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Determinants of breakfast consumption among adolescent girls: Application of the Health Promotion Model using Structural Equation Modeling

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Research article

Keywords: Breakfast, Pender Health Promotion Model, Structural Equation Model, Adolescent Girls

Posted Date: July 16th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-41756/v1

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Abstract

Background: Breakfast is an important sign of healthy nutrition for normal growth and development. Breakfast is considered as the most important meal of the day which is ignored by many adolescents. The purpose of this study was to predict breakfast behavior based on Pender Health Promotion Model(HPM) constructs using structural equation model(SEM).

Methods: A descriptive-analytical study was performed on 450 high school female students in west of Iran in 2019. Sampling was done through a multi-stage method.The questionnaire contained two parts. The first part of which was about demographic and behavior of breakfast consumption; and the second part was a questionnaire based on Health Promotion Model. Data were analyzed by means of SPSS and AMOS both version of 20 software and using Chi-square test as well as regression correlation model.

Results: The constructs of behavioral perceptions, commitment to action plan and behavioral effects explained 47% of the variance of breakfast intake behavior. In the structural equation model, the value of the chi-square statistic test came up to 429.2429 which was divided by resulted degree of freedom (1785), 2.405 and 5%, respectively ($P<0.001$). Fit indexes were either acceptable or good.

Conclusion: The HPM is a suitable theory for predicting the commitment to action plan and behavior of breakfast consumption in Iran.The structural equation model was evaluated as a comprehensive model through both direct and indirect approaches to predict the relationship between breakfast consumption and the predictive factors. This model showed a multi-factorial nature of the predictive factors.

Background

Breakfast is an important sign of healthy nutrition for normal growth and development. Despite positive attitudes toward breakfast intake by the society, it is common to miss it among children, adolescents and women(1). Ignoring breakfast among children of school age can present with inadequate nutrients intake, insufficient physical growth, cognitive impairment, and other behavioral issues. Since most of the girls will develop pregnancy in future, breakfast skipping may not only affect the health of the girl, but also the health of the future children(2). The rate of missing breakfast was reported to be more than 20% among Iranian children(3).

The habit of eating Breakfast is affected by individual, social and environmental characteristics such as age, gender, level of education, and income, parental occupation, family structure, social context, and individual beliefs, such as perceived benefits and barriers to health. Therefore, the constructs of HPMwas the best theoretical framework to determine the predictive tools for breakfast consumption. The HPM is one of the concepts used in the field of behavioral change. This model demonstrates the impact of factors that both directly and indirectly affect health promoting behaviors. This model describes individual, interpersonal, and health-related physical environment. Concepts of this model include individual factors, previous related behaviors, perceived benefits, barriers, and self-efficacy, as well as situational and interpersonal influences, positive and negative effects associated with conduct, commitment to action plans, preferences, and immediate demands(4–6). Although The HPM can be used to explain diverse adolescent health behaviors, only few studies have used this model in the field of nutrition. Previous studies, however, have confirmed its predictive previous

study in Iran have shown that The component of this model determined 33% of breakfast consumption(4). Likewise,In Dehdari study, Prior related behaviors, perceived barriers, self-efficacy, and competing demand and preferences were 4 constructs that could predict 63% variance of breakfast frequency per week among subjects(5) Wu and Pender have shown that perceived self-efficacy as component of this model is the strongest predictor of physical activity among adolescents in Taiwan(7).

Most studies in Iran have examined the pattern of breakfast intake as well as the effect of education on breakfast consumption(6, 8, 9). In Rahimi study, The HPM has been the theoretical framework for determining the predictors of breakfast intake. In this study, a direct linear regression model was used to measure HPM structures for data analysis(10). Since health outcomes due to breakfast consumption often have multiple causes, study in this field, involves consideration of multiple variables and structures as well as study of complex relationships between them; therefore, structural equation models can be of the best value for this study.

