

The Effect of Educational Intervention Based on Health Belief Model on Preventive Behaviors of Type 2 Diabetes Among at-risk Male Students

Saleh Safajou

Rafsanjan University of Medical Sciences <https://orcid.org/0000-0002-2148-3182>

Mohsen Rezaeian

Rafsanjan University of Medical Sciences

Yaser Salim Abadi

Rafsanjan University of Medical Sciences

Mostafa Nasirzadeh (✉ mnasirzadeh13@rums.ac.ir)

Rafsanjan University of Medical Sciences <https://orcid.org/0000-0003-0934-4697>

Research

Keywords: Educational intervention, health belief model, diabetes, prevention behaviors, students

Posted Date: April 20th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-435179/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: One of the most important strategies to prevent diabetes as an important health issue in adolescents is education and awareness. The aim of this study was to determine the effect of educational intervention (EI) based on health belief model (HBM) on preventive behaviors of type 2 diabetes.

Methods: The educational trial study was conducted in 2019-2020 among 143 high school male students at risk in Khash city (in southwestern Iran), using a random cluster method in two intervention and control groups. Data collection tools were demographic characteristics, knowledge, model constructs and disease prevention behaviors questionnaires. The training program was held in 7 one-hour sessions. Data were collected before, immediately and three months after the intervention and analyzed by SPSS 20 software using Chi-square, Independent t-test and Repeated Measures ANOVA at significant level of 0.05.

Results: Immediately after the implementation of the training program in the intervention group, a significant increase was observed in the mean scores of knowledge, model constructs and behavior ($P = 0.0001$). Three months after the EI, there was a significant difference between the mean scores of knowledge, perceived barriers, Cues to action and behavior between the two groups ($p < 0.05$).

Conclusion: Considering the effect of EI based on HBM on the promotion of diabetes prevention behaviors in students, the design, implementation and evaluation of theory-based EIs in the control and prevention of diabetes in adolescents is recommended.

Background

Diabetes is a chronic and metabolic disease that causes severe injury to the heart, blood vessels, eyes, kidneys, and nerves by disrupting the metabolism of carbohydrates, fats, and proteins over time. Further, it disrupts the normal routines of life, resulting in significant physical and psychological consequences. In recent years, the prevalence of type 2 diabetes among young people has increased dramatically [1, 2].

Diabetes as most common chronic diseases globally, affecting more than 100 million people annually. It is estimated that the rate of diabetes to be increased from 463 million in 2019 to 578 million by 2030 across the world [3]. In Iran, 3.7 cases increase per 100,000 people annually [4]. According to the World Health Organization, diabetes has been the seventh leading cause of death in 2016 [5] and the fourth in developing countries, imposing economic, psychological, and social costs on the individual, family, and society [6, 7].

Primary prevention has always been considered a key strategy in health promotion, aiming to maintain people healthy and prevent disease [8]. Adolescents with overweight, obesity, or the disease's history in their family are as one of the high risk groups for diabetes [5]. Thus, maintaining and promoting health (physical, psychological, and social) of the young and adolescent population seems necessary given the following issues: health is a natural right of each human being, including children and adolescents, about

one-third of the country's population are children and adolescents, children and adolescents quantitatively are the most valuable age groups in the community, young people, especially adolescents, are at the best ages to learn healthy living skills, and health promotion programs for adolescents are among the most cost-effective programs [9].

One of the essential strategies to promote students' health is implementing health education programs based on their active participation in various health activities. Health education includes biological, health, social, and educational information to promote societies, besides creating and changing people's behavior to improve their physical, psychological, and social health, which is done using educational aid equipment [10]. The health belief model is based on the rule that people respond well to health and disease prevention messages when they feel they are at risk (as perceived susceptibility), a health-threatening is very serious (as perceived severity), behavioral change has many benefits for them (as perceived benefits), and they can remove barriers to health behaviors (as perceived barriers); thus, in these situations, EIs and programs are effective [11, 12]. Shabibi et al. showed that the mean scores of perceived susceptibility, severity, benefits, and barriers, self-efficacy and self-care behaviors were at moderate and low levels before intervention. However, after the intervention, the mean score of each construct of the HBM and self-care behaviors increased significantly [13]. The present study aimed to determine the effect of educational programs on diabetes preventative behaviors based on HBMs among second-grade high school students at risk in the city of Khash (southwestern Iran).

