

Habitual tendency, cooking methods, and development of food choices behavior

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Abstract

Background: The purpose of this study was to investigate students' preference for food prepared in university dining halls. The students' understanding of cooking methods and related health states based on their food choices were also examined.

Methodology: A quantitative research method was employed using a one-way analysis of variance. The conceptual model of food choice was used to determine the reasons for students' preferences for campus food. The study was conducted from September to November 2018; six cooking methods were identified and a record of 98 meals was captured for investigation. Undergraduate students were invited to participate in the investigation and 461 were retained for analysis. Results: Stir-frying is a common method in food preparation, followed by frying. Students had a strong preference for food prepared by baking, frying, and boiling. Less preference was seen for food prepared by steaming and stir-frying. Freshmen students were in favour of college food but their interest declined when they reached senior level. An unhealthy food choice understanding was observed. This understanding may indicate unhealthy perceptions of food intake. Such unhealthy food choice habit does not decrease with increasing age.

Conclusion: The food choice decision involves a complex cognition process towards food understanding, mindset, and previous experiences. It will be an undesired consequence if unhealthy food choices are being reinforced because of the unhealthy or not preferred methods of food preparation. This study's findings indicate such connections, and future studies should analysing food processing and health development.

Keywords: Food choice; Cooking method; Health understanding; Campus food; Food preference; Habitual tendency

1. Introduction

The European Food Information Council (EUFIC) [1], in their official webpage, mentions food choice as people's deciding factor on what to buy and eat. Food choice involves a complex set of factors that vary from person to person; it is influenced by a person's economic background, culture, heritage, and experiences in upbringing [1-2]. Food choice behaviour also relates to an understanding of ingredients, habits of eating, specific preferences in taste, and religious reasons [1,3]. At times, it also depends on mood or other factors such as appetite, time, or dietary constraints.

Furst et al. [4] conducted a study and proposed a conceptual model of food choice. In this model, influencing factors for food choice include processes that a person has learnt, mindset gained from previous experiences, and judgement developed over time through various food understandings. Food information such as food nature (information

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pertaining to nutritional value and health benefits), food processing (cooking and preparation method), and food quality (colour, aroma, and taste) appear to be important cues for decision-making. Nevertheless, it is interesting to learn that people do not follow a rational decision-making process. Decisions on food choice and consumption are, at times, irrational [5]. For example, Wansink [6] observed that plate size has an influence on food consumption. Araya et al. [7] researched food labels and found that the warning labels decreased the probability of purchase, especially for breakfast cereals, but had no impact on the purchase of chocolates or cookies. Braithwaite et al. [8] observed a relationship between fast-food consumption in children and adults. When fast-food consumption was high in childhood, there was a trend of increasing rates of fast-food consumption in adolescence. Nutrition seems to be an important factor in food consumption but not a prerequisite in food choice. A decision in food choice is a result of the interactive process that involves a person's cognitive understanding and experiences regarding cues on food nature, cooking methods, food processing, eating atmosphere, and meal costs [9-11]. Once a person develops such a behaviour, a habitual tendency occurs and dominates the decision-making regarding food choice.

The development of this habitual tendency tends to relate to a person's preferences, beliefs, and religious and cultural practices in food experiences. When habitual tendency occurs, many essential factors in food choice are negated. For example, Nolan and Jenkins [12] suggested that this irrational belief in food consumption had an association with an increase in BMI. Fernandes et al. [13] observed that only a few individuals in their study reported the use of calorie information on menus as a method to control food intake or body weight. Several attempts have been made by different researchers [14-17] to focus on, for example, the importance and popularity of ethnic food consumption. Information from these studies may indicate the occurrence of habitual tendency for some preferences for food choice, and this tendency is sometimes stubbornly followed with irrational thoughts on food choice. This study attempts to understand this habitual tendency. It was conducted in Macau, with where the population is mainly comprised of Chinese inhabitants from Guangdong. Some college students were invited to evaluate Chinese ethnic cuisines, cooked through six common cooking methods in Guangdong. The study aimed to determine the development of tendency in food choice and related health issues in youth.

2. Cooking Methods and Nutrition

Food processing is a vital factor in consumers' food choices. Foods with different cooking methods produce distinct chemical reactions [18]. Changes in the content and type of compounds in food, such as vitamin C (VC), anthocyanin, and total glucosinolates, may occur [19-22]. Yuan et al. [18] asserted that such changes largely affect the physiological functions of the human body, thereby affecting human health. However, retention of health-promoting components and nutrients has received less attention from consumers while choosing dishes as compared to personal preferences [5]. Therefore, consumers should have a strong perception of the effects of cooking methods on food nutrition before choosing a cuisine.

