

# An Investigation of Healthy Food Consumption in Low-Income Families

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**Abstract** The highest obesity rates were associated with the lowest incomes and low educational levels. Little is currently known about low-income families' perceptions about healthy food and their decision-making processes when selecting food items. The purpose of this project was to assess perceptions, determinants, and decision-making processes regarding healthy food choices among low-income families in the U.S. Study participants were recruited from a local food pantry in Ruston, Louisiana in the US from February 2016 to May 2016. Researchers set up a table inside of the food pantry, and participants were asked to complete a written survey during their food pantry visits. A total 153 participants completed the survey. The survey instrument was composed of three sections. The first part consisted of items assessing participants' attitude, subjective norm, perceived behavioral control, and intention toward healthy food consumption. The second section included measurement items designed to assess salient beliefs and referents regarding healthy food consumption. The last section consisted of questions related to participants' social demographic information, including gender, age, race, income level, education level, and self-reported height (feet and inches) and weight (pounds). Descriptive analysis, exploratory factor analysis, confirmatory factor analysis, and multi-group structural equation modeling were used in the study. Most of the low-income families participating in the study hold positive attitude and high intention towards consuming healthy food ( $\beta = 0.730, p < 0.01$ ). For normal-weight, low-income individuals, intention to consume healthy food was only influenced by cost and environmental constraints ( $\beta = 0.552, p < 0.01$ ), while perceptions of family members, friends, and health practitioners ( $\beta = 0.757, p < 0.01$ ) significantly influenced overweight participants' intention. Nutrition and health monitoring and assistance are very important for the well-being of overweight low-income residents.

**Keywords:** *healthy food, the theory of planned behavior, overweight, low-income families*

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## 1. Introduction

According to the National Diabetes Statistics Report, 30.3 million individuals in the United States were living with diabetes in 2015, accounting for 9.4% of the US population [1]. Several reports indicated that another 84.1 million Americans had pre-diabetes [2,3,4]. Of the 30.3 million people diagnosed with diabetes, 90%-95% has type 2 diabetes, and 58% takes some type of anti-diabetic oral medication [5]. As of 2010, one out of every ten Americans had type 2 diabetes [1]. If current trends continue, one out of every three Americans will have diabetes by 2050 [5]. The total direct and indirect cost of diagnosed diabetes in the United States was US\$245 billion in 2012 [5].

Many factors influence body weight, such as genetics, energy intake, and energy expenditure. Food choices may be an important factor affecting energy intake. A healthy, nutritious diet could reduce the risk of many chronic diseases [6]. The 2015 USDA Dietary Guidelines for

Americans defines healthy food as items containing fruits (including 100% fruit juice), vegetables, and low-fat dairy and low in solid fat and added sugar [7]. Consuming appropriate amounts of healthy food provides the necessary nutrients that bodies need every day, helps prevent future diseases, gives individuals more energy, and improves health status [4].

A study conducted by the Centers for Disease Control and Prevention [4] showed that the highest obesity rates were associated with the lowest incomes and low educational levels. Anderson and Miroso [8] also indicated that consumers' choices not to purchase healthier food options are dominated by personal values and are heavily influenced by their perceptions. Due to the strong relationship between obesity and low income, healthy food consumption behaviors and the decision-making determinants and processes influencing those behaviors in this population must be understood. However, little is currently known about low-income families' perceptions about healthy food and their decision-making processes when selecting food items. More specifically, there has only been a few empirical studies that take both personal

and situational factors into account and provides a thorough theoretical/empirical explanation regarding the formation of low-income families' intention to consume healthy food.

Given this lack of empirical research, understanding attitudes, perceived barriers, and behaviors toward consuming healthy food may help food pantries as one community food resource to improve the nutritional quality and food intake of their local residents. Therefore, the theoretical framework for the present study was adopted from Ajzen's [9] theory of planned behavior (TPB), which has strong predictive ability for a wide range of human behaviors [10]. TPB is an extension of the theory of reasoned action (TRA), which allows us to examine the impact of both individual factors (i.e., attitude), social norms (subjective norms), and situational factors (i.e., perceived behavioral control). Thus, the purpose of this project was to assess perceptions, determinants, and decision-making processes regarding healthy food choices among low-income families in the U.S. Specific objectives were to (a) investigate perceived availability of healthy food choices in food pantries, (b) identify attitudes and factors influencing food choices of low-income families, and (c) to provide recommendations for local food pantries regarding provision of healthy food selections for their community.

