

## Research Article



# Healthy eating-out options are related to healthy eating intention in adults residing in Daqing (China)

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There are no financial or other issues that might lead to conflict of interest.

## ABSTRACT

**Purpose:** Eating behaviors are influenced by food environments, such as availability and/or accessibility of healthy food options. In this study, we examined the relationship between healthy eating-out options and the intention to eat healthily in adults residing in Daqing, China, using an extended theory of planned behavior (TPB).

**Methods:** Data were collected via an online survey conducted from April to May 2021 using a previously validated questionnaire in Daqing. A total number of 308 subjects aged 18–64, either Daqing oilfield workers or their family members were eligible and finally included in the analysis. The relationships among the attributes and the quality of healthy eating-out options, the three major constructs of TPB, and the intentions of healthy eating were examined using multiple linear regression analyses.

**Results:** Subjective norms ( $p = 0.049$ ) and perceived behavioral control (PBC) ( $p = 0.000$ ) were significantly related to the healthy eating intention. The quality and attributes of the food served statistically significantly explained the intention to eat healthily. After controlling for age, sex, and body mass index, not the quality but the attributes of food served ( $p = 0.037$ ), subjective norms ( $p = 0.016$ ), and PBC ( $p = 0.000$ ) had a significant relationship with the intention to eat healthily. The model explained 83.7% of the variance.

**Conclusion:** The healthy eating-out choices, along with subjective norms and PBC of TPB, may be a potential determinant of healthy eating intention among Chinese adults living in Daqing, China. Policy implications have highlighted that not only the personal intention to eat healthy foods, but also the available healthy food environment may be important for the choice of healthy options by the population of interest. Therefore, building an environment for healthy eating choices and campaigns aimed at increasing consumer awareness of healthy eating are equally important for a smart eating choice.

**Keywords:** behavior; intention; diet; adult; environment

## INTRODUCTION

As China's economy continues to develop and individuals' quality of life improves, people's intention to eat healthily continues to increase, and how to achieve a healthy diet has become a major concern for Chinese people. As China's restaurant industry has grown rapidly over the past 40 years [1], the number of people choosing to eat out is increasing exponentially [2].

When eating out, consumers are more likely to need more control or knowledge of ingredients and nutrients [3]. Compared to eating at home, eating out is more likely to be associated with excessive energy, simple sugars, fat or sodium, and fewer choices for healthy ingredients [4-6], resulting in nutritional-related public health problems such as obesity and increased risk of chronic diseases including hypertension, type 2 diabetes and cardiovascular disease. According to the national report from the Chinese government in 2020 [7], the prevalence of overweight and obesity among adults over the age of 18 was 34.3% and 16.4%, respectively, and the prevalence of hypertension, type 2 diabetes, and hypercholesterolemia increased significantly since 2015. The Chinese government also emphasized diet and prevention of major chronic diseases in the Healthy China Initiative and the Healthy China 2030 Plan to focus more on the public's major nutritional and chronic disease problems than before [8].

The theory of planned behavior (TPB) has been frequently used to determine individual intention of certain behaviors via three major constructs of attitudes, subjective norms, and perceived behavioral control (PBC) [9] in many areas of study including health-related behavioral choices in adults [10-12]. Providing nutritional information in restaurants or on food packages encourages consumers to make appropriate dietary decisions, although implications may vary depending on the degree of individual understanding of comprehensive information [13]. In order for consumers to choose healthier foods, it may be more effective to provide healthier choices to restaurants or markets that people frequently visit in their daily lives [14].

Few studies have investigated the intention of Chinese adults to eat healthily using TPB in their rapidly changing diets. Based on our two previous studies in adults living in Beijing [15], and Shanghai and parts of Anhui Province [16], PBC was consistently related to the intention of healthy dietary behavior. However, inconsistent results were observed in subjective norms. Thus, considering the differences in culture and environment between regions due to China's vast territories, generalization may not be possible only with the results of the 2 studies. In addition, previous studies did not consider food environment components such as healthy eating-out choices in Chinese people who eat out a lot. Therefore, this study was to examine the relationship among healthy eating-out options and intention to eat healthily based on an extended TPB in oilfield workers or their adult family members in Daqing, the Oil Capital of China, a relatively occupationally homogenous population.