Structural Equation Modeling is a multivariate analysis technique that allows the researcher to test a set of regression equations simultaneously and examine the relationships between different variables all together. The importance of this technique in medical science research is that often in this area of research, researchers investigate the relationships between different variables in a form of a model or network of relationships. Therefore, based on the assumptions about the relationships between variables, the general idea of these relationships is designed in form of a pre-made model. In such situations, researchers are confronted with the fundamental question of whether the structure of the prefabricated model is supported in real terms by the data. The distinctive feature of this model is the ability to fit the relationship between the variables of the study as well as to categorize and isolate the measurement error from other errors in the model. Also, correlation between errors, which is one of the limitations in many classic models, is allowed in this model(11, 12). In the present study, two direct and indirect approaches were used to predict breakfast consumption based on the HPM among high school girls in the west of Iran.

Methods

Design and Setting

This analytical cross-sectional study was conducted on students of six female high schools in the city of Khorramabad, Iran during the academic year of 2018–2019.

Sampling

The multi-stage cluster sampling method was used to increase the socio-economic coverage of the subjects(13) First, Khorramabad city was divided into three upper, middle and lower socio-economic areas, and in each cluster, two schools for girls and a total of 6 schools were identified by random clustering. Primary and secondary schools were considered as separate classes. In selected schools, according to the volume of each educational level, the participants were randomly and systematically entered into the study. Regarding the use of structural equation model for data analysis, the sample size was selected 5 times of number of free model parameters, which came up to 450 people.

Measurements

The data for the present study were collected by self-reporting of the participants. The data collection tool was a questionnaire containing two parts: the first part was about demographic variables and behavior of breakfast consumption. The behavior was measured by question of 'How many times a week you eat breakfast?' The second part including prior related behavior, perceived benefits of behavior, perceived barriers to behavior, perceived self-efficacy of behavior, activity-related affects, interpersonal influences, situational influences,, immediate competing demands and commitment to behavior planning.

Prior related behavior was discussed in form of two dimensions. What have you done in the past to spend on breakfast in a timely manner and what results you made of that effort? Each dimension included five items. Perceived benefits was designated in format of sixth formulation such as better learning, better mood, weight balance, general health, reduced use of priceless snacks and daily energy gain. Perceived barriers to behavior were explained in form of eight barriers such as not having appetite in the early morning, not having breakfast due to fear of getting overweight, having to hurry to go to school, not having breakfast by family members, as well as repeated and uniformity consumption of food at breakfast, family members' habitual eating habits, unwillingness to have breakfast alone, and a tendency to sleep more early in the morning. Perceived self-efficacy was described in form of 7 items including the degree to which a person has confidence in eating breakfast at a specific time, eating a light dinner, having a snack at night, having breakfast by himself, eating breakfast without family habits in spite of the haste to go to school and excess weight was measured. Activity-related affects was investigated in form of four items including enjoyment of breakfast, sense of being overnight after consumption, lack of breakfast due to the fear of being overweight and tedious breakfast. Interpersonal influences was measured in form of 4 items such as expectations, encouragements and role of behavioral patterns such as family, teacher and friends, incentives and role models. Situational influences were clarified in form of two items about the location and the appropriate situation for breakfast enjoyable environment. Immediate competing demands was formatted in five items such as more to stay in bed in the morning, enjoying eating unhealthy snacks instead of having breakfast, having lunchtime until late waking up, eating dinner and lunch instead of breakfast, and paying more attention to the time of arrival at the school. Finally commitment to plan behavior was categorized in six terms including the degree of commitment to planning breakfast for six steps such as preparing school supplies from the night before, getting sleeping early and having breakfast, eating a varied, healthy and tasty breakfast, having breakfast in a quiet place and encouraging yourself after being used to breakfast intake.

Questionnaire Scoring

To evaluate the variables of this study including prior related behavior, priorities and demands for immediate commitment to behavior planning, and interpersonal influences the following scoring criteria were used. According to this criteria, never scored 1, sometimes scored 2, with scored 3, often scored 4, and always scored of 5. There has been sub-scores like totally disagree which scored 1, disagree scored 2, I have no idea scored 3, agree scored 4, and totally agree scored 5. In regards to perceived self-efficacy, I am not sure at all scored 1, I am not sure scored 2, I have no idea scored 3, I am sure scored 4, and I am pretty sure scored 5.

