

Effectiveness of training on preventative nutritional behaviors for type-2 diabetes among the female adolescents: Examination of theory of planned behavior

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Abstract

Background: Since type-2 diabetes is the most common chronic disease among Iranian female adolescents, we applied theory of planned behavior to examine the effect of training to intention to preventative nutritional behaviors for type-2 diabetes among female adolescents.

Methods: In this experimental study 200 (11-14 year old) girls from 8 schools of Tehran city (100 in each intervention and control group) were recruited based on cluster sampling method during two stages. For intervention group, an educational program was designed based on the theory of planned behavior and presented in 6 workshop sessions to prevent type-2 diabetes. The data were collected before and two months after the workshops using a valid and reliable ($\alpha=0.72$ and $r=0.80$) author-made questionnaire based on Ajzens TPB questionnaire manual. The data were analyzed using t-test, chi-square test and analysis of covariance.

Results: Findings indicate that the two groups were homogeneous regarding the demographic characteristics before education, but the mean score of the theory components (attitudes, subjective norms, perceived behavioral control, and intention) was higher in the control group. Also, results showed all of the theory components significantly increased after the education in the intervention group ($p=0.000$).

Conclusion: Training based on the theory of planned behavior enhances the intention to adherence preventative nutritional behaviors for type-2 diabetes among the studied female adolescents.

Keywords: Health education, Theory of planned behavior, Diabetes Mellitus Type 2, adolescents.

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Introduction

The prevalence of type-2 diabetes is one of the main concerns of people in both the developed and developing countries (1). Although type-2 diabetes is not seriously considered as a common disease in the childhood and adolescence, however, an increase in the number of the teenagers with type-2 diabetes has been reported recently. In Iran, the prevalence of type-2 diabetes at the age group of 3-19 years is 45 in 100,000 people (2). Meanwhile, the studies indicate not only the prevalence of di-

agnosed type-2 diabetes among the Iranian women is more than men at all age groups, but also the number of Iranian females who are unaware of their diabetes is more than males (3). Further, the studies indicate that up to 2030 the number of patients with diabetes will increase up to 69% in developing countries (4). To this regard, people who will suffer from diabetes in the future are now in their childhood or adolescence; therefore, they need preventive care.

There is a positive and significant relationship between type-2 diabetes and obesi-

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ty. Over 90% of adolescents diagnosed with type-2 diabetes in the United States suffer from obesity. So, preventing obesity is one of the crucial steps to prevent type-2 diabetes (5). For that, healthy nutrition education is an important element (6). Nutritional intervention is an integral part of diabetes management and self-care education, aiming at attainment and maintenance of optimal metabolic outcomes, the prevention of medical complications, and improvement of general health by addressing individual nutritional needs (7). Primary care providers have an obligation to encourage lifestyle modifications that might delay or prevent the onset of type-2 diabetes in children at high risk. Lifestyle interventions focusing on weight management and increasing physical activity should be promoted in all children at high risk for the development of type-2 diabetes (8). Studies show that type 2 diabetes can be prevented by lifestyle interventions such as nutritional education in subjects who are at high risk for diabetes (1,2,5,7-11).

To increase the impact of health education we need appropriate education strategies through suitable methods and frameworks. As a method, holding workshops is an appropriate strategy for health education. Activities of workshop based on problem solving process, aim to provide participants with a condition to make decisions on a health problem or behavior, and then provide the solutions (7). As a framework, the Theory of Planned Behavior (TPB) provides a systematic framework for the health education. According to this theory, the intention to conduct a behavior is related to an individual's attitude toward the behavior, subjective norms about the behavior, and the rate perceived behavioral control (11,12). This theory pays attention to the impact of attitudes, subjective norms, and perceived behavioral control as components of intention to conduct nutritional behaviors (9,11).

The effectiveness of such a theory has been studied on problems such as malaria prevention behaviors among men (10), pre-

venting HIV/AIDS among adolescents (13), preventing smoking among adolescents (9), hypertension prevention self-care behaviors (11) and increasing physical activity among children and adolescents in physical education classes (7).

Considering obesity as the main cause of increase of type-2 diabetes among the adolescents, and the effectiveness of the TPB on changing the intention for conducting behaviors associated with health, this study aims to determine the effect of the education based on the TPB on the intention of conducting preventive nutritional behaviors of type-2 diabetes among a population of Iranian female adolescents.

