



A Study of Investigating Adolescents' Eating out Behavior by Using Analytic Hierarchy Process

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ABSTRACT

The main purpose of this study is to understand the factors affecting adolescents' eating out behavior, as well as to develop scientific principles for selection of factors affecting adolescents' eating out behavior. According to literature review and expert questionnaire survey, this study obtained the factors affecting adolescents' choice to eat out, and used these factors to establish the Analytic Hierarchy Process (AHP) hierarchical structure. This study used AHP to calculate the weight of factors affecting adolescents' choice to eat out, as well as to develop the principles for selection of factors affecting adolescents' eating out behavior. The research results can be provided as important reference for curriculum design and content of nutrition education and consumer education for adolescents, and suggestions on relevant planning can be provided for administrative units and health units.

Keywords: analytic hierarchy process, eating out behavior, dietary pattern, adolescents

INTRODUCTION

In recent years, due to the change in social pattern and the improvement of standard of living, dietary pattern has also changed, and the opportunity for most of the families to eat out has also increased (Coutinho, et al, 2016). Dietary intake concept can be improved from family and education (Pearson and Biddle, 2011). During elementary school stage, the supply of family prepared food and nutritious school lunch is common. Due to maturation and after-school tutoring, in addition to the options of family prepared food, lunch box, and group meals, adolescents may also have to eat out with peers (Moreno, et al, 2010). The opportunity to eat out and purchase food increases significantly. When adolescents face the factors affecting the selection of food, food perception and food consumption behavior have become relatively important (Ambrosini, et al, 2012).

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State of the literature

- This study investigated the factors affecting adolescents' eating out behavior.
- Delphi method and Analytic Hierarchy Process were used to evaluate the importance of factors affecting adolescents' choice to eat out.
- The results showed that adolescents attached the highest importance to individuals, family, and external environment factor during the choice to eat out.

Contribution of this paper to the literature

- The research results could be provided as important reference for curriculum design and content of nutrition education and consumer education for adolescents.
- Suggestions on relevant planning could be provided for administrative units and health units.
- This study combined with the practice and theorem to facilitate future inferences and follow-up research.

Because adolescents usually choose food according to their own preferences, it is common that they tend to choose high-calorie and deep-fried food and sugary drinks that are unfavorable to health (Kim, et al, 2016). However, to adolescents, this stage is a transitional stage where they learn dietary choices and independent choices (Cutler, et al, 2011). Although the curriculum guidelines of Ministry of Education for elementary school, junior high school, and senior high school all set up educational goals concerning food and consumption themes, the research direction and theme of this study are to investigate the factors affecting the decision-making of eating out and food choices of adolescents when they actually face choices (Spendlove, et al, 2015). It is hoped that the research results can be provided as important reference for teaching adolescents about dietary nutrition and consumer education.

LITERATURE REVIEW

Analytic Hierarchy Process (AHP) was a series of systematic decision-making model developed by T. L. Saaty in 1971. AHP aims to resolve the difficulties faced during decision-making and is mainly applied to uncertain situation and decision-making concerning evaluation criteria (Saaty, 1980). AHP can be used to develop several relevant hierarchical structures of various factors affecting the complicated decision-making. The correlation tree of various hierarchical factors was formed, and this study used definition scale to perform a pairwise comparison on factors, to determine the relevant importance of factors. Afterwards, this study used linear algebra and had experts to compare the factors of the same hierarchy to find out the relevant importance of decision-making factors compared with the upper hierarchy and the highest hierarchy, which could be viewed as priority. The relevant important priority of each factor was calculated hierarchy by hierarchy. In the end, the weight of various factors affecting the goal of decision-making system could be calculated (Dyer, 1990).

The calculation procedures of the AHP are as follows:

Step 1: Before the questionnaire was completed, the researcher would explain how to complete the questionnaire and provide examples to enable the subjects to easily understand how to complete it and save the time to complete it. In order to efficiently complete the questionnaire, the researcher would enable the subjects to understand that the evaluation value was obtained based on the pairwise comparison of various hierarchies of AHP and tick the boxes according to the relevant importance of indices of various hierarchies.

Step 2: Development of pairwise matrix: This study performed pairwise comparison of the importance of factors, and obtained the relevant importance of factors based on the questionnaire results to develop the pairwise comparison matrix.

Step 3: Calculation of eigenvalues and priority vectors: After pairwise comparison matrix was obtained, the weight of various hierarchical factors could be calculated. Eigenvalue of numerical analysis was usually used to calculate the priority vector.

Step 4: Consistency test: This study used the consistency ratio of AHP to evaluate and calculate the consistency index (C.I.) and consistency ratio (C.R.), in order to determine the consistency among various factors of a single hierarchy.