## 2. Methods

Prior to data collection, approval to use human subjects in research was obtained from the University Institutional Review Board (IRB).

### 2.1. Participant Selection

Multiple previous studies indicated that recruiting participants from local low-income social service agencies such as low-income health clinics, health fairs, and food shelves/pantries is a valid and efficient sampling method to collect an unbiased sample of the low-income population (Dammann and Smith, 2009; Mello *et al.*, 2010; Wing and Smith, 2009). Thus, the participants of the current study were recruited from a local food pantry in Ruston, Louisiana in the US, from February 2016 to May 2016. Researchers set up a table inside the food pantry, and participants who were 18 years of age or older were asked to complete a written survey during their food pantry visits. During the three-month data collection span, a total 153 adults enrolled in the study. All participants were local residents.

### 2.2. Instrument Development

A survey instrument was developed based on TPB scales and healthy food consumption literature [9,11,12,13]. Questions included in the survey were screened and approved by The Institutional Review Board (IRB) at the university. Twenty participants, each of whom were currently receiving food donations from local food pantries, pilot tested the survey to assess the clarity of the questions and determine whether response options were

clear. The questionnaire was revised and finalized based on the results of pilot tests.

The survey instrument was composed of three sections. The first part consisted of items assessing participants' attitude, subjective norm, perceived behavioral control, and intention toward healthy food consumption. The wordings of the measures were slightly modified from TPB scales [9] to be appropriate for the context of the current study. All the items included in the first section were rated on a five-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). Attitudes towards healthy food consumption (ATT) was measured by six items. An example item is "Eating healthy food items is beneficial." The internal reliability rate of these items as tested via Cronbach's alpha was 0.87. Participants' subjective norms (SN) were measured by two items; an example is "Most people who are important to me think I should eat healthy food items." The internal reliability rate of these items was 0.74. In addition, perceived behavioral control (PBC) was measured by three items; an example item is "The choice to eat healthy food items at home is completely up to me." The internal reliability rate of these items was 0.76. Lastly, intention to consume healthy food was measured by two items; an example reads "I intend to eat healthy food items at home in the future." The internal reliability rate of these two items was 0.84.

The second section included measurement items designed to assess salient beliefs and referents regarding healthy food consumption. Ajzen and Fishbein [14] indicated that new sets of beliefs and salient referents should be elicited for each new context and population. Hence, as an elicitation method, a panel of foodservice experts developed and reviewed the items in terms of beliefs and salient referents that specifically fit the context of the current study. More specifically, participants' behavioral belief (BB) regarding the outcomes of consuming healthy food was measured by five items scored on a five-point Likert-type scale (1 = strongly agree, 5 = strongly disagree). A sample item is "Eating healthy food items at home would enable me to be healthier." The internal reliability rate of these five items was 0.85. Five items were also used to measure the evaluation of these outcomes (OE) via a five-point Likert-type scale (1 = extremely unimportant, 5 = extremely important). A sample item reads "To me, choosing food that is beneficial for my health is \_\_\_\_." The internal reliability rate of these five items was 0.83. The salient referents' normative beliefs (NB) were measured by four items with a five-point Likert-type scale (1 = definitely should not, 5 = definitely should); a sample item is "My family members (such as daughters, sons, spouse, and relatives) think I \_\_\_\_\_ eat healthy food". The internal reliability rate of these four items was 0.78. The corresponding motivation to comply (MC) with those referents was also measured by four items with a five-point Likert-type scale (1 = very unlikely, 5 = very likely); an example item is "How likely is it for you to take advice of your family members (such as daughters, sons, spouse, and relatives)?" The internal reliability rate of these four items was 0.81. In addition, control beliefs (CB) regarding participants' perception of the presence of