Methods

Study subject

In this experimental study, 200 (100 in each case and control group) girl adolescents participated from 8 schools in Tehran city; selected based on cluster sampling method during two stages. According to previous related studies of the impact of education on the nutritional performance (7,14,15), and also with regard to 5% alpha error and the study power 90%, the sample size equals 40 people for each group. However, by considering the loss and coefficient of cluster sampling, and also with the purpose of decreasing error, sample size was considered 100 people in each group. We had no blinding procedure.

The study began in December 2010 and finished in January 2012. First, each of the 8 central regions of Tehran (district Southern 2 with 11 schools, Southern 5 with 9 schools, 6 with 30 schools, 7 with 32 schools, 9 with 14 schools, 10 with 16 schools, 11 with 21 schools, and 12 with 31 schools) was considered as a cluster, and then one school was selected from each cluster at random via table of random numbers. All students of these 174 schools were 30000 and 1473 students were selected in this stage. Randomly, 4 schools were allocated to intervention group and 4 allocated to control group. Finally, in each school, one class and in each class, 25 students

were selected randomly (100 girls in the intervention group and 100 girls in the control group). Since Southern and Northern regions of Tehran have considerable cultural, social, and economic differences, the comparison between the participants of these regions could show bias; therefore, the central regions of Tehran were selected. The schools were selected for convenient matters and the fact that health education in schools has a positive impact on the students' health, knowledge, attitudes, and skills (16). Moreover, the selection of girls as the research population refers to the fact that the prevalence of diabetes among women is more than men (3,17).

Inclusion and exclusion criteria

11-14 year old girls who had not been educated in prevention of type-2 diabetes over the recent six months and also have not had a special disease were participated in the study. The exclusion criteria were: not participating in even one of the class sessions, receiving any other similar educations, and loosing tendency to take part in the study. According to the mentioned criteria, none of the samples were excluded from the study.

Measurements

The tool is a self-report researcher-made questionnaire with two parts:

a. The questionnaire of demographic characteristics investigating age, parents' level of education, family past medical history of diabetes, the experience of participating in educational classes related to keeping a preventive diet of diabetes over the recent 6 months, and source of receiving health information.

b. The questionnaire consists of components of TPB, which was based on the TPB for preventing type-2 diabetes in four parts (18). This section is designed based on a review of studies by Fila and Smith (19), Rah et al. (20), Solhi et al. (7), and also by using the guideline of analyzing a questionnaire based on the TPB (21). The variable "preventive nutritional behavior of

type-2 diabetes" has entered the standard questionnaire of Fishbin and Ajzen. The developed questionnaire includes aspects of TPB including attitude (10 items), subjective norms (4 items), perceived behavioral control (6 items), and intention to behavior (6 items) in the preventive nutrition of type-2 diabetes. According to the available standard instruction, the 5 point Likert-type scale is used to measure the questions (0=strongly disagree, 1=disagree, 2=having no idea, 3=agree, 4=strongly agree). The possible ranges for attitude, subjective norms, perceived behavioral, and intention to behavior were 0-40, 0-16, 0-24, and 0-24, respectively.

Reliability and validity

Reliability of the questionnaire was obtained by the internal consistency (attitude $\alpha=0.66$, subjective norms $\alpha=0.7$, perceived behavioral control $\alpha=0.66$, behavioral intention $\alpha=0.85$, and total questionnaire $\alpha=0.72$), and test-retest ($r=0.80$). The validity of tool was determined by face and content validity, which confirmed by 15 nursing and five nutrition sciences experts. The total content validity index in the parts associated with "relevance", "simplicity", and "clarity" was 92.56, 90.94, and 92.81, respectively.

Intervention

After an introductory session for deans of schools, parents and student, the pre-test was carried out. After a week, an educational workshop in six sessions of 120 minutes duration was hold and presented by five community health nurses over three weeks for the intervention group. The sessions were separately held in each school; however, the educators of the workshop were the same in all the schools. A two-hour lecture and question answer session was held for parents by two community health nurses, too. This session was held to give information to parents about the diabetes prevention program to reduce their concerns about this program.

