness of killing process would bring endless desire and greediness which would putrefy the human mind. Some people were afraid of killing living creatures. When they ate meat or used animal products, they were terrified out of wits. Hence, some people made up their mind to stop torturing. They tried to use angel’s eyes to see the world and thought carefully about the unnecessary of creature killing. Through evoking their inner sympathy, they avoided the desire and lust [10].

2.2 LITERATURE REVIEW OF THE RESEARCH METHOD

2.2.1 Modified Delphi Method (MDM)

Delphi method was a widely used method to collect data from experts. The method was first designed by Dalkey and Helmer from the US Rand Corporation. By collecting the suggestions from the well-organized communicated groups, experts in the groups could anonymously express their idea to the discussed issues and finally concluded their common view of the issues. Modified Delphi Method was applied to many researches, including lesson-design, requirement assessment, policy decision-making, resource application. The method developed series of selection factors, finding hypothesis and finally combined the theme of related comments. To avoid time consuming and the restriction of human resources and funding, Modified Delphi Method was carried out. This method was modified to make the research to be practiced fluently [12].

2.2.2 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process was developed by a professor from University of Pittsburgh, Thomas L. Saaty in 1971. This research method was a structured technique for organizing and analyzing complex decisions. It used logical and stratified steps to aggregate complex questions. Saaty [11] had mentioned that AHP could be applied in twelve types of questions, including planning, generating a set of alternatives, setting priorities, choosing best policy alternatives, allocating resources, determining requirements, predicting outcomes or risk assessment, designing system, measuring performance, ensuring system stability, optimization, and resolving conflict.

3. RESEARCH METHOD

On the basis of the research background and motivation, the topic of this research is “The Application of Modified Delphi Method and AHP to Analyze the Influential Factors of Leading Vegetarianism Trends in Taiwan.” The main goal of this research is to find out the optimistic statistics of the influential factors, the related data, and the ranking of the major factors.

3.1 Participants

3.1.1 Modified Delphi Method Participants

This research applied Modified Delphi Method as the research method and invited fifteen experts. Among them, three were from academia, five from food industries, three from the government, and three from medical units.

3.1.2 AHP Participants

In this research, the AHP participants were vegetarians in Taiwan. Because of the restrictions of time consuming, and human resources, the research was limited to vegetarians from nine counties in Taiwan including New Taipei City, Taipei, Taoyuan, Hsinchu, Miaoli, Taichung, Tainan, Kaohsiung and Pingtung. The purpose was to understand the specific reasons why people chose to be vegetarians and what the main factors and the particular influential elements inside the main factors were.

3.2 Research Process

The research process was divided into three parts. First, the researcher collected the essay, paper, periodicals and books about Vegetarian Issues, Modified Delphi Method, and AHP. The preliminary study of the literature had great help on classify the possible factors of the leading trends of vegetarianism diet. Second, Modified Delphi Method was applied to start the semi-open questionnaires. The professional suggestions from experts in various areas were collected and the preliminary hierarchy framework was done under this method. In the last step, AHP was applied to analyze the main factors and influential criteria. The process of the research was as followed:

- STEP 1. Study the background knowledge of the research topics and collect related data.
- STEP 2. Literature Review.
- STEP 3. Modified Delphi Method was applied to develop the framework of preliminary hierarchy.
- STEP 4. Use AHP to analyze the influential factors of leading vegetarianism trends in Taiwan
- STEP 5. Analyze the consequences of the research and discuss.
- STEP 6. Conclusion