resources to perform a certain behavior were measured by five items on a five-point Likert-type scale (1 = strongly agree, 5 = strongly disagree); a sample reads “There is an adequate number of healthy food choices available at food pantries.” The internal reliability rate of these items was 0.85. The relevant perceived power of each control belief (PP) was measured by five items on a five-point Likert scale (1 = less likely, 5 = very likely); an example is “If there are more healthy food choices available at food pantries, I am \_\_\_\_\_ to choose healthy food items at food pantries.” The internal reliability rate of these items was 0.74. Based on Ajzen’s [9] suggestion, the summated level of each belief construct was computed by the square root of multiplication of their evaluative components using the “expectancy-value” (E-V) method ( $\sqrt{\sum BB_i OE_i}$ ,  $\sqrt{\sum NB_j MC_j}$ ,  $\sqrt{\sum CB_k PP_k}$ ).

The last section of the survey consisted of questions related to participants’ social demographic information, including gender, age, race, income level, education level, and self-reported height (feet and inches) and weight (pounds). Participants’ height and weight information were used to calculate body mass index (BMI). Participants were categorized as normal weight (18.5 to 24.9), overweight (25.0 to 29.9), and obese (above 30.0) based on the categorization developed by the Centers for Disease Control and Prevention [2].

### 2.3. Statistical Analysis

The data were analyzed in three steps. In the first step, SPSS Statistics 22.0 for Windows (IBM Corporation, Armonk, NY) was used to conduct a descriptive analysis, screen the data, and conduct a reliability test and exploratory factor analysis (EFA). In the second step, confirmatory factor analysis (CFA) was conducted using Mplus 7.4 [15] provide evidence on the construct validity. Lastly, multi-group structural equation modeling (SEM) was used to identify the relationship among constructs and examine the model invariance across participants with different BMI.

## 3. Results

### 3.1. Participant Characteristics

A total of 153 participants completed the survey. A majority of the sample (81.7%) was female. Sample median age was 48 years. In terms of education level, 13.8% of the sample did not have high school degree, and

more than half of the sample had a high school or General Education Diploma (GED) degree (56.8%). Only 4.7% of the sample had a college education or above. A majority of the sample was African American, and the family size of about half of the sample was between three and five persons. Approximately 75% of the participants reported a household income level lower than \$10,000, and about 95% of the participants had a household income below the poverty level proposed by the United States Census Bureau 2016 poverty report [16]. In addition, the majority of the participants had an elevated weight status (overweight [26.1%] and obese [52.3%]). Additional demographic characteristics are displayed in Table 1.

**Table 1. Sociodemographic characteristics of a cohort of 153 participants from low-income families**

| Demographic factors        | N (Percentage) |
|----------------------------|----------------|
| Gender                     |                |
| Male                       | 28 (18.3%)     |
| Female                     | 125 (81.7%)    |
| Generation                 |                |
| Baby Boomers (above 60)    | 24 (21.6%)     |
| Generation X (36-59)       | 79 (51.6%)     |
| Millennials (18-36)        | 40 (26.8%)     |
| Education                  |                |
| Lower than High school     | 21 (13.8%)     |
| High School or GED         | 86 (56.2%)     |
| Some college               | 39 (25.5%)     |
| Bachelor’s degree or above | 7 (4.7%)       |
| Income                     |                |
| Under \$10,000             | 115 (75.2%)    |
| \$10,001-\$20,000          | 25 (16.3%)     |
| Over \$20,000              | 12 (7.9%)      |
| Race                       |                |
| White                      | 23 (15.0%)     |
| Black                      | 125 (81.7%)    |
| Hispanic                   | 2 (1.3%)       |
| Other                      | 1 (0.7%)       |
| Size of family units       |                |
| One person                 | 35 (22.9%)     |
| Two persons                | 22 (14.4%)     |
| Three to five persons      | 71 (47.7%)     |
| Above five persons         | 11 (7.2%)      |
| BMI                        |                |
| 18.5-24.9                  | 33 (21.6%)     |
| 25.0-29.9                  | 40 (26.1%)     |
| >30                        | 80 (52.3%)     |