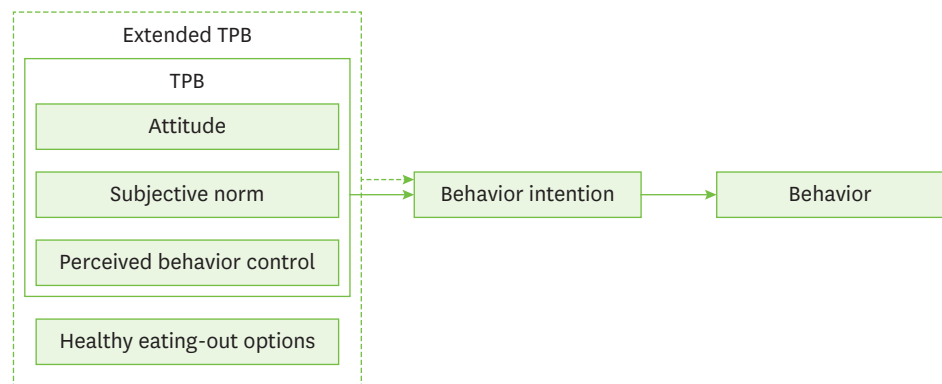
## METHODS

### Conceptual framework

To elucidate relationships among the three major constructs of TPB (i.e., attitude, subjective norm, PBC), healthy eating-out options, and behavioral intentions of healthy eating, this study utilized Ajzen's conceptual framework (Fig. 1) [9]. The hypotheses based on the conceptual framework are as follows: first, the three constructs of TPB may be related to behavioral intention of healthy eating; second, in addition to the three major constructs of TPB, healthy eating-out options may also related to behavioral intention of healthy eating.

### Sampling population

The study protocol was described in detail in our previous studies [15,16]. The study population was Chinese adults living in Daqing, meaning grand celebration, as a regional center city in Heilongjiang, is an important national oil production and petrochemical



**Fig. 1. A study conceptual framework.**  
TPB, theory of planned behavior.

industrial base approved by the State Council. In contrast to previous study populations with diverse occupational background [15,16] in China, participants were Daqing oilfield workers or their family members. From April to May 2021, a total of 311 participants voluntarily responded to the online self-management questionnaire containing reward information in return for responding to the survey in the form of a QR code or a questionnaire link using WeChat social media and a targeted snowball sampling due to the coronavirus disease 2019 (COVID-19) pandemic. After excluding three subjects with incomplete information, 308 subjects were finally eligible for the analysis. This study received approval from the Institutional Review Board (IRB) of Sangmyung University in October 2020 (SMUIRBC-2020-009).

### Study questionnaire

The process of developing the questionnaire for this study is described in detail in our previous studies [15,16]. Shortly, determinants of healthy eating behavior referring to previous studies [17,18] were reviewed and selected based on the context of Chinese adults, translated into Chinese by experts, and the form was finalized through a preliminary survey of Chinese students majoring in food and nutrition. Due to the limited previous studies examining the determinants of healthy eating behavior based on the TPB, we used questionnaires validated in adolescents [17,18]. However, high explanatory power (76.6% [15] and 70.5% [16]) was observed in Chinese adults.

Data on age and sex were reported. Self-reported height (cm) and weight (kg) were calculated as body mass index (BMI, kg/m<sup>2</sup>) and categorized as < 18.5 kg/m<sup>2</sup>, 18.5–22.9 kg/m<sup>2</sup>, 23.0–24.9 kg/m<sup>2</sup>, and 25.0–29.9 kg/m<sup>2</sup>. Data on the average monthly income were collected as < 3,000 Yuan, 3,001–5,000 Yuan, 5,001–10,000 Yuan, 10,001–15,000 Yuan, and > 15,000 Yuan. Education levels were categorized into three ( $\leq$  middle school, high school,  $\geq$  college). Drinking frequency in the last one year was classified into four levels (never,  $\leq$  once per 2 months, once every month, 2–4 per months). Lifetime smoking was categorized into three (never,  $\leq$  100 cigarettes, and > 100 cigarettes).