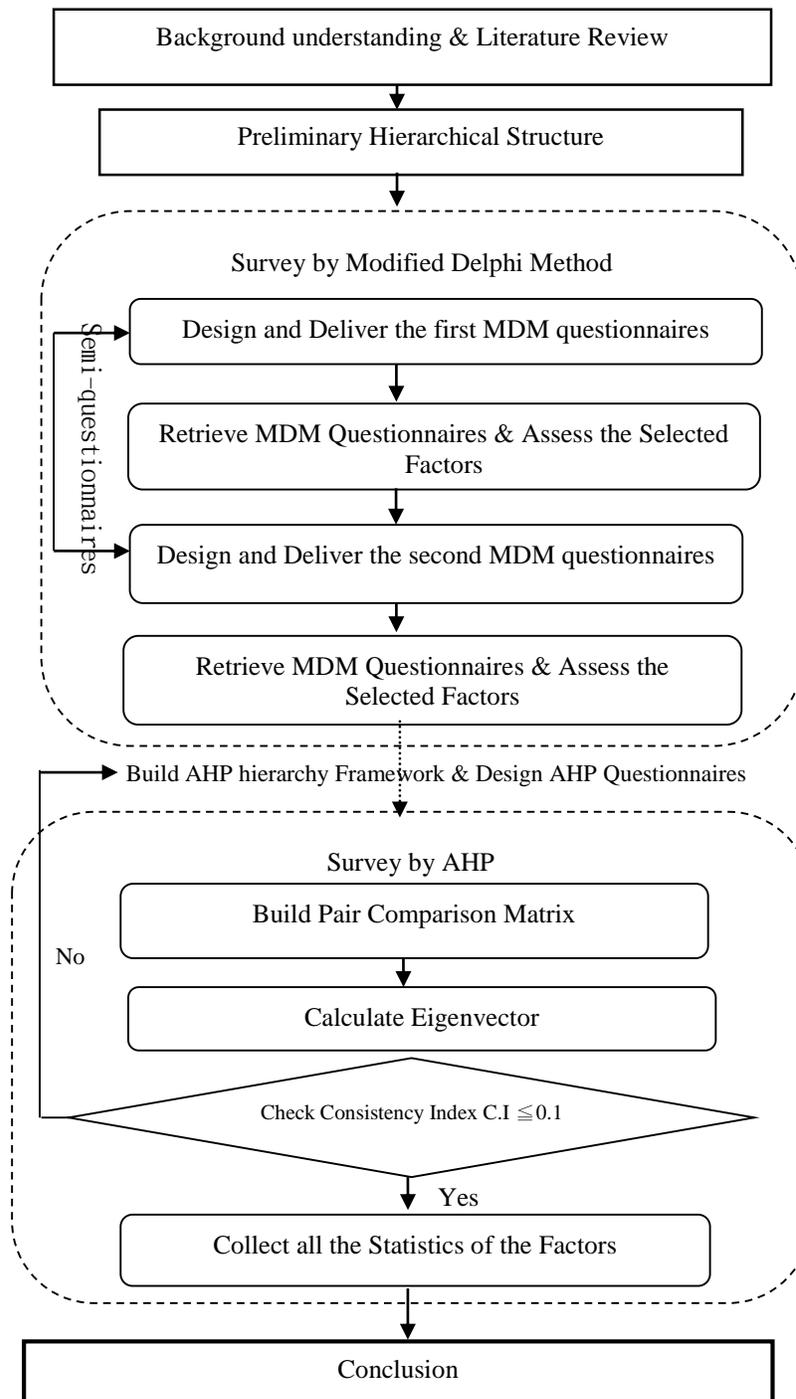


Fig1. Research Flow Chart.

3.3 The Development of Hierarchical Structure

This research collected the influential factors of leading Vegetarianism Trends in Taiwan from the literature review and preliminarily set up the hierarchical structure. The five main criteria in the hierarchical structure were “Religious Factor”, “Health Factor”, “Environmental Protection Factor”, “Mental Factor” and “Cultural Factor.” The Modified Delphi Method was applied to do the expert questionnaires and was used to check the appropriateness of the main factors. The valid response rate of the first expert questionnaire was 100%. The Five-point Likert scale was applied to analyze the consequences of the MDM questionnaires. It turned out that some sub-criteria’s averages were lower than 3.5 or the standard deviation was over 1, such as “Job Factor” in “Religious Factor”, “Losing Weights” in “Health

Factor”, and the whole three sub-criteria in “Cultural Factor.” Therefore, the five sub-criteria would be deleted from the hierarchical structure. And the expert support of the other assessed sub-criteria were more than 75%. The convergence was up to three-quarters. Therefore, except the 5 deleted sub-criteria, the 11 initial assessment factors were involved in the preliminary hierarchy framework of this study.