The educational content focused on the

diabetes and its importance, complications, types, and risk factors (attitude) (sessions one and two), significance of improving and protecting the adolescents' health, and expectations of society, family and friends from the adolescents to protect their health (subjective norm) (sessions three and four), importance of changing lifestyle to prevent diabetes (the perceived behavioral control) and healthy nutrition to prevent diabetes (sessions five and six) (21,22). According to the program schedule, after determining the purposes of each educational session, an educational content was presented via a short lecture, and then the scenarios based on the problem-solving design were presented to the adolescents. Later, the adolescents were divided into groups with five members to solve the problem, discuss it, exchange ideas, and finally present the results of their work. The session was over by one of the managers' conclusion. At the end of each session, a pamphlet including the content of that session was given to the students. Moreover, the educational session was held for one or both of the adolescents' parents. The session concentrated on the importance of preventive nutrition for diabetes in the adolescence. The control group has had no educational program. In line with Solhi's study, the post-test was performed in both groups two months after the last workshop session (7). Because of students were repeatedly recommended to complete all items of the questionnaire, the study had no missed data.

Data analysis

To the study homogeneity of two groups from the perspective of demographic characteristics, the inferential statistics including chi-square and t-test was applied. Kolmogorov - Smirnov test was used to test the normal data distribution and independent t-test and analysis of covariance were used to compare the mean of scores between two groups of control and intervention. Level of significance was 0.05. Data were analyzed via SPSS version 14.

Ethical considerations

The study is confirmed by the Committee of Ethics, Tehran University of Medical Sciences. The research objectives were explained for all of the adolescents participating in the study, deans of schools, and adolescents' parents, and then their written consents were obtained. Moreover, a similar workshop for the control group and their parents was presented after collecting post-test data.

Results

Descriptive results

The mean (SD) age of the participants was 13.2 ± 0.78 (case=12.9 (0.62), control=13.2 (0.78)), their parents educated up to the middle school on average (43.5% of mothers and 55% of fathers), most of them did not have a family history of diabetes (82.15%), and the majority of them had not had participated in the educational classes of keeping a diet over the recent 6 months (92.1%). Moreover, TV and radio were the health information resources of most of them (43.5%). The findings indicated that, the control and the intervention groups were homogeneous regarding the demographic characteristics (Table 1).

Analytical results

Results indicate that before the intervention, attitude, subjective norms, and perceived behavioral control of the control group are higher than the intervention group. Therefore, to analyze the data, analysis of covariance was applied. However, comparing the mean and standard deviation of the adolescents' behavioral intention between two groups before the intervention reveals no significant statistical difference. Therefore, the score of behavioral intention after the education was studied in both of the groups via independent t-test (Table 2).

The results indicate that after the educational program, the mean of the components of the TPB in the intervention group has increased (Table 2).

Also, the inter-group study between the control and the intervention groups indi-

Table 1. Comparison of participants' demographic characteristics between the intervention and the control groups

Group		Case% (n)	Control% (n)	Total% (n)	p
Father's education	Uneducated	2% (n=2)	4% (n=4)	3% (n=6)	p=0.89 [£]
	Primary school-middle school	58% (n=58)	52% (n=52)	55% (n=110)	
	Diploma-higher than diploma	36% (n=36)	40% (n=40)	38% (n=76)	
	BA. or higher degrees	4% (n=4)	4% (n=4)	4% (n=8)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
Mother's education	Uneducated	4% (n=4)	9.8% (n=10)	6.9% (n=14)	p=0.55 [£]
	Primary school-middle school	44% (n=44)	43.1% (n=43)	43.6% (n=87)	
	Diploma-higher than diploma	44% (n=44)	35.3% (n=35)	39.6% (n=79)	
	BA. or higher degrees	8% (n=8)	11.8% (n=12)	9.9% (n=20)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
Father's job	Retired	10% (n=10)	11.8% (n=12)	10.9% (n=22)	P= 0.93 [£]
	Worker	20% (n=20)	15.7% (n=16)	17.8% (n=36)	
	Employee	20% (n=20)	19.6% (n=20)	19.8% (n=40)	
	Self-employed	42% (n=42)	43.1% (n=42)	42.6% (n=84)	
	Unemployed	4% (n=4)	2% (n=2)	3% (n=6)	
	Others	4% (n=4)	7.8% (n=8)	5.9% (n=12)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
Mother's job	Housekeeper	2 (n=2)	7.8 (n=8)	5% (n=10)	p=0.18 [£]
	Employed	98% (n=98)	92.2% (n=92)	95% (n=190)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
History of disease	Yes	2% (n=2)	2% (n=2)	2% (n=4)	p=0.75 [£]
	No	98% (n=98)	98% (n=98)	98% (n=196)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
History of medicine use	Yes	0% (n=0)	3.9% (n=4)	2% (n=4)	p=0.49 [£]
	No	100% (n=100)	96.1% (n=96)	98% (n=196)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
History family of diabetes	Yes	20% (n=20)	15.7% (n=16)	17.8% (n=36)	p= 0.57 [£]
	No	80% (n=80)	84.3% (n=84)	82.2% (n=164)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
History of participation in educational classes	Yes- more than 6 months	6% (n=6)	9.8% (n=10)	7.9% (n=16)	p= 0.71 [£]
	No	94% (n=94)	90.2% (n=90)	92.1% (n=184)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	
Information resources	TV and radio	44% (n=44)	49% (n=49)	46.5% (n=93)	p= 0.81 [£]
	Friends	8% (n=8)	5.9% (n=6)	6.9% (n=14)	
	Family members	30% (n=30)	33.3% (n=33)	31.7% (n=63)	
	Teachers	8% (n=8)	2% (n=2)	5% (n=10)	
	Members of health group	4% (n=4)	3.9% (n=4)	4% (n=8)	
	Internet	6% (n=6)	5.9% (n=6)	5.9% (n=12)	
Total		100% (n=100)	100% (n=100)	100% (n=200)	

