

## The Predictors of Healthy Eating Behavior among Pregnant Women: An Application of the Theory of Planned Behavior

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### Abstract

#### Background

It has been documented that maternal nutrition is associated with positive birth outcomes. This study was aimed at determining the predictors of healthy eating behavior among pregnant women in Qazvin, Iran in the context of the theory of planned behavior (TPB).

#### Materials and Methods

In this longitudinal study, 182 pregnant women who were referred to teaching hospitals in Qazvin in 2016 were recruited for participation. Data were obtained using TPB-specific questionnaires at baseline. The same pregnant women were asked to complete a food frequency questionnaire (FFQ) 3 months later. A series of hierarchical regression analysis was conducted to examine factors associated with healthy eating behavior among pregnant women.

#### Results

The pregnant women reported low amounts of whole grain consumption and low-fat dairy product consumption. All TPB variables significantly predicted healthy eating behaviors at three-month follow-up. Perceived behavioral control (PBC) and behavioral intention were found to be the strongest predictors of healthy eating behaviors among pregnant women. The pregnant women's subjective norms had the weakest relationship with healthy eating behaviors. The TPB model together with age provided a moderate to high explanation of consumptions in low-fat dairy products ( $R^2=0.57$ ,  $P<0.01$ ), fruit ( $R^2=0.30$ ,  $P<0.01$ ), vegetable ( $R^2=0.28$ ,  $P<0.01$ ) and whole grains ( $R^2=0.44$ ,  $P<0.01$ ).

#### Conclusion

The TPB explained significant variation in intention and healthy eating behaviors among pregnant women. Future studies should target on the PBC and intention to promote healthy eating behaviors among pregnant women.

**Key Words:** Behavior, Eating, Healthy Diet, Pregnancy, Social Theory, Theory of Planned Behavior.

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## 1- INTRODUCTION

Pregnancy is associated with many physiological changes, such as increased plasma volume and red blood cells and a subsequent reduction in the level of circulating proteins bound with nutrients (1). Adequate nutrient intake is regarded as a component of a healthy lifestyle and a reflection of nutrition behaviors that can improve a person's health (2); by contrast, inadequate nutrient intake exerts negative effects on health at different ages (3) and can cause premature delivery and low birth weight (4). More than half of pregnancies in developing countries are unplanned, and pregnant women are usually referred to medical health centers when the appropriate time for the prevention of nutritional deficiencies has already passed (5). Barker et al.'s presentation of the theory of fetal origins was followed by growing interest in fetal development and the prevention of nutritional deficiencies in newborns. He stated that nutritional deficiencies in infants and their small size at birth (weight, height, etc.) are associated with the risk of diseases in pregnant women, such as type 2 diabetes and cardiovascular disorders (6).

The need for energy, nutrients, and micronutrients increases during pregnancy (7), and the amount of energy needed by pregnant women with good nutritional status must be slightly increased if their bodies are to adapt to elevated energy requirements during pregnancy (8). Nutritional deficiencies and poor nutrition behaviors during pregnancy are caused by various factors, such as increased need for nutrients, reduced nutrient intake due to diseases, inadequate nutritional intake due to lack of nutritional knowledge, and religious beliefs (9). In developing countries, most cases of low birth weight are caused by maternal malnutrition before and during pregnancy (8, 10-12). Failure to satisfy nutritional requirements, excessive nutrient intake, and unhealthy dietary

behaviors are not only associated with fetal abnormalities (4, 13), but also expose children to the risk of developing non-insulin-dependent diabetes, cardiovascular diseases, and neurological abnormalities at later ages, especially adulthood (14). Proper nutrition plays an important role in fertility (15), and some nutritional deficiencies, such as vitamin D deficiency, are more prevalent among women than men (16); marginal deficiencies in calcium, folic acid, vitamin D, and iron are also high in healthy pregnant women (17). Previous studies have revealed a relationship between maternal diet during pregnancy and infants' anthropometric measurements (18, 19); in addressing these problems, behavior modification is an important risk reduction strategy (20-23). The World Health Organization identified a number of first-level strategies for pregnant women, namely, determining and solving nutritional problems, including inadequate intake of food groups, such as fruits, vegetables, and dairy; addressing commonly occurring problems, such as iron deficiency and anemia (24); and implementing treatment measures, including supplementation with iron and folic acid (24).