On the basis of the first round MDM questionnaire, the second round expert questionnaire was designed and delivered to seek for the further confirmation and suggestions from experts in various areas. The valid response rate of the second expert questionnaire was 100%. And the expert support of the other assessed sub-criteria were more than 76%. The 4 preliminary assessment factors and 11 preliminary assessment sub-factors were involved in the hierarchy framework of this study. See Table 1 The First Round Expert Questionnaire: Expert Support of Additional Assessed Criteria and Table 2. The Second Round Expert Questionnaire: Expert Support of Additional Assessed Criteria.

Table 1. The First Round Expert Questionnaire: Expert Support of Additional Assessed Criteria.

Objectives	Criterion	Statistics (Average/ Percentage)	Standard deviation	Sub-criterion	Statistics (Average/ Percentage)	Standard deviation	Save/ Delete
The Influential Factors of Leading Vegetarianism Trends in Taiwan	Religious Factors	4.60 (92%)	0.73	Personal Value	4.13 (82.6 %)	0.834	Save
				Third Party Influence	3.86 (77.2%)	0.834	Save
				Family Influence	4.06 (81.2%)	0.961	Save
				Job Factors	2.93 (58.6 %)	0.884	Delete
	Health Factor	4.33 (86%)	0.61	Reducing Disease	4.46 (89.2 %)	0.640	Save
				Extending Life	4.06 (81.2%)	0.884	Save
				Losing Weight	3.80 (76%)	1.014	Delete
	Environmental Protection Factors	4.26 (85%)	0.88	Reducing Greenhouse Effect	4.46 (89.2 %)	0.640	Save
				Reducing Land Load	4.06 (81.2 %)	0.961	Save
				Strengthening Ecological Conservation	4.13 (82.6 %)	0.834	Save
	Mental Factors	3.60 (72%)	0.82	Practicing morality	4.06 (81.2%)	0.961	Save
				Eliminating fear	3.53 (70.6 %)	0.915	Save
				Reducing Desire	3.80 (76 %)	0.862	Save
	Cultural Factors	2.53 (50%)	0.91	No-killing Theory	3.46 (69.2 %)	0.994	Delete
Reincarnation Theory				3.00 (60 %)	1.369	Delete	
Fraternity Theory				2.46 (49.2 %)	1.216	Delete	

Table 2. The Second Round Expert Questionnaire: Expert Support of Additional Assessed Criteria.

Objectives	Criterion	Statistics (Average/ Percentage)	Standard deviation	Sub-criterion	Statistics (Average/ Percentage)	Standard deviation	Save/ Delete
The Influential Factors of Leading Vegetarianism Trends in Taiwan	Religious Factors	4.66 (93.2%)	0.488	Personal Value	4.13 (82.6 %)	0.743	Save
				Third Party Influence	3.86 (77.2 %)	0.640	Save
				Family Influence	4.40 (88 %)	0.737	Save
	Health Factor	4.53 (90.6%)	0.516	Reducing Disease	4.53 (90.6 %)	0.640	Save
				Extending Life	3.80(76%)	0.862	Save
	Environmental Protection Factors	3.86 (77.2%)	0.915	Reducing Greenhouse Effect	4.00 (80 %)	0.743	Save
				Reducing Land Load	3.93 (78.6 %)	0.676	Save
				Strengthening Ecological Conservation	4.33 (86.6 %)	0.816	Save
	Mental Factors	4.13 (82.6%)	0.743	Practicing morality	4.26 (85.2 %)	0.704	Save
				Eliminating fear	3.86 (77.2 %)	0.834	Save
				Reducing Desire	3.80 (76%)	0.676	Save

Based on the typical of the analytic hierarchy (AHP) chart, this research designed the decision-making hierarchy structure and develop the decision-making framework. See Fig2. And the description of criterion for decision-making was shown in Table3.