**Table 2. Descriptive analysis and correlation matrix of variables**

|                | Mean (SD)   | AVE  | 1      | 2      | 3      | 4      | 5      | 6      | 7 |
|----------------|-------------|------|--------|--------|--------|--------|--------|--------|---|
| 1. $BB_i OE_i$ | 4.43 (0.69) | 0.75 | 1      |        |        |        |        |        |   |
| 2. $NB_j MC_j$ | 4.22 (0.70) | 0.72 | 0.52** | 1      |        |        |        |        |   |
| 3. $CB_k PP_k$ | 4.14 (0.65) | 0.70 | 0.55** | 0.63** | 1      |        |        |        |   |
| 4. ATT         | 4.28 (0.77) | 0.62 | 0.57** | 0.43** | 0.47** | 1      |        |        |   |
| 5. SN          | 4.32 (0.79) | 0.58 | 0.50** | 0.49** | 0.57** | 0.57** | 1      |        |   |
| 6. PBC         | 4.19 (0.87) | 0.68 | 0.54** | 0.44** | 0.50** | 0.46** |        | 1      |   |
| 7. INT         | 4.29 (0.92) | 0.84 | 0.58** | 0.53** | 0.56*  | 0.44** | 0.59** | 0.54** | 1 |

Note: \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

### 3.2. Descriptive Analysis and Measurement Model

First, missing data analysis was conducted to identify any missing data patterns in the current dataset; the results indicated that the dataset had a missing at random (MAR) pattern. Therefore, a full information maximum likelihood estimation was conducted to handle missing data following the instructions of Enders et al [17]. Then the construct validity of the measurement model was examined by CFA (Table 2). The results of CFA demonstrated a reasonable model fit ( $\chi^2 = 302.22$ ;  $df = 166$ ,  $p < 0.01$ , CFI = 0.95, TLI = 0.93, RMSEA = 0.071, SRMR = 0.049) [18]. The standardized factor loading of each item varied from 0.77 to 0.92. Convergence validity was assessed by average variance extracted (AVE) score. All AVE scores were over 0.50, indicating convergence validity [18]. In addition, discriminant validity was assessed by comparing the AVE scores of each variable with the square of the correlation estimates between them. In all cases, the AVE scores were bigger than the squared correlation indices, providing evidence of discriminant validity [18]. Overall, the measurement model demonstrated adequate data integrity.

Additionally, a power analysis was conducted by Monte Carlo simulation [15] to examine whether the sample size of the current study provided enough statistical power for SEM analysis. Based on Muthén & Muthén [15], the criteria for determining appropriate sample size are (1) bias of parameters no larger than 10%, (2) bias of standard errors no larger than 5%, (3) coverage ranging from 0.91 to 0.98, and (4) power of at least 0.80 [14,19,20]. The results of power analysis satisfied all four criteria, indicating the sample size was appropriate for the proposed measurement and structural model.

Majority of the participants held a very positive attitude toward healthy food consumption (mean = 4.28,

SD = 0.77) and had relatively high intention to consume healthy food (mean = 4.29, SD = 0.92). When asked about the three most important things that need to be improved in the food pantry, 68.9% of the participants included “providing healthier food” in answering this open-ended question. More specifically, 43.1% of the participants hoped to obtain more vegetables and fruits from the food pantry, and 15.7% of participants believed that the food pantry should provide more milk and meat. Additionally, 24.3% of the participants indicated that they hoped the food pantry could provide more food choices.