The theory of planned behavior (TPB), proposed by Ajzen, has been widely used in various studies and meta-analyses that employ the constructs of TPB as basis for predicting intention and behavior (25-27). The theory maintains that intention is the most important determinant of behavior. Intention is influenced by three factors: a person's attitude toward a given behavior that reflects one's positive or negative evaluation of the behavior; one's perception of social pressures caused by important people in performing or not performing certain behaviors and social norms (25); and one's perception of degree of ease and difficulty of behavior (perceived behavioral control), which encompasses internal and external factors.

These factors can impede or facilitate behavior implementation (25). A few studies have examined the predictors of pregnant women's nutrition behaviors (28, 29). Considering the importance of nutrition during pregnancy, the current research determined the predictors of nutrition behaviors among pregnant women who were referred to teaching hospitals in Qazvin, Iran on the basis of the constructs of TPB.

## 2- MATERIALS AND METHODS

For this longitudinal study, convenience sampling was used to recruit 182 pregnant women who were referred to Kosar teaching hospital for prenatal care in 2016, Qazvin city, Qazvin province-Iran. The mean and standard deviation (SD) age of the participants was  $25.23 \pm 3.67$  years old. Among them, 119 (79.3%) and 39 (20.7%) held diplomas and completed university education, respectively.

The inclusion criteria were an age range of 15 to 45 years and a gestational age of 18 to 24 weeks; literacy; Iranian nationality and fluency in the Persian language and informed consent. The exclusion criteria were problems or specific conditions experienced in the current pregnancy, such as bleeding, multiple pregnancy, rupture of amniotic sac, pre-eclampsia, and diabetes; absence from more than 50% of training sessions; and voluntary withdrawal from the study.

### 2-1 Measures

#### 2-1-1 Sociodemographic variables

These were assessed using a self-reported measure and consisted of age, level of education and gestational age.

#### 2-1-2 Body Weight and Height

Body weight and height were assessed using a calibrated digital scale with a precision of 0.1kg (Tanita, Tokyo, Japan)

and all-mounted stadiometer (Seca, Chino, CA), respectively.

#### 2-1-3 Dietary assessment

The usual daily intake of foods and nutrients were collected using a shortened semi-quantitative meal frequency questionnaire (FFQ). The FFQ has 61 food items in eight categories including; cereals and cereal products; milk and dairy products; vegetables (fresh or cooked); fruits (fresh, canned and dried fruits); meat, eggs and meat products (including organs); beverages; sweets, baked and junk foods; and oils and fats. For this study, low fat dairy products, fruit and vegetable and whole grains were considered as healthy eating behaviors. This measure is available in Persian language and its psychometric properties have been confirmed (30).

#### 2-1-4 Attitude

Four items were used to measure attitude. "For me eating healthy foods daily over the next month would be: unpleasant/pleasant, bad/good, negative/positive, and unfavorable/favorable".

All items are rated on a 5-point response scale ranging from 1 to 5. Internal reliability was good for the attitude measure ( $\alpha=0.89$ ) (21).

#### 2-1-5 Subjective norms

Three items were used to measure subjective norms. "My husband believes that I should eat healthy food". All items are rated on a 5-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal reliability was acceptable for the subjective norms ( $\alpha=0.84$ ) (21).

#### 2-1-6 Perceived behavioral control (PBC)

Seven items were used to measure PBC toward healthy eating. "I have complete control over whether I eat healthy food

daily during the next month". All items are rated on a 5-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal reliability was acceptable for the PBC ( $\alpha=0.93$ ) (21).