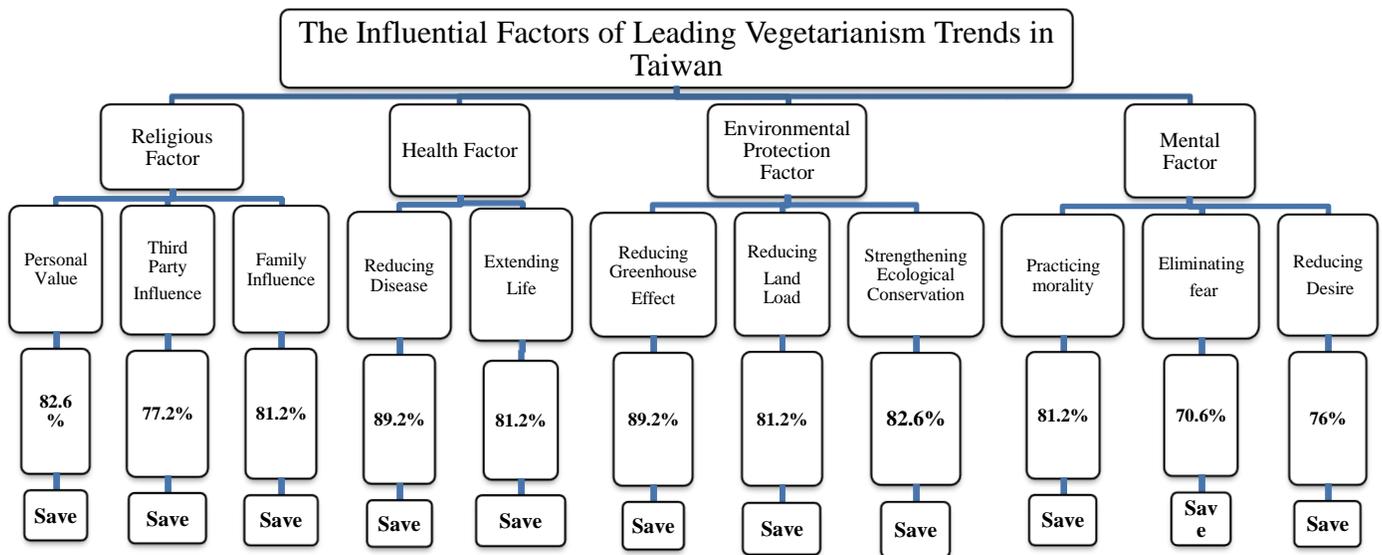


Fig2. Decision-making Framework.

Table 3. Description of Criterion for Decision-making.