Validity

HPM provided the theoretical concept for the instrument development. we produced a set of specific items for this study as recommended by the model. This model is one of the most accurate and important models that

shows the relationship between health beliefs and behaviors. (14). Validity of the instrument were assessed through the following process(15).

Face Validity

Both qualitative and quantitative methods were applied for face validity. For the purpose of qualitative approach, 20 students were asked to assess each item for ambiguity and difficulty. In general, there were no problems in reading and understanding the items by students. The quantitative face validity was evaluated through impact score. The impact score for each item was calculated as multiplying the importance of an item with its frequency. The impact scores of greater than 1.5 were considered suitable(16). The validity of the questionnaire has been confirmed in previous study by Dehdari(5).

Content validity

An expert panel including 15 such as health education, nutrition, psychologist, statistics, epidemiology and examined the content validity. The expert panel was asked to comment on the necessity and relevance of the items in order to calculate the Content Validity Ratio (CVR) and the Content Validity Index (CVI), respectively. The necessity of an item was assessed using a three-point rating scale: (i) not essential, (ii) useful, but not essential, (iii) essential. Following the experts' assessments, the CVR for total scale was computed. According to Lawshe, if more than half of the panelists indicate that an item is essential, then that item has the least content validity. Here, the CVR for the scale equal or greater than 0.59 was considered satisfactory.(17). The CVI was estimated by experts' ratings of items relevancy, simplicity, and clarity on a 4-point Likert scale(15).

Reliability

Internal consistency of the instrument was assessed by using Cronbach'salpha coefficient(18). Alpha values of equal or greater than 0.70 was thought satisfactory

DATA ANALYSIS

To describe the data, a frequency distribution table was used. The structural equation model was employed to predict breakfast behavior based on the constructs. In this model, the results of standardized regression coefficients, correlation coefficients and standard factor loads were used with significance level of 0.05. In addition, for model fit assessment, 2 /dfχ, GFI, CFI, IFI and RMSEA indices were used. For the purpose of all analyzes, IBM SPSS 21 and AMOS 21 were utilized.

ETHICAL CONSIDERATION

This study was conducted after obtaining ethical approval from the Ethics Committee of Lorestan University of Medical Sciences, Lorestan, Khorram-abad, Iran. This study was funded by the Lorestan University of Medical Sciences with the registration number A-10-1556-2.

Results

The mean age of the participants was 15.5 ± 1.7. Frequency distribution of demographic characteristics and behavior of breakfast consumption in the past week are presented in Table 1. Table 2 demonstrates the mean and standard deviation of the constructs of HPM. In the structural equation model, the value of the chi-square

statistic was 429.2429, which was divided by the degree of freedom (1785), 2.405 and 5%, respectively ($P < 0.001$). Fit indices were all acceptable or good (Table 3). Figure 1 entitled Structural Equation Model shows the behavior of breakfast intake based on HPM. Behavioral administrative structures, commitment to action plan and behavioral emotion explained 47% of the variance of breakfast behavior.

Table 1
Frequency distribution of demographic characteristics and behavior of breakfast consumption in the past week

Variable Name	*Category*	Frequency	Percent
Age	< 15	122	27.1
	≤ 15	328	72.9
Educational level	First Grade High School	170	37.8
	Second Grade High School	280	62.2
Education Major	Mathematics	48	10.7
	Experimental Sciences	155	34.4
	Human Sciences	56	.124
	Technical and professional	21	4.7
Average	17 > μ	37	8.2
	≤ μ < 19 17	138	30.7
	19 ≤ μ	275	61.1
BMI	Low Weight	21	4.7
	Normal Weight	357	79.3
	Excess Weight	72	16.0
Household Income	I > 125$	21	4.7
	$125 ≤ I<$250	57	12.7
	$250 ≤ I<$500	166	36.9
	$500 ≤ I	206	45.8
Child's Birth Order	1	203	45.1
	2	131	29.1
	3	50	11.1
	≤ 4	66	14.7
Mother's Employment	Employed	113	25.1
	Housewife	337	74.9
Breakfast Preparation	Person Himself	158	35.1
	Mother or Father	235	52.2
	Other People	57	12.7
Sleeping Time	8–9	8	1.8