### 2-1-7 Behavioral intention

Two items were used to measure behavioral intention to eat healthy foods. 'In the next month, I intend to eat healthy food everyday'. All items are rated on a 5-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal reliability was acceptable for the behavioral intention ( $\alpha=0.88$ ) (21).

### 2-2 Statistical analysis

All statistical analyses were performed using SPSS version 21.0 (IBM SPSS, Armonk, NY). Descriptive statistics were performed for all variables. Zero order correlations were computed to examine intercorrelations among study variables. A series of hierarchical regression analyses was conducted to test factors associated with healthy eating behavior among pregnant women.

In the hierarchical regression analyses, low fat dairy products, fruit and vegetable and whole grains were the dependent variables. Attitude, subjective norms as well as PBC were entered as independent variables in the first step. Intention was added in the second step. According to the Aiken and West's recommendations, all variables were standardized before conducting the main analysis to avoid unnecessary multicollinearity (31).

## 3- RESULTS

The mean  $\pm$  SD of the early-pregnancy body mass index (BMI) of the subjects was  $20.06 \pm 1.29$  (Table.1). Zero-order correlation coefficients are shown in Table.2. A moderate correlation was found between the TPB variables as well

as healthy eating behaviors. The PBC was strongly correlated with the other variables of TPB. The strongest correlations were those between PBC and consumption of low-fat dairy products ( $r=0.67$ ) and consumption of whole grains ( $r=0.54$ ). A hierarchical regression analysis showed that attitude ( $B = 0.15$ ,  $P < .0001$ ), subjective norm ( $B = .09$ ,  $P < .05$ ) and PBC ( $B = 0.44$ ,  $P < .0001$ ) accounted for 25 % of the variance in fruit consumption ( $F(5,172) = 99.22$ ,  $P < .0001$ ) (Table.3).

The addition of intention ( $\beta = .19$ ,  $P < .001$ ) added 5% of the variance explained in fruit consumption behavior ( $\Delta F(1,175) = 24.12$ ,  $P < 0.001$ ). The three TPB variables (i.e. attitude, subjective norms and PBC) together accounted for 22% of the variance in vegetable intake behavior ( $R^2 = 0.22$ ,  $F(5, 169) = 82.21$ ,  $P < 0.01$ ). The addition of behavioral intention accounted for a 6% increase in explained variance in vegetable intake behavior ( $\Delta F(1,177) = 140.49$ ,  $P < 0.001$ ). Another hierarchical linear regression was used to test the predictive validity of the TPB in relation to eat low-fat dairy products behavior.

As it is shown in Table.3, attitude, subjective norms and PBC together accounted for 40% of the variance in eating low-fat dairy products ( $R^2 = 0.40$ ,  $F(5,181) = 200.91$ ,  $P < 0.001$ ). When behavioral intention added to the analysis at step 2, the explained variance in behavior to eat low-fat dairy products increased by 17% ( $\Delta F(1,183) = 738.24$ ,  $P < .0001$ ). In the final model, the TPB variables (i.e. attitude, subjective norms and PBC) accounted for 41% of the variance in eating whole grains ( $R^2 = 0.41$ ,  $F(5,180) = 145.24$ ,  $P < 0.001$ ). The addition of behavioral intention raised the extracted variance to 44%, a statistically significant change ( $\Delta F(1, 179) = 36.89$ ,  $P < 0.005$ ).

**Table-1:** Demographic characteristics of the pregnant women

| Variables        | Mean $\pm$ SD    |
|------------------|------------------|
| Age              | 21.4 $\pm$ 4.3   |
| Weight           | 63.91 $\pm$ 4.08 |
| Height           | 1.59 $\pm$ 0.91  |
| BMI              | 20.06 $\pm$ 1.29 |
| Education (year) | 8.12 $\pm$ 3.65  |

SD: Standard deviation.