Religious Factor	Personal Value	It's a personal view point toward certain religious doctrine. Without other people's influences, people accept the vegetarianism doctrines regulated by certain religion.
	Third Party Influence	Through other people's introductions toward certain religion, people start to accept the vegetarianism doctrines and start to obey.
	Family Influence	Family members have believed in certain religion for a long time. To follow the religion as family tradition, people accept the religion's vegetarianism doctrines.
Health Factor	Reducing Disease	There are more and more modern civilized diseases nowadays. To prevent from contracting the diseases, people try to follow the diet regulated by vegetarianism and avoid eating unhealthy meat.
	Extending Life	With the development of medical technology, people start to pay attention to extend their life. For life extension, some people try to follow vegetarianism as a way to increase life expectancy.
Environmental Protection Factor	Reducing Greenhouse Effect	Human beings' diet preference of meat leads to increase a large number of captive animals which discharge great number of greenhouse gas "carbon dioxide." The greenhouse gas results in raising temperature on Earth surface, glacial melting, rising sea-level and indirectly causing animal habitat destruction. To avoid this situation, people try to change their meat diet preference to vegetarianism.
	Reducing Land Load	People need 5 to 7 kilograms of grains to get 1 kilo of meat. This is an unbalanced proportion. To forbid excessive consumption of natural resources, people try to follow vegetarianism to only have natural food.
	Strengthening Ecological Conservation	To respect species structure and emphasize on biological balance, people refuse to have meat and follow vegetarianism to protect the whole ecological system.
Mental Factor	Practicing morality	To practice the two basic principles "Ren" and "Yi" in Confucianism, people try to follow vegetarianism.
	Eliminating fear	People have fear for animal products or eating meat. When they eat meat, blood, brutality, savagery come to mind. To avoid the terrifying situation, people choose not to have animal meat and obey the doctrines of vegetarianism.
	Reducing Desire	People hope to make their six sensations be pure and clean. Hence, people follow vegetarianism to pursue the heart without greedy, prurience and lust.

4. RESEARCH ANALYSIS

AHP was applied in this research. Based on the induction and conclusion of the Modified Delphi Method, this research applied AHP to do the regional study and snowball sampling in Taiwan. The AHP questionnaire was designed and delivered in three districts of Taiwan, including northern Taiwan, central Taiwan and southern Taiwan. 30 AHP questionnaires were delivered in each districts. Therefore, there were 90 AHP questionnaires in total. Through the contact with vegetarians or religious groups which followed the doctrines of vegetarianism, the researcher successfully found 90 respondents who were willing to fill in the AHP questionnaire and give suggestions. In addition, for the convenience of filling in AHP questionnaires and raising the valid response rate, the researcher sent every AHP questionnaire to the questionnaire respondents or explained the research objectives in person. The releasing time of AHP questionnaire is from December 1st to December 31, 2016. In the 90 AHP questionnaires, 84 are valid questionnaires and 6 were invalid questionnaire. The valid response rate of the AHP was 93%.

4.1 AHP Analysis

The AHP questionnaire was divided into three parts. The first part is the research goal. The purpose of this research is to analyze the influential factors of leading vegetarianism trends in Taiwan. The second part is the objectives including "Religious Factor", "Health Factor", "Environmental Protection Factor" and "Mental Factor." And the third part is 11 criterions including "Personal Value", "Third Party Influence", "Family Influence", "Reducing Disease", "Extending Life", "Reducing Greenhouse Effect", "Reducing Land Load", "Strengthening Ecological Conservation", "Practicing morality", "Eliminating fear", and "Reducing Desire." The criterions' comprehensive weights are showed in the Table 4.

Table 4. The Criteria's Comprehensive Weights.

The Criteria's Comprehensive Weights						
	Criterion	Criterion Weights	Sub-criterion	Sub-criterion Weights	Comprehensive Weights	
The Influential Factors of Leading Vegetarianism Trends in Taiwan	Religious Factor	0.424	Personal Value	0.624	0.265	
			Third Party Influence	0.205	0.086	
			Family Influence	0.172	0.072	
			total	1	total	0.423
			C.I.=	0.027	C.R.=	0.046
	Health Factor	0.349	Reducing Disease	0.822	0.286	
			Extending Life	0.178	0.062	
			total	1	total	0.348
			C.I.=	0.000	C.R.=	0.000
	Environmental Protection Factor	0.125	Reducing Greenhouse Effect	0.509	0.063	
			Reducing Land Load	0.207	0.025	
			Strengthening Ecological Conservation	0.284	0.035	
			total	1	total	0.123
			C.I.=	0.002	C.R.=	0.003
	Mental Factor	0.102	Practicing morality	0.6	0.061	
			Eliminating fear	0.253	0.025	
			Reducing Desire	0.148	0.015	
			total	1	total	0.101
			C.I.=	0.054	C.R.=	0.093
	The Total of Comprehensive Weights				1	
C.I.=		0.083		C.R.=		0.092