Variable Name	*Category*	Frequency	Percent
	9–10	19	4.2
	10–11	56	12.4
	11–12	212	47.1
	After 12	155	34.4
Waking Time	6	136	30.2
	6.30	175	38.9
	7	66	14.7
	7.30	24	5.3
	Other	49	10.9
Breakfast Consumption	Never	36	8.0
	1–2 Times	78	17.3
	2–3 Times	29	6.4
	3–4 Times	38	8.4
	5–6 Times	44	9.8
	Every Day	225	50.0

Table 2
The mean and standard deviation of Pender Health Promotion Model constructs

Structure	mean ± sd. deviation	Cronbach's alpha coefficient of internal consistency
Prior Related Behaviors	61.351 ± 18.040	0.838
Perceived Benefits	74.333 ± 15.769	0.806
Perceived Barriers	77.416 ± 15.496	0.757
Perceived Self-efficacy	57.194 ± 18.789	0.814
Activity-related Affects	61.244 ± 13.180	0.712
Interpersonal Influences	67.128 ± 22.627	0.908
Situational Influences	57.851 ± 19.410	0.562
Immediate Competing Demands	50.177 ± 20.993	0.675
Commitment to Planning	56.977 ± 19.013	0.640

Table 3
Bread Pregnancy Fit Fitness Assessment Indices Based on Pender Health Promotion Model

Index name	RMSEA			χ^2/df		NFI	IFI	GFI	CFI	PCFI
	Estimate	95% confidence interval	P-Value	Estimate	P-Value					
Amount	0.056	0.058 – 0.054	< 0.001	2.405	< 0.001	0.702	0.803	0.762	0.800	0.756

Table 4
Direct, indirect and total effects derived from standardized regression coefficients of Structural Equation Model

Variable	consumption Breakfast		
	direct	Indirect	Total
Prior related behaviors	-	0.454	0.454
Perceived benefits	-	-	-
Perceived barriers	-	-	-
Perceived Self-efficacy	-	-	-
Activity-related affects	-		-
Interpersonal influences	-	-	-
Situational influences	-	-	-
Immediate competing demands	0.110	-	0.110
Commitment to planning	0.361	-	0.361
Personal factors	-	0.139	0.139
Behavioral effects	0.362	0.087	0.275
Behavioral perceptions	0.646	0.188	0.458

Discussion

The final structural equation model of this study showed that behavioral perceptions, behavioral effects, and commitment to planning had direct effects on the behavior of breakfast consumption. The fitness indices of the HPM in the current study were acceptable.This model explained 47% of the variance of health promoting behaviors. The behavioral perceptions and behavioral effects have direct and indirect relationships with the behavior of breakfast as well, and also predict the behavior of breakfast by influencing the commitment to the

action plan indirectly. Along with previous studies, behavioral perceptions and behavioral effects are prominent variables that influence the behavior of contributing health promotion (4, 19, 20).

The beliefs such as perceived benefits, perceived barriers, perceived self-efficacy and activity-related affects are behavioral perceptions that can facilitate or prevent the motivation to change behavior (21). According to a previous study, psychological indicators, such as activity-related affects about breakfast intake may impact the regular habit of breakfast intake(22). Activity-related affects are emotions that occur prior to, during, and after a specific health-related behavior. A healthy food that is not tasty is one of the most important factors preventing breakfast behavior, because the most important criterion for choosing food in young people is the taste(23). Consistent with previous studies, availability of healthy foods based on the interests of the children can increase the amount of fruits and vegetable compositions(24, 25).