### 3.3. Structural Equation Modeling Analysis

An SEM analysis was conducted to examine the relationship between each construct. The global model fit indices indicated sufficient construct validity for the proposed model ( $\chi^2 = 466.22$ ;  $df = 215$ ,  $p < 0.01$ , CFI = 0.952, TLI = 0.928, RMSEA = 0.076, SRMR = 0.049) [18]. Standardized path coefficients with  $p$ -values indicated the direction and magnitude of the significant impact of each path in the estimated model; the results are shown in Table 3 and Figure 1. The SEM results showed that participants' behavioral belief related to healthy food consumption ( $BB_iOE_i$ ) was significantly related to their attitude ( $\beta = 0.730$ ,  $p < 0.01$ ) and the salient referents' normative belief ( $NB_jMC_j$ ) was significantly related to participants' subjective norm (SN;  $\beta = 0.712$ ,  $p < 0.01$ ). Additionally, the relationship between participants' control belief and their perceived behavioral control (PBC) regarding healthy food consumption was also significant and positive ( $\beta = 0.509$ ,  $p < 0.01$ ). In terms of antecedents of intention to consume healthy food, PBC ( $\beta = 0.718$ ,  $p < 0.01$ ) and SN ( $\beta = 0.237$ ,  $p < 0.01$ ) were significantly related to behavioral intention while there was no significant relationship between participants' attitude and behavior intention ( $\beta = 0.054$ ,  $p = 0.580$ ).

Table 3. Structural equation modeling results (N = 153)

| Hypothesized paths         | Coefficient | t-value | p-value |
|----------------------------|-------------|---------|---------|
| $BB_iOE_i \rightarrow ATT$ | 0.730       | 15.229  | <0.000  |
| $NB_jMC_j \rightarrow SN$  | 0.712       | 11.145  | <0.000  |
| $CB_kPP_k \rightarrow PBC$ | 0.509       | 6.719   | <0.000  |
| $ATT \rightarrow INT$      | 0.054       | 0.553   | 0.580   |
| $SN \rightarrow INT$       | 0.237       | 3.020   | 0.003   |
| $PBC \rightarrow INT$      | 0.718       | 7.781   | <0.000  |

Note:  $\chi^2 = 466.22$ ;  $df = 215$ ,  $p < 0.01$ , CFI = 0.952, TLI = 0.928, RMSEA = 0.076, SRMR = 0.049;  $R^2 = 0.494$ .

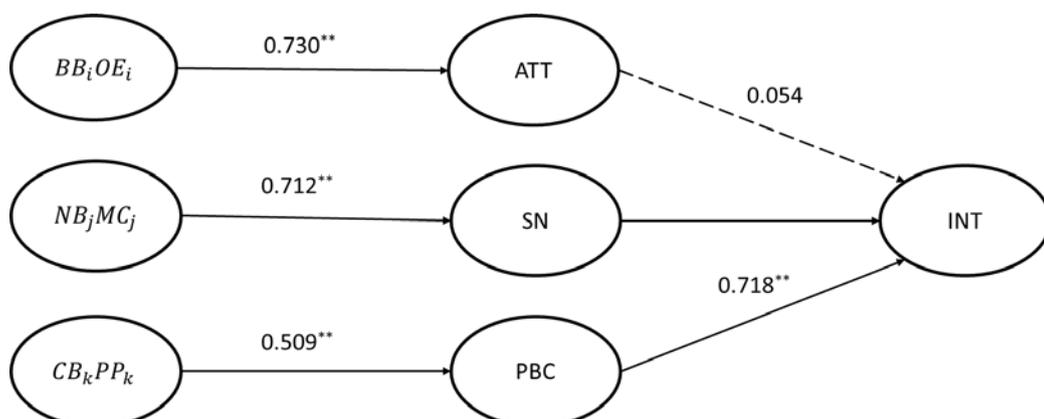


Figure 1. Structural Equation Model with Parameter Estimates (Note: \*  $p < 0.05$ ; \*\*  $p < 0.01$ )

### 3.4. Group Invariance Test of BMI

As the antecedents of healthy food consumption may vary between participants with normal weight and those who are overweight, participants were divided into normal weight (i.e.,  $18.5 < \text{BMI} < 24.9$ ) and overweight ( $\text{BMI} > 24.9$ ) groups based on their BMI index calculated from their self-reported height and weight. Based on this grouping method, 46 participants were clustered into the normal weight group, and 77 participants were clustered into the overweight group.