¥: Independent T test, £: Chi- square

cates that there is a significant increase in the mean of the score of the theory components within the control group before and after the educational program ($p < 0.001$). However, there is a significant decrease in the mean of scores of the attitude ($p = 0.001$) and behavioral intention ($p = 0.007$) in the control group (Table 3).

Discussion

The results indicate that a behavioral theory, such as the TPB, could be a good framework to achieve the educational objectives in changing feeding behaviors. Since type-2 diabetes is more prevalent among Iranian women – whether female adolescents or adults- than men (23), then this study entered female adolescents, who

Table 2. Comparison of the meanscore (SD) of the components of the TPB between the intervention and the control groups before and after education

Components of the TPB	Before intervention		p (95% CI for mean difference)	After education		p (95% CI for mean difference)
	Case Mean±SD	Control Mean±SD		Case Mean±SD	Control Mean±SD	
Attitude	79.68±13.17	84.54±7.98	p=0.02 [¥] (-9.19,-0.55)	92.99±7.76	79.76±10.42	p<0.001 ^{€***} (9.56,16.83)
Subjective norms	63.12±14.5	70.1±14.20	p=0.01 ^{¥**} (-1.42,-12.58)	81.2±10.2	67.52±16.81	p<0.001 ^{€***} (8.17,19.17)
Perceived behavioral control	64.88±16.34	70.66±11.01	p=0.04 ^{¥*} (-11.31,-0.26)	78.88±15.95	67.68±14.61	p<0.001 ^{€***} (5.15,17.23)
Behavioral intention	80.26±14.73	82.81±13.22	p=0.36 [¥] (-8.07,2.98)	93.80±8.10	77.64±12.89	p<0.001 ^{¥***} (11.9,20.41)

€: analysis of covariance, ¥: Independent t-test, ***: Significant at level 0.001, **: Significant at level 0.01, *: Significant at level 0.05

Table 3. Inter-group comparison of the mean scores (SD) of components of the TPB in the control and the intervention groups before and after the education

Components of the TPB	Intervention group			Control group		p (95% CI for mean difference)
	Before education Mean ±SD	After education Mean ±SD	p (95% CI for mean difference)	Before education Mean ±SD	After education Mean ±SD	
Attitude	79.68±13.17	92.99±7.76	p<0.001 ^{€***} (-17.38,-9.18)	84.54±7.98	79.76±10.42	p<0.001 ^{€***} (1.97,7.60)
Subjective norms	63.12±14.05	81.2±10.20	P<0.001 ^{€***} (-21.57,-14.59)	70.11±14.20	67.52±16.81	p=0.24 [€] (-1.77,6.94)
Perceived behavioral control	64.88±16.34	78.88±15.95	p<0.001 ^{€***} (-19.97,-8.03)	70.66±11.01	67.68±14.61	p=1.29 [€] (-1.33,7.29)
Behavioral intention	80.26±14.73	93.80±8.10	p<0.001 ^{¥***} (-16.87,-10.20)	82.81±13.22	77.64±12.89	p=0.007 ^{¥**} (1.46,8.86)

€: analysis of covariance, ¥: Independent t-test, ***: Significant at level 0.001, **: Significant at level 0.05

might suffer from type-2 diabetes in the adolescence or adulthood, as a result of ignoring the risk factors of the type-2 diabetes. Moreover, using educational workshop at school could increase the power of intervention and reliability of the results (24,25).