Questions regarding the three constructs of TPB (attitudes, subjective norms, PBC) and intention of healthy eating behaviors were well described in our previous studies [15,16]. The Cronbach alpha coefficients were measured to verify internal consistency: 0.97 for attitudes (6 questions), 0.96 for subjective norms (8 questions), 0.91 for PBC (4 questions), and 0.91 for intention to healthy eating (4 questions).

Two aspects of healthy eating-out options, i.e., quality [19,20] and attribute [19-21] of food served, were assessed by asking respondents to rate on a 5-point Likert scale question (1 = definitely disagree to 5 = definitely agree). Healthy eating-out options were asked in the context of a restaurant that a subject usually chooses on a typical day with family, friends, or co-workers [21]. The quality of food served was assessed by 5 questions [19,20]: “The taste of food is satisfying”, “The taste of food is original”, “The food is hygienic”, and “The food is made of fresh ingredients”. The Cronbach alpha coefficient for five items was 0.97. The attribute of food served was asked by seven questions [19-21] regarding the food of the restaurant the participants chose on a typical day is: “prepared using natural ingredients”, “packaged in an eco-friendly manner”, “accurately labeled with the country of origin”, “beneficial to health”, “beneficial to weight control”, “low in calories”, and “low in fat”. The Cronbach alpha coefficients for 7 items was 0.94.

### Statistical analysis

Continuous data were expressed as means with SD and categorical data were expressed numbers and percentages. Simple or multiple linear regression analyses were used to test relationships among the three major constructs of TPB, healthy eating-out options, and behavioral intention of healthy eating. Final models were adjusted for age, sex, and BMI. Statistical analyses were performed using SPSS software (Statistical Package for the Social Sciences, version 21.0; IBM, Armonk, NY, USA). Statistical significance was defined as  $p < 0.05$ .

## RESULTS

### General characteristics of study subjects

Of a total of 308 subjects, 161 (52.3%) were females and means of age and BMI were  $32.0 \pm 11.7$  years and  $22.7 \pm 4.2$  kg/m<sup>2</sup>, respectively (**Table 1**). More than three-quarters of subjects earned  $\leq 10,000$  yuan monthly and had college graduates or higher degree. One-third of subjects did not drink alcohol in the past year and two-thirds of subjects did not smoke in their lifetime.

### Constructs of TPB and healthy eating-out options

The average values of attitude questions ranged from 4.04 (desirable-undesirable) to 4.16 (good-bad) and the total mean value was 4.10 (**Table 2**). The mean scores of the subjective norm ranged from 3.91 (internet information) to 4.08 (family members) and the average value was 3.98. The mean scores of the PBC were lowest at “No matter what the difficulties you have, do you want to eat healthily?” (3.75) and highest at “Will you try hard to eat healthily?” (4.04) and the average value was 3.87. The average value of statements of behavioral intention to eat healthily was ranged from 3.74 (“I have a plan to have a healthy meal in the next 2 weeks”) to 3.84 (“I would like to recommend healthy meals to my friends, family, and co-workers”) and the total mean was 3.78. The mean value of the quality of healthy eating-out choice ranged from 3.63 (“The food is hygienic”) to 3.74 (“The taste of food is satisfying”) and the total average was 3.69. The average values of the attribute of food served were lowest at 3.31 (low in fat) and highest at 3.66 (beneficial to health) and the total mean value was 3.43.

### Relationship among 3 major constructs of TPB, healthy eating-out options, and intention of healthy eating

As subjective norms decrease ( $p = 0.049$ ) and PBC ( $p = 0.000$ ) increases, behavioral intention of healthy eating increases and the model explains 83.6% of variance of the behavioral intention