Prior to comparing each path of the proposed model, measurement invariance was examined to determine whether the measurement model across groups is invariant. More specifically, a non-restricted model was assessed first, and then this model was compared to the fully restricted model that constrains factor loadings and coefficients across groups using the chi-squared test [18]. The result showed that the two models were statistically different ( $\Delta\chi^2(6) = 44.714, p < 0.01$ ), indicating that there is a significant difference between the structural models of

the two groups. The results for the structural models are shown in Table 4 and Figure 2. In the normal weight group, only PBC was significantly related to INT ( $\beta = 0.552, p < 0.01$ ), while ATT ( $\beta = 0.141, p = 0.380$ ) and SN ( $\beta = 0.381, p < 0.124$ ) were not significantly related to INT. For participants in the obesity group, SN ( $\beta = 0.757, p < 0.01$ ) and PBC ( $\beta = 0.184, p < 0.05$ ) were significantly related to INT, while there was no relationship between ATT and INT ( $\beta = 0.103, p < 0.440$ ).

A contrast analysis was utilized to compare each path of the proposed model in each group with the bootstrapping resampling method, which can provide unbiased confidence intervals (C.I.) for parameters (CDC, 2017). The results of contrast analysis showed that there were significant differences in terms of the relationship between SN and INT ( $\Delta\beta = 0.376, \text{C.I.} = [0.164, 0.590]$ ) and the relationship between PBC and INT ( $\Delta\beta = -0.368, \text{C.I.} = [-0.064, -0.672]$ ). More specifically, compared to the normal weight group, the relationship between SN and INT was significantly stronger while the PBC and INT path was significantly weaker for the obesity group.

Table 4. Results of multi-group SEM analysis

| Hypothesized paths                  | Normal Weight (N = 46) |         | Obesity (N = 77) |         |
|-------------------------------------|------------------------|---------|------------------|---------|
|                                     | Coefficient            | p-value | Coefficient      | p-value |
| $BB_iOE_i \rightarrow \text{ATT}$   | 0.602                  | <0.000  | 0.559            | <0.000  |
| $NB_jMC_j \rightarrow \text{SN}$    | 0.457                  | 0.001   | 0.512            | <0.000  |
| $CB_kPP_k \rightarrow \text{PBC}$   | 0.632                  | <0.000  | 0.378            | <0.000  |
| $\text{ATT} \rightarrow \text{INT}$ | 0.141                  | 0.320   | 0.103            | 0.440   |
| $\text{SN} \rightarrow \text{INT}$  | 0.381                  | 0.124   | 0.757            | <0.000  |
| $\text{PBC} \rightarrow \text{INT}$ | 0.552                  | <0.000  | 0.184            | 0.032   |