4.2 The Rank of AHP Criteria

In the process of AHP analysis, with the use of the rating scale, the consequences of AHP questionnaire were digitized into a digital form that could be processed by a computer and then compared every two factors and built the comparison matrix of the criteria. The geometric mean and the comprehensive weights would be extracted from the comparison matrix. The final step was to rank the AHP criteria. With the ranking of the AHP criteria, the importance of the influential factors about leading vegetarianism trends in Taiwan would be presented, shown in Table 5.

Table 5. The Rank of Criteria.

Criterion	Comprehensive Weights	Sub-criterion	Sub-criterion Weights	Comprehensive Weights	Rank
Religious Factor	0.424	Personal Value	0.624	0.2645	2
		Third Party Influence	0.205	0.0869	3
		Family Influence	0.172	0.0729	4
Health Factor	0.349	Reducing Disease	0.822	0.2868	1
		Extending Life	0.178	0.0621	6
Environmental Protection Factor	0.125	Reducing Greenhouse Effect	0.509	0.0636	5
		Reducing Land Load	0.207	0.0258	9
		Strengthening Ecological Conservation	0.284	0.0355	8
Mental Factor	0.102	Practicing morality	0.600	0.0612	7
		Eliminating fear	0.253	0.0258	9
		Reducing Desire	0.148	0.0150	11

According to the final results of the AHP analysis, it showed that vegetarians in Taiwan considered the top 3 important factors of leading vegetarianism trends were “Reducing Disease”, “Personal Value” and “Third Party Influence.” Moreover, the criterion of “Religious Factors” got 0.424 comprehensive weights which were more than 40 percent of all.

To sum up the ranking of all the criterion weights, the top one was the sub-criterion “Reducing diseases” and the second place was “Personal Value.” These two got 55% of the comprehensive weights. Therefore, this research regarded these two criteria as the most important influential factors of leading vegetarianism trends in Taiwan. And the ranking from the third place to the eighth place which got 30% of the comprehensive weights were regarded as the second important influential factors. And the rest three sub-criteria “Eliminating fear”, “Reducing Land Load”, and “Reducing Desire” which only got 15% of the comprehensive weights would be taken as the less important influential factors, shown in Table 6.

Table 6. The Importance of Criteria.

Rank	The Degree of Importance (Percentage)	Sub-criterion	Comprehensive Weights	Criterion
1	High Degree of Importance 55%	Reducing Disease	0.286	Health Factor
2		Personal Value	0.265	Religious Factor
3	Moderate Degree of Importance 30%	Third Party Influence	0.086	Religious Factor
4		Family Influence	0.072	Religious Factors
5		Reducing Greenhouse Effect	0.063	Environmental Protection Factor
6		Extending Life	0.062	Health Factor
7		Practicing morality	0.061	Mental Factor
8		Strengthening Ecological Conservation	0.035	Environmental Protection Factor
9	Low Degree of Importance 15%	Eliminating fear	0.025	Mental Factor
10		Reducing Land Load	0.025	Environmental Protection Factor
11		Reducing Desire	0.015	Mental Factor

5. CONCLUSION

With the change of time, the world food culture become more diverse. The historical background, various religion and cultural customs might have great influence on diet of a place. How did vegetarianism trends permeated through the food culture? And what was the reason to lead vegetarianism trends? On the basis of these questions, the research used vegetarians in Taiwan as the study samples and studied the main factors of leading vegetarianism trends in Taiwan. By applying Modified Delphi Method and AHP, we found out the importance and the ranking of the influential factors. Hope that the results would offer Taiwan government, medical units, School Health Unit, restaurant industries operators and even individuals as a resource for the future policy advocacy, personal diet decision-making and restaurant management.

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