With respect to cooking methods and nutrition, many empirical studies have been conducted on certain ingredients. Xu et al. [23] studied the effects of five domestic cooking methods on the nutritional attributes of red cabbage; Yuan et al. [18] tested the effect of five cooking methods on the nutritional quality of broccoli; Kao et al. [19] examined the impact of three distinct Chinese domestic cooking methods on the health-promoting compounds of 25 fresh vegetables; and Lixin [24] studied the influence of different cooking methods on the nutrition of wild vegetables. These studies suggest that cooking methods that use less water and time, such as steaming, are good for retaining nutrients in food. Otherwise, stir-frying and boiling may cause a large reduction in nutrients, such as total phenolic, VC, free radical-scavenging compounds, and total soluble sugar [18,23]. With regard to baking, scholars have different views of its effects on health. Some believe that baking increases the content of acrylamide in food, which has many toxic properties such as neurotoxicity, genotoxicity, carcinogenicity, and reproductive toxicity [21,22]. Furthermore, Keramat et al. [22] have suggested that bakery products account for approximately 20% of human exposure to acrylamide. Conversely, Raatz et al. [25] conducted a baking test on salmon and found that the process did not reduce the content of n-3 polyunsaturated fatty acids, which can decrease the risk of cardiovascular disease, indicating that baking salmon is an acceptable preparation method for health benefits. Although various studies have been conducted to test the effects of cooking methods on food nutrients, the effects can only be measured approximately, not accurately.

In summary, stir-frying, boiling, and frying may not seem to be healthy cooking methods, as they would result in the leaching of more nutrients and health-promoting compounds, such as VC, from the prepared food as compared with other common methods [18,26-27]. With respect to healthy cooking methods, Yuan et al. [18] suggested that steaming is the best cooking treatment, as it does not cause any significant loss in the total content of nutrients and health-promoting compounds such as VC, carotenoids, and polyphenols. The purpose of this study was to determine students' preference for cooking methods and the different meals prepared in dining halls in residential colleges (RCs). The study

expects to explore the most popular meal options as prepared by different cooking methods and investigate the related health issues with the students' meal choices.

3. Methodology

3.1. Participants and consent

The study invited 520 undergraduate students to answer a questionnaire on different meals offered by colleges. After deleting 59 incomplete questionnaires, 461 were retained. The participants included students from four residential and neighbouring colleges located in a single district. Each college has its own dining hall; however, all colleges share the same supplier who provides the meals. Students who stayed in college consumed 15 free meals (breakfast, lunch, and dinner) per week. As meals were prepared by the same supplier for several years, the food menu has remained unchanged. Therefore, senior students had four years of consuming similar meals. Regarding the learning stage of participants, 253 were freshmen (54.9%); 102, sophomores (22.1%); 73, juniors (15.8%); and 33, seniors (7.2%). The distribution of sample grades is in reasonable concordance with the actual situation of the RCs, where the number of freshmen whose stay in the RCs is mandatory, and far exceeds that of other grades. Participants were recruited in a questionnaire survey during lunch and dinner in dining halls. They were informed about the purpose and aim of the study. When participants agreed to participate, they would be invited to sign a consent form and receive an electronic questionnaire. They were to provide their preferences for different meals prepared by the food catering supplier. All participants were adults (over 18 years old). Participation was voluntary and anonymous. Data were treated anonymously, and the study was conducted in accordance with the principles of the Declaration of Helsinki 1975.

3.2. Tool

The research consisted of photos of 117 different meals from September to November 2018 which were provided in dining halls in selected colleges. According to the common cooking methods in Cantonese food culture [28], the meals with names could be classified under six common cooking methods (steaming, frying, stir-frying, boiling, baking, and braising). For reliability, three research students with nutrition and physical education backgrounds who had no relationship with the four colleges and were well aware of every meal were invited to assist in classifying the meals. The final meal list was identified only when at least two researchers agreed to the same classification. As per classification, 13 meals were prepared by steaming; 18, frying; 45, stir-frying; 6, boiling; 11, braising; and 5, baking, resulting in a total of 98 meals.