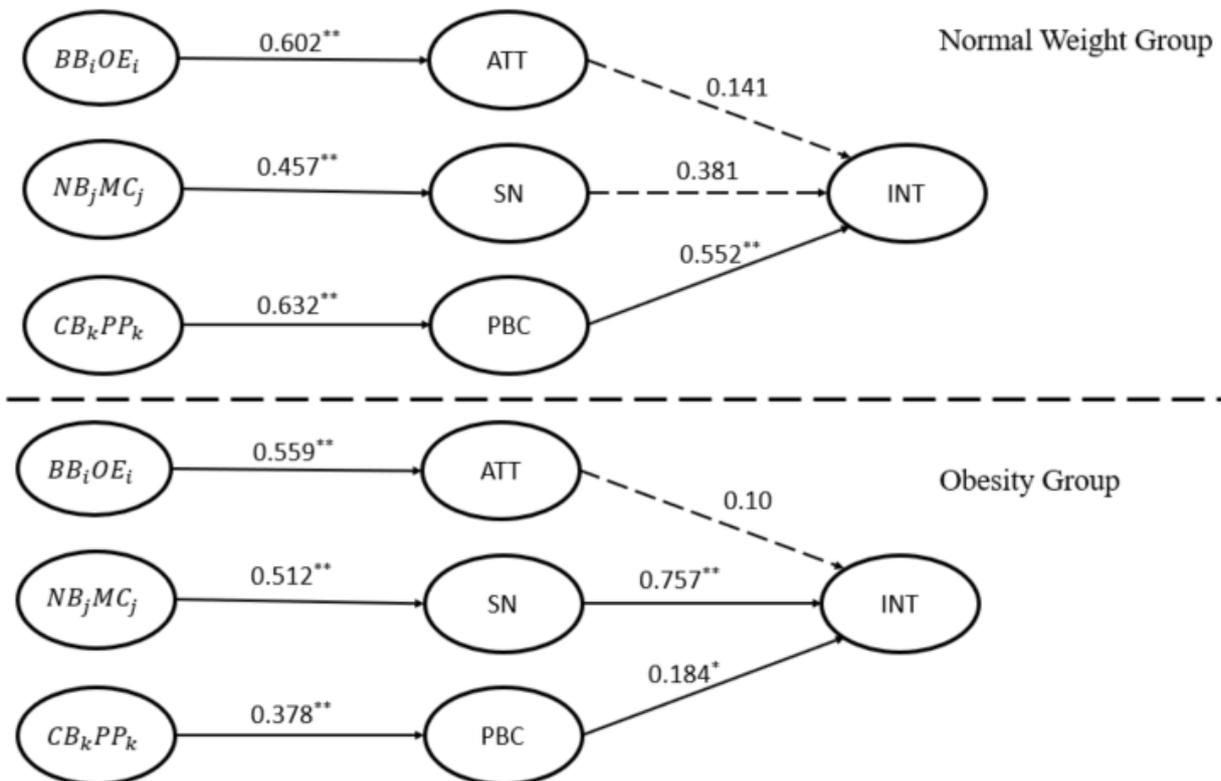


Figure 2. Structural Results for Normal Weight and Obesity Group

## 4. Discussion

The purposes of the current study were to investigate attitude and consumption intention toward healthy food among low-income families and examine the mechanisms underlying how low-income families make decisions regarding healthy food consumption.

First, the findings of this study showed that even though approximately 75% of the low-income participants were overweight or obese, the majority of them have a very positive attitude towards healthy food and high intention to consume healthy food at home [21]. This finding implies that there is a lack of association between behavioral intention and healthy food consumption behavior for low-income families. This result is consistent with the findings of multiple previous studies regarding healthy food consumption among the low-income population [3,22,23]. Armitage and Conner [24] proposed that the relationship between intention and behavior is significantly weaker when the intention of consuming healthy food is unstable and influenced by environmental cues [25]. The intention of low-income families may constantly be changing due to environmental stressors such as food insecurity [25]. Leung et al. [25] indicated that food insecurity is inversely associated with healthy food consumption among low-income adults, which provides empirical evidence for Fila and Smith's explanation [7].

Additionally, contrary to the conceptual framework of TPB [10,26], the relationship between attitude towards healthy food consumption and behavioral intention was not significant, while SN and PBC were both significantly related to behavioral intention among low-income families. The present results are consistent with those of Boyington et al. [27] and Lien et al. [28] and the studies of Fila and Smith [22], which aimed to understand healthy eating behaviors among young adolescents. According to Ajzen and Fishbein [14], the TPB framework has good predictability in contexts in which subjects' behaviors are volitional. However, both young adolescents' and low-income families' healthy eating behaviors are not under volitional control. Walker et al. [29] examined the factors influencing food consumption decisions among low-income adults using qualitative concept mapping and showed that even though low-income families are conscious of nutrition recommendations and diet-related health issues, their purchasing decisions may be more strongly shaped by other factors, such as cost or availability (i.e., food deserts). This study contributes to the literature on low-income families' healthy eating behaviors by providing empirical evidence for the proposition made by Walker et al. [29]. Due to the positive attitude and consumption intention toward healthy food among low-income families, the present study implies that nutrition education programs for low-income families may be less effective than financial and social support. Food pantries should try to provide healthier food items such as vegetables and fruits for these low-income families. Additionally, the findings of Walker et al. [29] showed that specific inventory plans of healthy food items should be developed especially around the paydays of low-income families to help their cyclical food restrictions [30].