Perceived self-efficacy means a person's confidence in his ability to achieve the desired goals. Nutritional self-efficacy is the perceived ability of a person to choose healthy foods, especially in difficult conditions when there are limitations in healthy food choices or when there is no incentive to choose them(26). In nutrition education studies, much emphasis has been placed on self-efficacy as a predictor of nutritional intent and behavior(27, 28).. Studies on use of fruits and vegetables in children and adolescents also show that self-efficacy is a positive and important predictor in increasing the consumption of fruits(29, 30).

Perceived benefits are beliefs about the usefulness of breakfast and the reduction of adverse effects caused by not taking it(31). A previous study showed that informing people about the benefits of having healthy snacks will further motivate them to do it as a behavior. In addition, promoting other positive outcomes of breakfast, such as promoting psychosocial function, increasing awareness, improving the mood, as well as the effect of breakfast intake on the adequacy of diet should be considered (32). In previous studies, the relationship between perceived benefits and nutritional behaviors, especially breakfast, has been investigated(4, 27, 33).

Perceived barriers perceptual factors about breakfast intake may include morning anorexia, homogeneity and lack of breakfast diversity, time consuming, and being alone at breakfast time(34). The use of tangible incentives, such as breakfast in a place where one wishes or is tailor-made, or mental encouragement, such as its positive impact on individual academic performance, increases the participation of audiences to adopt the behavior of breakfast intake In addition, providing social support to increase participation and reduce perceived barriers is effective(1).

The behavioral effects such as interpersonal influences and situational influences have direct and indirect relationships with the behavior of breakfast as well, and also predict the behavior of breakfast. The situational influences are perceptions about the capacity of the living environment in facilitating a particular health-related behavior. The situational influences are those that increase the personal access to healthy breakfast. A systematic review showed that access to fruits and vegetables at the neighborhood level of living was directly related to intake of those foods by adolescents and children (32). Cultural and structural factors of the community, such as existence of healthy food choices in the school buffet, affect the dietary habits of children (33). Therefore, breakfast should be available so that children and adolescents can consume it which reduces perceived barriers to breakfast intake among children and adolescent.

The interpersonal influences are perceptions about the behaviors and beliefs of others, such as family members and friends, regarding the performance of a specific health-related behavior. This factor has been investigated in previous systematic review as a variable of subjective norms, such as family and friends(35). The encouraging effects of the family on improving nutritional behaviors of children have been studied and documented. There are studies that show the role of mothers in developing appropriate and inappropriate nutritional behaviors among children(36). Peer education is also an effective strategy for changing behavior. Peer groups have had the most impact on the performance of children and adolescents in all domains, which can be positive or negative(37).

Prior related behaviors are indirectly related and predictive of breakfast intake. Prior related behaviors influence the beliefs, effects and regulation of performing health promotion behaviors(21). Wong *et al*. describe behavior as the strongest predictor of breakfast intake in the future (38). According to a study on the effects of sleeping habits on breakfast intake, children who eat breakfast on daily basis, they go to bed earlier than unborn babies(39). In addition, there is a positive relationship between the time a child has been inactive, such as watching television or gaming, with frequency and type of consuming low value snacks(40).

The final decision to conduct a behavior is largely influenced personal factors(31). The results of the present study showed that personal variables such as family size, birth rate, birth order, time of falling sleep, dinner time, previous semester, and participation in breakfast have a significant correlation with the average number of breakfast dishes. The results of previous studies have shown that breakfast was associated with personal characteristics such as the status of work of parents, their socioeconomic status, and their education(41, 42).

Our study had a couple of advantages and a limitation as well. The advantages include use of relatively large sample size and structural equation model for statistical data analysis. Nonetheless, we failed to collect information about a number of variables the may influence our findings.

Conclusion

It can generally be stated that HPM is a suitable theory for predicting the commitment to action plan and behavior of breakfast consumption. It is recommended to focus on the predictive power of Pender's health promotion model constructs and model fit on breakfast consumption behavior across communities. In planning educational interventions, the commitment to maintaining breakfast behavior should be promoted through the creation of pleasant experiences that have a positive effect on individual perceptions and behavioral effects.