In comparison with the control group and before the education, the significant positive increase of adolescents' attitude in the intervention group indicates the effectiveness of the educational program to improve the attitude toward the preventative nutritional behaviors of type-2 diabetes. The achieved results are in agreement with the results of the similar studies. In their research, Hardman et al applied TPB to study the intention to conduct health behaviors with the final purpose of increasing the physical activity among the adults (26). Kothe et al applied TPB to increase regular eating of breakfast among the young students (27), and Baker et al. applied it to increase the intention to have a healthy diet and physical activities among adolescents (28). Our participants' attitude significantly

changed after the educational intervention. However, no change occurred in the study of Parrot et al., study on the attitude toward having physical activities among the adults (29). The different results are because of the different health objectives of the studies. In fact, achieving a special attitude depends on two factors of enjoying a behavior, and having access to the advantages of that behavior (21). According to the results, in comparison with before educational program and with the control group, subjective norms of the intervention group have increased. It seems that applying the workshop method and the peers' interactions about the diabetes, its complications, and preventive nutrition lead to the increase of the score of the component. Parrot et al. reported no increase in physical activity as a result of educational program delivered via E-mail (29). Also, Hardeman et al study reported no modification in subjective norms in the field of physical activity via the face to face and telephone-based theoretical educational methods (26). It seems that the merely theoretical education and

not involvement of friends and families were the causes of their failure, however, Baker's study of the adolescents with the purpose of predicting nutrition and behavior patterns based on the TPB also failed to modify the adolescents' subjective norms (28). The importance of the educational method is revealed after being compared with the results of a study by Kothe et al who applied a combined method of study (27). It seems that more practical definitions and more studies are needed in relation to the effective factors associated with the structure of subjective norms. Just like other components of the planned behavior theory, the perceived behavioral control increased in the intervention group after performing the educational program. Results indicated the impact of education based on the workshop method on changing lifestyle in preventing diabetes. The same results were achieved in the previous studies (11,26-29). Moreover, in a study that aimed to determine the effect of behavioral control and intention on the increase of consuming fruits and vegetables, an intervention via booklet was presented to students. In this study, self-efficacy and perceived behavioral control were considered as variables. The results indicated that the score of the individuals' intention increased; however, the intervention failed to improve their self-efficacy and perceived behavioral control (30). In contrast, a study on the use of an educational method to modify a special behavior, increased the behavioral control (31). It seems that paying attention to barriers that individuals have to confront is effective in explaining the contradictions.

Finally, it should be mentioned that the performed interventions of the present paper influenced conducting preventive nutritional behaviors of type-2 diabetes. The results were in agreement with results of Kothe et al., indicating that the increase of the three structures of the theory led to the increase of behavioral intention (27). Also, in the studies of Hardeman et al and Baker et al the behavioral intention increased, however, subjective norms did not change

(26,28). In the study of Parrot et al only the perceived behavioral control indicated a positive change, no other change was observed in the behavioral intention in comparison with before intervention (29). The results of the present study and previous studies indicate that the increase of the behavioral intention does not depend on the increase of the three components of the theory, however, the significant and positive change of attitude and perceived behavioral control is effective and necessary in increasing it.

Limitations

One of the confounding variables was the researchers' inability to completely control the participants not to receive educational information from other educational resources during the study. Anyhow, the researchers have recommended the adolescents and their families to avoid some educational programs. The research was carried out only in Tehran city (with 8.5 million populations) and its results cannot be generalized to all of the Iranian female adolescents. Nonetheless, Tehran is the capital of Iran that makes 11.12 % of the total population of Iran (24) and 99.6 percent of its population refers to the five main ethnic groups of Iran (25).

Conclusion

The results of the study confirm the effectiveness of educational program based on the workshop method and the TPB on the intention to conduct preventive nutritional behaviors of type-2 diabetes among the female adolescents. In other words, after the educational intervention, adolescents are more likely to conduct preventive nutritional behaviors of diabetes. They also expected their beloved ones to have a preventive diet in relation with diabetes. They are more able to act based on a preventive diet of diabetes after the intervention. In a nutshell, their intention to conduct a preventive nutritional behavior of diabetes has increased among them.

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