**Table-2:** Inter-correlation between TPB variables

| Variables                            | 1 | 2      | 3      | 4      | 5      | 6      | 7      | 8      | Mean | SD   |
|--------------------------------------|---|--------|--------|--------|--------|--------|--------|--------|------|------|
| 1. Attitude                          | 1 | 0.43** | 0.51** | 0.41** | 0.47** | **0.29 | 0.21*  | 0.30*  | 3.31 | 0.34 |
| 2. Abstract norm                     | - | 1      | 0.33** | 0.39** | 0.35** | 0.33*  | 0.38*  | 0.51** | 3.30 | 0.39 |
| 3. Perceived behavioral control      | - | -      | 1      | 0.38** | 0.44** | 0.27*  | 0.54** | 0.67** | 3.15 | 0.29 |
| 4. Intention                         | - | -      | -      | 1      | .048** | 0.24*  | 0.28*  | 0.32*  | 3.12 | 0.43 |
| 5. Fruit consumption                 | - | -      | -      | -      | 1      | 0.23*  | 0.26*  | 0.28*  | 4.03 | 1.61 |
| 6. Vegetable consumption             | - | -      | -      | -      | -      | 1      | 0.48** | 0.59** | 2.05 | 0.98 |
| 7. Whole grain consumption           | - | -      | -      | -      | -      | -      | 1      | 0.21*  | 1.04 | 0.59 |
| 8. Low-fat dairy product consumption | - | -      | -      | -      | -      | -      | -      | 1      | 1.07 | 0.78 |

Notes: \*P&lt;0.05. \*\*P&lt;0.01; SD: Standard deviation.

**Table-3:** Hierarchical linear regressions of healthy eating behaviors at time 2 onto age, education, attitude, subjective norms, perceived behavior control and intention

| Steps            | Fruit          | Vegetable      | low fat dairy products | Whole grains   |
|------------------|----------------|----------------|------------------------|----------------|
|                  | B (t)          | B (t)          | B (t)                  | B (t)          |
| <b>Step 1</b>    |                |                |                        |                |
| Age              | 0.04 (1.68)    | 0.03 (1.76)    | -0.06 (-1.97)*         | 0.05 (1.96)*   |
| Education        | 0.04 (1.94)*   | 0.05 (2.04)*   | 0.04 (2.20)*           | 0.03 (1.51)    |
| Attitude         | 0.15 (6.67)**  | 0.35 (14.57)** | 0.54 (27.27)**         | 0.13 (5.52)**  |
| Subjective norms | 0.09 (2.93)**  | 0.10 (4.48)**  | 0.08 (4.31)**          | 0.04 (1.60)    |
| PBC              | 0.44 (21.02)** | 0.13 (5.27)**  | 0.15 (7.58)**          | 0.59 (26.88)** |
| R2 change        | 0.25           | 0.22           | 0.40                   | 0.41           |
| F change         | 99.22**        | 82.21 **       | 200.91**               | 145.24**       |
| <b>Step 2</b>    |                |                |                        |                |
| Age              | 0.03 (1.92)    | 0.05 (2.31)*   | -0.02 (-1.20)          | 0.04 (2.10)*   |
| Education        | 0.08 (1.47)    | 0.04 (1.75)    | 0.03 (1.77)            | 0.03 (1.40)    |
| Attitude         | 0.11 (4.5)**   | 0.22 (8.82)**  | 0.33 (18.14)**         | 0.09 (3.30)**  |
| Subjective norms | 0.09 (2.32)*   | 0.10 (4.21)*   | 0.07 (4.08)**          | 0.02 (0.80)    |
| PBC              | 0.43 (20.80)** | 0.14 (5.54)**  | 0.10 (6.92)**          | 0.58 (26.61)** |
| Intention        | 0.19 (5.78)**  | 0.29 (11.85)** | 0.49 (27.17)**         | 0.11 (4.11)**  |
| R2 change        | 0.05           | 0.06           | 0.17                   | 0.03           |
| F change         | 24.12**        | 140.49         | 738.24**               | 36.89**        |

Notes: B: standardized regression coefficients, PBC: perceived behavior control; \*P&lt;0.05. \*\*P&lt;0.01.