Table 1 All types of food from the questionnaire were evaluated according to cooking methods and main ingredients

	Stir-frying	Frying	Steaming	Boiling	Braising	Baking	Total
Pork	5	7	4	1	2	3	22
Chicken	0	6	1	3	0	2	12
Egg	3	0	3	1	1	0	8
Fish	1	4	2	1	0	0	8
Leafy green	4	0	0	0	0	0	4
Mushroom	0	0	0	1	0	0	1
Beef	1	0	0	2	0	0	3
Duck	0	1	0	0	1	0	2
Stem	10	0	0	0	0	0	10
Gourd vegetable	15	0	3	1	1	0	20
Meat & Vegetable	6	0	0	1	1	0	8
Total	45 (46%†)	18 (19%)	13 (13%)	11 (11%)	6 (6%)	5 (5%)	98 (100%)

†: Percentage of meals in each cooking method

Thus, 19 meals were not classified. Participants assessed every meal in the questionnaire based on the Likert scale ranging from 1 (strongly not prefer) to 5 (strongly prefer). In cases where participants never eat a specific meal, they

were instructed to provide a score of 0. In addition, the meals were determined according to the main ingredients on the plate: egg, leafy greens, gourd vegetables, stems, mushroom, beef, pork, fish, chicken, duck, and meat and vegetables in which the main ingredients are meat and vegetables together. Therefore, the meals were further classified according to the 11 main ingredients among the different cooking methods (Table 1).

4. Result

In the present study, descriptive (mean, standard deviation) and frequency analyses were used to explore the preferences for meals and cooking methods. Kendall's tau-b correlation was used to determine the association between meal preference and students' years in the college. Statistical differences among cooking methods and years were calculated using one-way analysis of variance (ANOVA), and Bonferroni adjustments were applied to determine the factors that differed among different years. Data were analysed using SPSS (version 26.0).

4.1. General cooking method preferences among all students and students in different years

The most and least preferred cooking methods for students were explored based on the average scoring of all meals in the selected cooking methods. Table 2 shows the average and standard deviation of the scoring of cooking methods among all students and the development of preference for every cooking method among students in different years. The most preferred cooking method for students was baking; on the contrary, the least favourite method was stir-frying. However, at the same time, the dining hall offered the most different meals prepared by stir-frying (46%), which is the least preferred cooking method by students.

All six cooking methods were more popular with freshman students than with those in other years. Except for baking ($M=2.85$, $SD=1.07$), students did not seem to welcome the other five methods (every $M < 2.50$), especially junior students who rated the food poorly in every method. Additionally, ANOVA showed a significant difference in the overall food preference among students from different years ($F = 3.07$, $p = 0.03^*$). Post hoc test results showed a statistically significant difference between the preference of freshman, sophomore, and junior students in the overall evaluation of dishes (freshman vs. sophomore, 2.12 vs. 1.98, $p < 0.05$; freshman vs. junior, 2.12 vs. 1.92, $p < 0.05$), which indicates that freshman, sophomore, and junior students showed different preferences for dining hall food.

ANOVA was also applied to analyse the statistical difference of preference for every cooking method among students in different years. Results showed that there was no difference in the preference for cooking methods, except for frying (Table 2). In terms of satisfaction with frying, there were differences in the mean of preferences among senior students ($F=11.63$, $p<0.001$). Post hoc analysis results showed that there was a difference between the preference in freshman, junior, and senior students (freshman vs. junior, 2.50 vs. 1.86, $p < 0.001$; freshman vs. senior, 2.50 vs. 1.98, $p < 0.001$). The preference of junior and senior students for frying, which is an unhealthier cooking style, declined, indicating that they were aware of the implications of frying on health.

Table 2 Average of cooking methods among all students and according to different years

Cooking Method	Overall M±SD	1 Year	2 Year	3 Year	4 year	ANOVA F	p-value
Baking	2.85±1.07	2.88±1.09	2.89±1.00	2.66±1.09	2.85±0.98	0.92	
Frying	2.32±0.82	2.50±0.86	2.22±0.67	1.96±0.75	1.98±0.78	11.63	0.001***
Boiling	2.24±0.76	2.31±0.79	2.15±0.63	2.11±0.76	2.24±0.82	1.84	
Braising	2.05±0.81	2.10±0.80	1.97±0.79	1.96±0.72	2.10±1.03	1.00	
Steaming	1.89±0.73	1.97±0.73	1.79±0.70	1.81±0.69	1.80±0.89	2.18	
Stir-frying	1.85±0.66	1.89±0.67	1.80±0.58	1.79±0.66	1.78±0.86	0.76	
Overall	2.05±0.61	2.12±0.62	1.98±0.50	1.92±0.63	1.95±0.77	3.07	0.03*

Figure 1 presents the food preference of students in a downward trend from freshmen ($M=2.12$). There was a slight drop of 0.14 in the rating between freshman and sophomore students. The preference was the least ($M=1.92$) among junior students. The overall evaluation of dishes by senior students showed a slight increment of 0.3. As grades increased, the likeness of the students to food exhibited a fluctuation, in which the preference of third year students hit

the lowest. According to Kendall’s tau-b correlation, there is a significant, negative, but weak association between years and preference for food.