**Table 1.** General characteristics of study subjects (n = 308)

Variables	Values
Female	161 (52.3)
Age (yrs)	32.0 ± 11.7
18–29	171 (55.5)
30–39	47 (15.3)
40–49	56 (18.2)
50–56	34 (11.0)
Body mass index (kg/m <sup>2</sup> )	22.7 ± 4.2
< 18.5	40 (13.0)
18.5–22.9	137 (44.5)
23.0–24.9	60 (19.5)
≥ 25	71 (23.0)
Education levels	
≤ Middle school	16 (5.1)
High school	55 (17.9)
≥ College	230 (77.0)
Monthly income (RMB)	
< 3,000	63 (20.5)
3,001–5,000	90 (29.2)
5,001–10,000	80 (26.0)
10,001–15,000	35 (11.4)
> 15,000	40 (12.9)
Alcohol drinking during last one year, time	
Never	101 (32.8)
≤ Once per 2 months	111 (36.0)
Once every month	53 (17.2)
2–4 per month	32 (10.4)
Almost everyday	11 (3.6)
Ever lifetime smokers	
Never	203 (65.9)
≤ 100 cigarettes smoked	26 (8.4)
> 100 cigarettes smoked	79 (25.6)

Values are presented as mean ± SD or number (%).

(**Table 3**). The food quality ( $p = 0.000$ ,  $R^2 = 10.2\%$ ) and attribute ( $p = 0.000$ ,  $R^2 = 19.9\%$ ) significantly explained the intention to eat healthily. After controlling for age, sex, and BMI, not quality but attributes of food served ( $p = 0.037$ ), subjective norms ( $p = 0.016$ ), and PBC ( $p = 0.000$ ) showed a significant relationship with intention to eat healthily. The model explained 83.7% of the variance of the behavioral intention of healthy eating.

## DISCUSSION

This study examined the relationships between healthy eating-out options and intention to eat healthily based on an extended TPB in adults residing in Daqing, China via an online survey during COVID-19. Subjective norms and PBC were related to healthy eating intention. The quality and attributes of the food served significantly explained the intention to eat healthily. After controlling for age, sex, and BMI, not quality but attributes of food served ( $p = 0.037$ ), subjective norms ( $p = 0.016$ ), and PBC ( $p = 0.000$ ) showed a significant relationship with intention of healthy eating and the model explained 83.7% of the variance. Our results suggest that not only personal factors related to the intention of healthy behaviors but also healthy food environment may be important for the public to choose healthy eating.

In line with findings from our previous studies in Beijing [15] and in Shanghai and Anhui province [16], PBC was the strongest determinant of intention to eat healthily among 3 major

**Table 2.** Validity and descriptive statistics of study variables (n = 308)

Variables (Cronbach alpha)	Mean ± SD
<b>Attitude (0.97)</b>	
A healthy diet is generally beneficial.	4.14 ± 0.78
A healthy diet is generally useful.	4.14 ± 0.71
A healthy diet is generally good.	4.16 ± 0.76
A healthy diet is generally enjoyable.	4.10 ± 0.85
A healthy diet is generally interesting.	4.06 ± 0.81
A healthy diet is generally desirable.	4.04 ± 0.81
Subtotal	24.64 ± 4.79
Mean	4.10 ± 0.80
<b>Subjective norm (0.96)</b>	
Family members think I should engage in healthy eating.	4.08 ± 0.78
My friends think I should engage in healthy eating.	4.04 ± 0.85
My schoolmates and co-workers think I should engage in healthy eating.	3.97 ± 0.83
Experts (doctors, nutritionists, etc.) think I should engage in healthy eating.	3.98 ± 0.82
Government agencies think I should engage in healthy eating.	3.97 ± 0.86
TV programs (including what I see on the Internet) think I should engage in healthy eating.	3.94 ± 0.88
Newspapers and magazines (including what I see on the Internet) think I should engage in healthy eating.	3.95 ± 0.86
Internet information (blogs, YouTube, etc.) think I should engage in healthy eating.	3.91 ± 0.88
Subtotal	31.84 ± 3.98
Mean	3.98 ± 0.85
<b>PBC (0.91)</b>	
Will you try hard to eat healthily?	4.04 ± 0.78
Do you have enough discipline to eat healthily?	3.93 ± 0.87
Do you have enough time to eat healthily?	3.76 ± 0.96
No matter what the difficulties you have, do you want to eat healthily?	3.75 ± 0.95
Subtotal	15.48 ± 3.56
Mean	3.87 ± 0.89
<b>Behavioral intention (0.91)</b>	
I am willing to have a healthy meal within the next 2 weeks.	3.77 ± 0.94
I want to have a healthy meal in the next 2 weeks.	3.78 ± 0.95
I have a plan to have a healthy meal in the next 2 weeks.	3.74 ± 0.96
I would like to recommend healthy meals to my friends, family, and co-workers.	3.84 ± 0.91
Subtotal	15.13 ± 3.76
Mean	3.78 ± 0.94
<b>Healthy eating-out option, food quality (0.97)</b>	
The taste of the food is satisfying.	3.74 ± 0.80
The taste of the food is original.	3.65 ± 0.79
The temperature of the food is appropriate.	3.72 ± 0.78
The food is hygienic.	3.63 ± 0.77
The food is made of fresh ingredients.	3.70 ± 0.79
Subtotal	22.15 ± 4.72
Mean	3.69 ± 0.79
<b>Healthy eating-out option, food attribute (0.94)</b>	
The food of the restaurant I chose on a typical day is prepared using natural ingredients.	3.51 ± 0.93
The food of the restaurant I chose on a typical day is packaged in an eco-friendlier manner.	3.53 ± 0.87
The food of the restaurant I chose on a typical day is accurately labeled with the country of origin.	3.37 ± 1.00
The food of the restaurant I chose on a typical day is beneficial to health.	3.66 ± 0.83
The food of the restaurant I chose on a typical day is beneficial to weight control.	3.37 ± 0.97
The food of the restaurant I chose on a typical day is low in calories.	3.31 ± 0.96
The food of the restaurant I chose on a typical day is low in fat.	3.31 ± 0.97
Subtotal	24.06 ± 6.52
Mean	3.43 ± 0.93