Step 5: Calculation of overall hierarchical weight: This study used the formula of "row vector average standardization" to calculate the average of each column of matrix A first to develop matrix B. Afterwards, this study standardized matrix B (the value of each column divided by the sum of the row) to obtain the weight matrix W (Saaty, 2008).

METHODOLOGY

The purpose of this study is to investigate the factors affecting adolescents' eating out. This study used Delphi method and AHP as the research methods to confirm the issues, establish the evaluation criteria, and set up the weight. Moreover, this study also set up the hierarchical weight of factors affecting adolescents' eating out based on the questionnaire results.

Establishment of evaluation criteria

This study used the criteria obtained from expert interview to design the pre-test questionnaire of selection of factors, and then used 5-point Likert scale to screen the criteria. After the evaluation criteria that have no effect were screened, this study used AHP to develop the structures of criteria and sub-criteria.

Expert interview and expert pre-test questionnaire

This study used Delphi method and brainstorming to perform interviews with experts. According to the literature review, this study summarized the factors affecting eating out behavior and developed an open-ended questionnaire. The open-ended questionnaire was used to understand relevant factors affecting adolescents' eating out behavior and collect and

summarize interview data. This study performed statistical frequency analysis on the interview content and the factors proposed by experts. This study found out the importance of relevant factors according to their frequency, and summarized hierarchical factors, relevant factors and criteria to develop the pre-test questionnaire according to the results (Linston and Turoff, 1975; Vidal, et al, 2011).

This study developed the pre-test questionnaire according to the returned expert questionnaire. This study used Likert scale for scoring the pre-test questionnaire. 5-point Likert scale was used for scoring every factor, and points 1 to 5 were used to score the strength of correlation of every evaluation criterion (Vaidya and Kumar, 2006). The experts scored the evaluation factors according to their influence on eating out. This study designed the semi-closed questionnaire where there is a field of "Other Suggestions." The experts who received interviewed could fill in their suggestions or comments on revisions of criteria as reference for this study (Subramanian and Ramanathan, 2012).

This study used statistical methods to screen the factors with a mean of importance greater than 3.5 for the final compilation of questionnaire. After the questionnaires were returned, and the statistics of experts' comments were collected, this study deleted the items with a mean less than 3.5, and developed the hierarchical structure of factors affecting adolescents' choice to eat out.

Questionnaire design and research subjects

According to the statistical results of expert interviews, this study developed the hierarchical structure of factors affecting adolescents' choice to eat out. This study used AHP to design the formal questionnaire of tick boxes of pairwise comparison on weight ratio for the subjects to complete. This study selected a certain senior high school as the study site where there are a total of 30 classes. Grade 1, 2, and 3 includes 10 classes, respectively. There are 406 male students and 745 female students, with a total of 1,152 students. This study used stratified random sampling to sample 3 students from each class. After the questionnaires were distributed, 90 questionnaires were returned.

RESEARCH RESULTS

Hierarchical structure analysis on selection of factors

This study summarized the factors affecting adolescents' eating out behavior according to the literature review, and designed the first "expert open-ended questionnaire." A total of 5 experts who have an in-depth understanding of adolescents' dietary consumption were invited to receive the interviews, and the statistics of factors proposed by them for more than 3 times were taken into account. Moreover, this study used 5-point Likert scale for scoring, and used the evaluation criteria for important factors to design the second expert pre-test questionnaire. Factors with a score greater than 3.5 assessed by the experts were used in this study. A total of 4 categories and 16 items were summarized in detail as shown in [Table 1](#).

Table 1. Selection of relevant factors affecting adolescents' choice to eat out

Hierarchy 1	Hierarchy 2	Hierarchy 3
Goal	Main Criteria	Sub-criteria
Factors Affecting Adolescents' Choice to Eat Out	A. Individuals, family and external environment	A1. Economic capacity and amount of allowance
		A2. Peers and friends
		A3. Attention to dining at home and habit
		A4. Convenience of eating out
		A5. Opportunity and experience of eating out
	B. Need and motivation	B1. Physiological need
		B2. Psychological need
		B3. Habit
		B4. Convenience of eating
	C. Product information	A1. Business signs and recommended certification
		A2. Price
		A3. Promotion and premium
		A4. Product endorsement and advertising
	D. Decision-making capacity of product consumption	D1. Safety and health conditions
		D2. Overall perception of product
		D3. Calorie concept

Questionnaire analysis

Analysis on the importance of main criteria for selection of factors affecting adolescents' choice to eat out

This study analyzed the questionnaire result of the main criteria, and performed pairwise comparison of 4 main criteria. According to the AHP formula, this study calculated the weight of 4 main criteria. The pairwise comparison of the main criteria is shown in **Table 2**.