4.2. Food preference combined with cooking method (healthy and unhealthy choices of food and cooking methods)

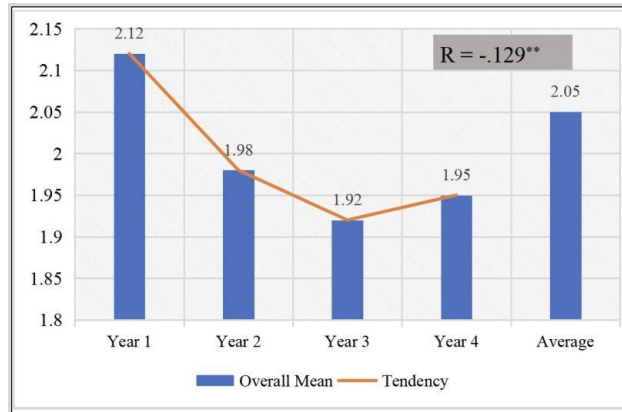


Figure 1 Overall food evaluation mean and tendency

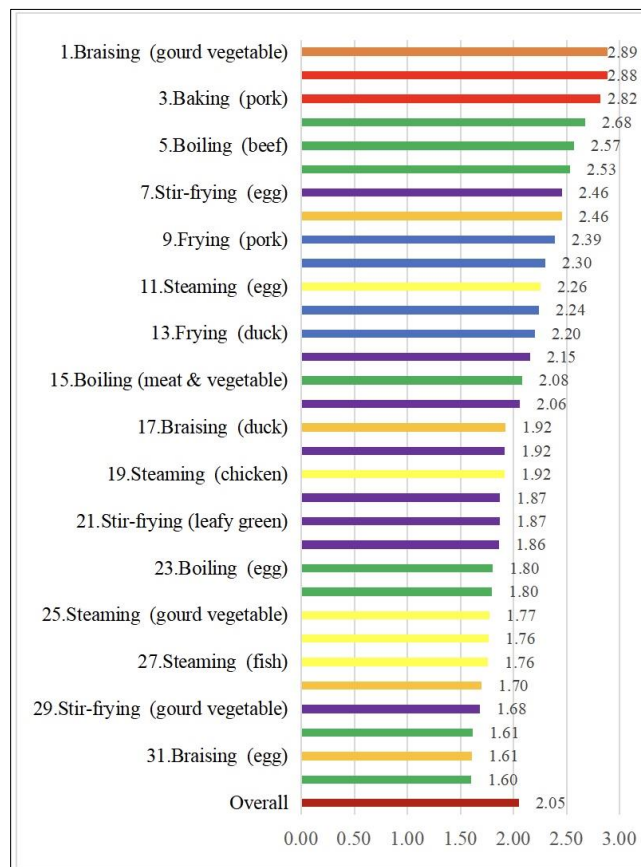


Figure 2 Ranking of food according to mean

Among the 32 types of food choices, only 6 were rated above an average of 2.50, including the braising of gourd vegetables; baking of chicken and pork; and boiling of chicken, beef, and pork (Figure 2). These six kinds of meals were mainly prepared by baking, which chemically produced toxic substances, and boiling, which led to a greater loss of nutrients from the main ingredients, indicating that students had unhealthy food choices. Conversely, the preference

for 16 kinds of food showed a lower mean than 2.50, which included 4 out of 5 food items prepared by steaming, a healthy cooking method. Results further showed that students had a low perception of healthy food choices.

5. Discussion

The overall average on the meal evaluation was 2.05, indicating that students had a low preference for the meals provided. The conceptual model of food choice proposed by Furst et al. [4] developed three factors that influence consumers' perceptions of food choices, including experience, mindset, and judgement. In this study, mindset and judgement were the main influencing factors. Moreover, students had less chance to eat outside the campus owing to the closed school environment, especially on weekdays. In addition, there were not many choices on campus at the time of investigation. According to our statistics, only three main venues provided students with dishes at the time of investigation. If this is the case, eating one kind of food for a long time leads to a decrease in food interest. Therefore, students' preference continued to decrease from first to third years. However, it is surprising that senior students had a higher evaluation compared to junior students. The reasons for this were not tested in this study.