PBC, perceived behavioral control.

constructs of TPB. This means that the more control one has over actions, the more influence one has on the intention of healthy eating. The more resources and opportunities individuals have and the fewer obstacles they anticipate, the more control they have over their behaviors. Individuals are more likely to adopt healthy eating behaviors when they perceive healthy eating

**Table 3.** Relationship among three major constructs of theory of planned behavior, healthy eating-out options, and intention of healthy eating (n = 308)

Model	Independent variable	$\beta$	SE	p-value
Model 1	Attitude	0.01	0.06	0.782
	Subjective norm	-0.11	0.06	0.049
	PBC	0.99	0.05	0.000
Fit	F-value = 521.35, p-value = 0.000, Adjusted R <sup>2</sup> = 0.836			
Model 2	Healthy eating-out option, food quality	0.32	0.07	0.000
	Fit F-value = 35.86, p-value = 0.000, Adjusted R <sup>2</sup> = 0.102			
Model 3	Healthy eating-out option, food attribute	0.45	0.06	0.000
	Fit F-value = 77.23, p-value = 0.000, Adjusted R <sup>2</sup> = 0.199			
Model 4 <sup>1)</sup>	Subjective norm	-0.10	0.05	0.016
	PBC	0.99	0.05	0.000
	Healthy eating-out option, food quality	0.01	0.03	0.724
Fit	F-value = 259.15, p-value = 0.000, Adjusted R <sup>2</sup> = 0.835			
Model 5 <sup>1)</sup>	Subjective norm	-0.10	0.05	0.016
	PBC	0.97	0.05	0.000
	Healthy eating-out option, food attribute	0.05	0.03	0.037
Fit	F-value = 263.51, p-value = 0.000, Adjusted R <sup>2</sup> = 0.837			

PBC, perceived behavioral control.

<sup>1)</sup>Adjusted for age, sex, and body mass index.

to be easy [9]. Therefore, in order to promote healthy eating intentions, nutrition education to increase individuals' control over healthy eating may be effective.

Inconsistent results were found in subjective norms. In our previous studies, subjective norms were significantly related to the intention of healthy eating in adults in Beijing [15], but not in those in Shanghai and Anhui province [16]. Subjective norms refer to the belief that a significant person or group of people will approve and support a particular behavior [9]. Subjective norms are determined by perceived social pressure from others to behave in a certain way, and their motivation to comply with the opinions of those people [22]. In China, the land is vast and there are considerable differences between the northern and the southern areas in terms of local culture, and customs. Thus, people may not be influenced to the same degree by the expectations of others or by social pressures. In addition, people living in northern China tend to have a higher motivation to be strict with themselves than people in the south. This explains why subjective norms in the north (Beijing, Daqing) and south (Shanghai, Anhui) do not have the same impact on healthy eating.