#### 4- DISCUSSION

The results showed that the TBP variables satisfactorily predicted the healthy eating behaviors among pregnant women. The findings also indicated that PBC was the most important predictor of behavioral intention and healthy eating behaviors. This finding is consistent with the results of Malek et al. (28). Therefore, the degree of difficulty in healthy eating behaviors is critical in pregnant women's decision to engage in healthy nutrition behaviors. The pregnant women reported strong engagement in healthy eating behaviors when they perceived high control over their condition to perform healthy eating behaviors. They exhibited an intention to carry out such behaviors under high PBC and positive attitudes toward the behavior. These results are also consistent with previous studies (28, 29).

The social effects of healthy eating behaviors among pregnant women can be somewhat attributed families and husbands. Healthy eating behaviors that are based on individual choices are an integral part of maternal health, and individual attitudes toward these behaviors play an important role in maternal care during pregnancy (32). Moreover, we share the same findings to another cross-sectional study (28); that is, attitude, subjective norm, and perceived behavioral control explained a large amount of variance in behavioral intention (our study: 22-41%; Malek et al.'s study: 66%).

In addition, behavioral intention contributed only a small proportion of variance in healthy eating (our study: 3-17%; Malek et al.'s study: 3.4%). The results of the study indicated that age and education variables played no significant role in predicting healthy eating behaviors. Similar findings were derived by Whitaker et al. (29), who found that demographic characteristics exerted little effect on the prediction of healthy eating behaviors. This may be the reason why demographic

variables are disregarded as principal predictors in the models used in many studies (29, 33); nevertheless, demographic variables can exert an indirect effect on behavior through the variables in a model. In the current research, consumption of vegetables was reported by more than half of the women (56.7%), which is lower than the recommendation in the food pyramid. This finding is inconsistent with the results of Mohammadi et al. (34), who showed that a large percentage of pregnant women consumed fresh vegetables. The results of a similar study on pregnant women in the USA indicated that the consumption of fruit and vegetables was high (51%) and low (24%), respectively (35). In the present work, the consumption of meat and beans was less than the amount recommended in the food pyramid (34), however, found a meat and meat substitute intake among their participants that was relatively higher than the recommended amounts (34). Likewise, Nakhaee et al. (36) found that meat and bean intake among their participants was higher than recommended daily amounts. A number of limitations in the current work are worth discussing. First, a self-report questionnaire was used to determine the nutrition behaviors of the pregnant woman, but this is a subjective measurement that can generate incorrect descriptions of some reported variables.

To reduce such errors, the pregnant women were asked some questions about nutritional intake. The values were calculated in portions and recorded in the relevant questionnaire. Second, participants were recruited from a single medical center, thereby reducing the generalizability of the results. Further studies should include a larger sample. Third, the fatigue and impatience of the women may have affected response accuracy—an issue that was beyond the researcher's control. Accordingly, some

control questions were incorporated into the questionnaire to increase the accuracy of the information derived from the respondents.

## 5- CONCLUSION

This study revealed that the theory of planned behavior (TPB) variables strongly predicted healthy eating behaviors among pregnant mothers. All factors should be comprehensively considered in designing interventions that modify nutrition behaviors in pregnant women. To improve mothers' engagement in healthy nutrition behaviors, this group should be appropriately informed regarding this issue through the media and health centers. Considering the criticality of maternal nutrition during pregnancy and the findings derived in this research, measures should be taken to modify pregnant women's diets. Such initiatives should include the provision of necessary training when pregnant women are referred to health centers.

## 6- AUTHORS CONTRIBUTIONS

- Study design: ACH, AHP, MJ.
- Data Collection and Analysis: ACH, AHP, C-YL.
- Manuscript Writing: ACH, AHP.
- Critical Revision: C-Y, MJ, AHP.

## 7- CONFLICT OF INTEREST

The authors had not any financial or personal relationships with other people or organizations during the study. Therefore, there was no conflict of interests in this article.

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