Abbreviations

HPM
Health Promotion Model
SEM
Structural Equation Model

Declarations

Ethics approval and consent to participate:

This study was conducted after obtaining ethical approval from the Ethics Committee of Lorestan University of Medical Sciences, Lorestan, Khorram-abad, Iran. Informed consent to participate was obtained from the parents/guardians of the minors included in this study..

Consent to Publish:

Not applicable

Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on a reasonable request.

Competing interests:

All authors have read and approved the content of the article. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding:

This study was funded by the Lorestan University of Medical Sciences as part of a thesis with the registration number A-10-1556-2. The Lorestan University of Medical Sciences had funded this study in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Authors' contributions:

MI and FB have made substantial contributions to the conception and design. NCH and ZA participated in the study design and data acquisition. FE, MI, FB and AA were involved in drafting and revising the manuscript, which was critically for important intellectual content. All authors have read and approved the manuscript.

Acknowledgements:

The researchers would like to express their gratitude to the participants and the staff of the high schools of Khorramabad, Iran.

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Figures

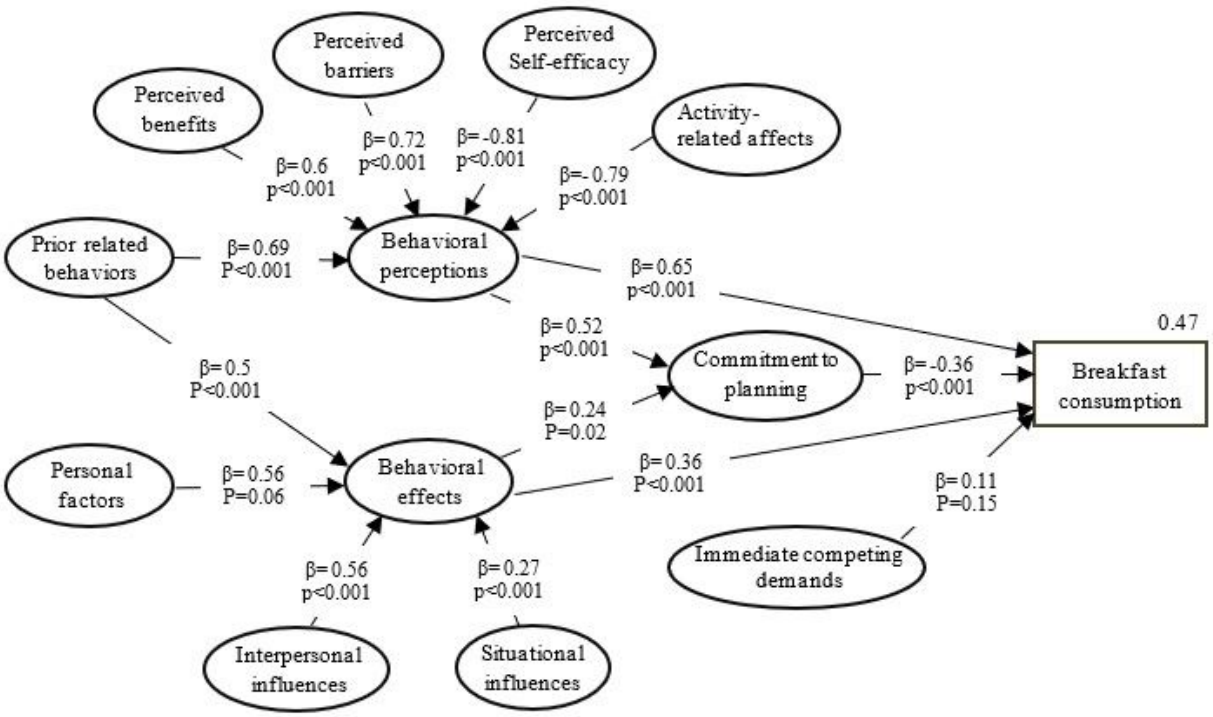


Figure 1

Structural Equation Modeling of Breakfast Intake Based on HPM