According to the calculation result, C.I. = 0.0784 < 0.1, C.R. = 0.0871 < 0.1, suggesting that there was consistency among main criteria. After the AHP analysis on the summarized questionnaire data, the index to which the highest importance was attached was individual, family, and external environment factor (weight = 0.4964), followed by need and motivation (weight = 0.2613), product information (weight = 0.1284) and decision-making capacity of product consumption (weight = 0.1139).

Analysis on the importance of sub-criteria for selection of factors affecting adolescents' choice to eat out

According to the calculation method mentioned above, this study analyzed the importance of sub-criteria as shown in **Table 3**.

Table 2. Analysis on the importance of main criteria

	Individuals, family and external environment	Need and motivation	Product information	Decision-making capacity of product consumption	Weight	Order
Individuals, family and external environment	0.527091	0.664818	0.403299	0.390588	0.4964	1
Need and motivation	0.154495	0.194864	0.411848	0.283806	0.2613	2
Product information	0.147769	0.053495	0.113064	0.199154	0.1284	3
Decision-making capacity of product consumption	0.170645	0.086823	0.071789	0.126452	0.1139	4

Table 3. Analysis on the importance of sub-criteria

Main Criteria	Weight	Sub-criteria	Weight of Sub-criteria	Comprehensive Weight	Order
Individuals, family and external environment	0.4964	Economic capacity and amount of allowance	0.4190	0.2080	1
		Peers and friends	0.1881	0.0934	4
		Attention to dining at home and habit	0.2126	0.1055	3
		Convenience of eating out	0.1085	0.0539	6
		Opportunity and experience of eating out	0.0718	0.0356	11
Need and motivation	0.2613	Physiological need	0.5130	0.1340	2
		Psychological need	0.1868	0.0488	8
		Habit	0.1839	0.0481	9
		Convenience of eating	0.1162	0.0304	12
Product information	0.1284	Business signs and recommended certification	0.3583	0.0460	10
		Price	0.3966	0.0509	7
		Promotion and premium	0.1822	0.0234	14
		Product endorsement and advertising	0.0794	0.0102	16
Decision-making capacity of product consumption	0.1139	Safety and health conditions	0.6455	0.0735	5
		Overall perception of product	0.2194	0.0250	13
		Calorie concept	0.1351	0.0154	15

As a result, after the weights of 4 main criteria and 16 sub-criteria were obtained, in terms of sub-criteria, students attached the highest importance to the economic capacity and amount of allowance of individuals, family, and external environment factor. The highest score among the 16 sub-criteria was 0.2080, followed by the physiological need of need and motivation factor (0.1340), attention to dining at home and habit, which also belonged to the main criterion of individuals, family, and external environment (0.1055).

The results above showed that, during the choice to eat out, adolescents attached the highest importance to individuals, family, and external environment factor. In terms of main criteria, the weight of individuals, family, and external environment was 0.4964, suggesting that its importance was high (highest score). During the investigation on the single factors, the basic analysis on individuals, family, and external environment showed that adolescents attached the highest importance to economic capacity and amount of allowance. The basic analysis on the need and motivation showed that adolescents attached the highest importance to physiological need. The basic analysis on the need and motivation factor showed that adolescents attached the highest importance to physiological need. The basic analysis on the product information factor showed that adolescents attached the highest importance to price. The analysis on the decision-making capacity of product consumption showed that adolescents attached the highest importance to safety and health conditions.

CONCLUSION

This study used AHP to evaluate the importance of factors affecting adolescents' choice to eat out. According to the analysis, the concepts of consistency were obtained. This study reached the following conclusions:

First, adolescents still attached the highest importance to economic factor. The weight of economic capacity and amount of allowance was 0.2080, while the price of product was 0.0509, suggesting that adolescents still attached the highest importance to economical consideration. Economy has a direct effect on the choice to eat out.

Second, the factor in the second place was physiological need (0.1340). This result is consistent with Maslow's argument – once a lower level of need is met, it can further advance to a higher level of need for satisfaction. In terms of dietary consumption, consumers will not take into account other factor until their physiological need of starvation is meet first.

Third, the factor in the third place was attention to dining at home and habit (0.1055). Family's dietary habit has a direct effect on adolescents' dietary consumption. Individual dietary habit and establishment of tastes are significantly correlated with their family members.

Fourth, the factor in the fourth place was the influence of peers and friends (0.0934). Peer group is significantly correlated with dietary behavior, suggesting that adolescents mainly purchase food under the company of peers.

Fifth, the factor in the fifth place was safety and health conditions (0.0735), suggesting that adolescents viewed safety and health as the important factor during the choice of food.

Finally, the research results of this study can be provided as important reference for curriculum design and content of nutrition education and consumer education for adolescents, and suggestions on relevant planning can be provided for administrative units and health units.

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