The results of the multi-group SEM showed significant differences between the normal weight group and the overweight group in terms of SN  $\rightarrow$  INT and PBC  $\rightarrow$  INT relationships. PBC is the only significant predictor of low-income families' healthy food consuming intention for the normal weight group. Multiple studies have provided empirical evidence that an individual's obesity status is significantly influenced by his/her meta-cognition ability, such as self-control and self-monitoring practices [31,32,33]. More specially, a normal-weight individual tends to have a higher level of self-control and self-monitoring ability regarding his/her eating behaviors and tends to require less help from others to lose weight compared to obese people [32,33]. The high self-control and self-monitoring ability of normal-weight people indicate that SN is not a significant predictor of healthy eating intention for the normal-weight group in the present study. Thus, due to the higher level of self-control and self-monitoring, the only constraint for the normal-weight group regarding their healthy eating behaviors is external barriers (i.e., healthy food availability and accessibility), which is a part of PBC measurements [9]. Moreover, the most critical predictor of healthy eating behaviors of the overweight group is SN, even though PBC is also significantly related to their behavioral intention. This can be explained by their relatively low self-control and monitoring behaviors and by the fact that some severely obese participants' eating behaviors are more likely to be monitored and regulated by their family members and health practitioners. The results imply that there is a strong demand for regular nutrition assistance for low-income families due to the large proportion of overweight individuals among low-income families [25,29].

A strength of this study is the use of the TPB framework as a conceptual foundation and methodology. The TPB model provides a comprehensive framework that explains how personal and environmental factors influence an individual's decision-making process. In addition, multiple meta-analyses have showed that the TPB model provides robust predictive utility in predicting human behaviors [10,34]. Therefore, by developing a survey instrument and conceptual model based on the TPB framework, the current study provides results with higher reliability and validity compared to other exploratory studies regarding healthy food consumption among low-income populations. In addition, both individual and environmental factors were found to influence the healthy food consuming intention of low-income families based on the TPB framework. Another strength of the present study was the use of multi-group SEM as the data analysis method. SEM refers to a class of methodologies that examines the relationship between structural (i.e., latent) parameters by using means, variances, and covariances structure of observed data [36]. SEM enables the analysis of latent variables and their relationship without measurement errors compared to the traditional ordinal least squares methods [18]. Additionally, by deriving both measurement and structural models from the covariance matrix of observed data, the relationships between latent variables can be investigated simultaneously, which significantly decreases type I errors of analysis [18]. In addition, different antecedents of healthy food consumption for normal-weight and overweight populations were found in the current study by

using multi-group SEM analysis. This in-depth analysis provides more practical recommendations in terms of improving health conditions of low-income populations.

The current study is not without limitations. First, the cross-sectional design does not provide the causal relationship between the constructs included in the study. Future research can use a longitudinal study design to demonstrate the causal relationship between determinants and healthy food consumption by using cross-lagged effects and autocorrelation effects [28]. Second, this study used self-reported data and did not control for respondents' affects, emotions, or evaluative perceptions. Thus, mono-source bias and social desirability bias [35] may inflate or distort the parameters of interest. Therefore, the study suggests the need to seek out alternative data sources for use in future studies. Lastly, all the data was collected from a single source. Hence, common method bias may be an issue. Future research should consider collecting data from multiple sources or at multiple times to avoid the potential common method bias.

## 5. Conclusion

The results of this study indicate that most of the low-income families participating in the study hold positive attitude and high intention towards consuming healthy food. Also, more than half of the participants expressed the opinion that food pantries would provide more vegetable and fruits. However, attitudes towards healthy food consumption were not related to the consuming intention for low-income families. For normal-weight, low-income individuals, intention to consume healthy food was only influenced by cost and environmental constraints, while perceptions of family members, friends, and health practitioners significantly influenced overweight participants' intention. The results highlight that policies focusing on food assistance programs are required to ensure low-income families access to affordable, healthy food. Furthermore, nutrition and health monitoring and assistance are very important for the well-being of overweight low-income residents.

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