Conversely, as Bartoshuk [29] suggested, the experience of food choice in people is related to food's taste, smell, and texture. That is, if people do not like the quality of a certain food item when they first try the dishes, it will affect their satisfaction with food in the future. In this study, students may not like the food processed in the dining hall or the cook's practice, which will reduce expectations for dining hall dishes in students. For example, to reduce costs, restaurants do not use fresh meat as food ingredients; thus, the dishes are not delicious. Therefore, it is understandable why students' comments on dining hall dishes were always low. Thus, considering the influence of various factors, even though students had a low evaluation of food, it cannot show that they had a health perception of food choice.

With respect to the preference for food, students appeared to have a fixed liking for it, although different food ingredients were used. Table 2 shows that baking ($M = 2.85$) was the favourite method among students. Boiling and frying were also preferred by students, although the evaluation of food prepared by boiling showed an uneven distribution, with two peaks. In this case, students preferred boiling of chicken ($M = 2.68$), beef ($M = 2.57$), and pork ($M = 2.53$) to boiling of eggs ($M = 1.80$), mushrooms ($M = 1.80$), fish ($M = 1.61$), and gourd vegetables ($M = 1.60$). Steaming and stir-frying were the least favoured methods, which may have something to do with the quantity provided in the dining hall (the largest proportion among the six cooking methods).

There was no statistical difference between the preference of students in different years in the cooking methods, except in the case of frying ($p < 0.001$; Table 2). Time does not appear to be a necessary factor for the change in preference for cooking methods. However, an interesting phenomenon was observed in the preference of freshmen in the frying method, wherein the preference declined with time. As frying causes food nutrients to leach out and has a serious negative impact on human health, junior and senior students may be considering the influence of the method on health benefits.

Regardless of ingredients of the dishes, the cooking method itself has a great impact on human health. For example, fried food is positively associated with general and central obesity [30]. Among the six cooking methods in this study, steaming is the healthiest method because it retains many health-promoting compounds and nutrients in the food. Among the dishes studied, only 13 were steamed. Other cooking methods that use a lot of water and time, such as boiling, frying, and stir-frying, accounted for a large proportion (51% in total; Table 1), which implies that the cooking structure in the RC dining hall was not ideal. Following the effect of cooking method on health, the amount of steamed food should be increased appropriately, such as steaming of eggs ($M=2.26$) and chicken ($M=1.92$), which the students like. In addition, as the evaluation of students that steaming was carried out properly ($M=1.89$, $SD=0.73$), the dining hall could pay attention to the improvement of its quality. In contrast, the number of stir-fried food items could be decreased, such as stir-frying of meat and vegetables ($M=1.87$), leafy greens ($M=1.87$), stems ($M=1.86$), and gourd vegetables ($M=1.68$).

6. Conclusion

Our findings suggest that students do not think highly of food from their dining halls because of the influence of their mindset and judgement. There is a tendency that if they do not like the food, they will not change this idea over time. As the meal menu does not change much, students' preferences seem to be negatively reinforced over time; thus, there is no significant change in preferences regarding their food choice in the second, third, and fourth years of study. Our findings indicated that students preferred baking, boiling, and frying, but the supplier had the food prepared mostly by stir-frying, which was less preferred by students. More than half of the food items made in the dining hall were stir-fried, which had a negative impact on students' preferences. This study may suggest that there is a tendency to develop

a particular meal by the chef, and this behaviour does not change much, even though there is food evaluation by students. The participants indicated a tendency of their preferences while the meal menus remain unchanged. This observation suggests a few challenges for food catering services for students. Should preparation of meals be done according to students' preferences? What happens if students' preferences are not healthy choices? Cost of meal preparation is another issue to be considered. High-quality food will certainly cost high. This goes back to the question of whether there is a desire to put students' health in the forefront, or is this just a way to fill their need for food. In this observation, increasing the proportion of food prepared by steaming and boiling would be an appropriate and healthy strategy for preparing meals for the youth. Nevertheless, this strategy needs to be carefully investigated. In conjunction with a scientific basis in food preparation in a college environment, there will be a better way in attracting students through healthy eating. Our investigation may indicate the possibility of undesired consequences of unhealthy food choice, as it is being reinforced because of unhealthy or unfavourable method of food preparation. Further, this study may indicate the possibility of such a connection, but future investigation is needed to analyse the link between the tendency in food choice and preferences in methods of cooking.

Compliance with ethical standards

Disclosure of Conflict of interest

The authors declare there is no personal or organizational conflict of interest with this work.

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