Attitude refers to the positive or negative feelings that an individual holds about the behavior [9]. Attitude was not a significant predictor of healthy eating in our previous studies [15,16] and in this study, conducted in China. By its very nature, attitude is influenced by human preferences and is, as a result, relatively subjective. Therefore, attitude is less powerful and less likely to modify individual intention to healthy eating in the context of Chinese adults.

However, these constructs of TPB need to be interpreted within the context of study population. Daqing oilfield is the largest oilfield in China, discovered in 1959. In early 1960, 30,000 demobilized soldiers, 3,000 demobilized officers, 1,000 professionals such as engineers and geologists, personnel from various departments of the State Council, and cadres and workers came to Daqing to support the so-called oil battle from all over the country [23]. Daqing spirit, an important element of Chinese national spirit, must be considered within this specific historical context [24]. The Daqing oilfield not only produced amounts of oil but also formed a pioneering, realistic, and dedicated spirit of Daqing by generations of people to serve their country [23,24]. As shown in 'making the impossible

possible', one of the slogans raised by Daqing Iron Man Wang Jinxi, the Daqing spirit contains a hardworking spirit of self- independence and self-reliance [24]. Individuals are more inclined to engage in healthy eating when they consider it to be easy. Subjective norms are established by perceived social pressure from others and the incentive to conform to the ideas of others. In this respect, with regard to the Daqing spirit, our sample population may have high PBC and subjective norms, as consistently shown in our results, although further studies on how and to what extent they have implications are needed.

Moreover, our results showed that healthy eating out options of food served was independently related to behavioral intentions of healthy eating. This can be also explained by the nature of study location. Daqing is a typical immigrant city, where most people working in the oil industry from all over the country gather, and people also bring with and enjoy special cuisines from all over the country [24,25]. As Daqing's economic level continued to develop and became a model for the Chinese government's good healthcare practices, its residents have paid relatively more attention to the freshness, taste, and healthiness of food than to the price, which has been reflected in the occurrence of high-end private fruit stores, restaurants, and cake shops in recent years [25,26]. After the inclusion of subjective norms and PBC, only attribute of food served, not food quality of it, was positively related to healthy eating intention. As revealed by the realistic nature of Daqing spirit, Daqing citizens pay more attention to factors that can lead to actual change such as control weight, low in calorie and fat, and environmentally friendly packaging, than to factors related to food quality that they might have already acquired such as freshness and uniqueness.

There are several limitations to our study. Due to the COVID-19 pandemic, we used an online-based self-administered questionnaire although each question was described in a very detailed way. Therefore, the data collected in this study may not be as accurate as those collected through face-to-face interviews. There might be the various unmeasured issues related to the COVID-19 pandemic, although no specific outbreak during the study period existed. In addition, the sample size of the study was relatively small although the population is relatively homogeneous. In addition, we only examined the relationship cross-sectionally. Whether there is a significant association between the three constructs of TPB, healthy eating-out options and behavioral intentions should be confirmed in a longitudinal study with a larger sample size all over Chinese population. However, there are several strengths of our study. First, with China's rapid economic development, the concern for healthy eating is increasing dramatically every day, yet more research needs to be done in this area. Second, this study is the first to examine healthy eating-out options as a construct to measure healthy eating intentions. Third, this study fills the gap of the need for related previous studies [15,16] that only explored first-tier cities by providing a detailed study in Daqing, a prefecture-level or a third-tier city in the north. It is worth noting that Daqing is the number-one oil and petrochemical production base in China, and the healthy eating behavior of individuals living there are very valuable to study.

## SUMMARY

In summary, the attribute of healthy eating-out choices, along with subjective norms and PBC of TPB, may be a potential determinant of healthy eating habits among Chinese adults living in Daqing, China. Therefore, several practical and policy implications may include policies to increase familiarity with and awareness of healthy eating habits, campaign opportunities



to strengthen local marketing of healthy dining options, and diversity of message emphasis, based on consumer perceptions on healthy eating practices among the study population.

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