Methods

Study design and setting

The present educational trial was of the pretest-posttest design with two groups conducted among the second-grade high school male students in Khash city, Sistan-Baluchestan province, in 2019–2020. Khash is one of the border and less-privileged cities of Sistan and Baluchestan located in the southwest of Iran, whose population, according to the 2016 census, is equal to 129,645 people and has a hot and dry climate. The Khash people speak Baluchi-Sarhadi, Baluchi-Makrani, and Persian languages; the latter is common in schools and government offices. Four samples (school) were randomly selected using the cluster sampling method out of eight public high schools; then, two were randomly assigned to the intervention group and two to the control group. Later, the list of students at risk (history of diabetes in a student or first-grade family, student body mass index higher or equal to 25: inclusion criteria) was determined from the health record. Next, the researchers referred to the classes and, after explaining research objectives, asked selected students to complete the pretest in their presence. Exclusion criteria included absence in more than two sessions during the EI, dissatisfaction with participation during the study, and withdrawal from participating in EI sessions.

Study participants and sampling

$$n = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 \sigma^2}{(d)^2}$$

The sample size, based on the formula and adopted from Niazi et al. [14], was estimated 143 people; 70 in the educational group; 73 in the control group (Fig. 1; Consort flow diagram), (standard deviation equals 3.5; d is the least significant difference between the two groups, which according to similar studies, equals 1.67; Z indicates the normal distribution percentile calculated for the indices of 0.975 and 0.80).

Data collection tool and technique

The data collection tool was a questionnaire adopted from other scientific texts and sources [13], including demographic information, awareness, HBM constructs, and preventive behaviors. Demographic information consisted of 8 questions, covering age, education/occupation of parents, income level, the number of family members, and body mass index. The second part was on awareness with 33 questions and a three- and four-choice item scale; the correct answer scored two, the wrong scored zero, and the "I do not know" answer scored one; the score range of this section was between 0 to 66. The third part, the HBM, questions involved with perceived susceptibility (8 questions with a range of 8–40), perceived severity (7 questions with a range of 7–35), perceived benefits (8 questions with a range of 8–40), perceived barriers (10 questions with the range of 10–50), perceived self-efficacy (12 questions with the range of 12–60), and cues to action (8 questions in the range of 8–40). The fourth section included questions about student behavior (7 questions in the range of 7–35).

The response scale in model constructs was 5-point Likert from I definitely agree with score 5 to I definitely disagree with score 1. A higher score, except for perceived barriers, reflected the student's greater belief in diabetes. The behavioral response scale was 5-point Likert from always to never. The validity of the questionnaire was also assessed and confirmed by ten experts in health education and promotion, as well as epidemiologists, using CVI and CVR evaluations. Further, Cronbach's alpha coefficient used to evaluate the reliability of the constructs of awareness, susceptibility, severity, benefits, barriers, self-efficacy, as well as cues to action and behavior, were 0.7, 0.68, 0.71, 0.77, 0.84, 0.86, 0.83, and 0.70 respectively.

After analyzing the pretest results, educational content based on the HBM's constructs was prepared and adjusted. The students in the intervention group were divided into groups of 10 to 15 people, and the prepared educational program was implemented in five 60-minute training sessions in school halls as lecture, question-answer, and group discussions using slides, pamphlets, and CDs to raise students' awareness about the types of diabetes, symptoms, risk factors, and preventive strategies, improve students' perceptions and beliefs to sensitize them to the disease (perceived susceptibility and severity), promote perceived self-efficacy and benefits to empower students in adopting preventive behaviors, as well as discussing potential barriers and reducing perceived barriers. Also, two 60-minute training sessions were held for teachers and parents of students as cues to action, aiming to involve parents in studying, guiding, and monitoring student behavior. Once the study was completed, the training package was given to the control group as well. A posttest was performed immediately and three months after the intervention, and the results were analyzed by SPSS 20 software (for Windows; SPSS Inc., Chicago, IL)

using chi-square, independent t-test, and Repeated Measures ANOVA at a significant level of 0.05. The Kolmogorov-Smirnov test was also used to examine the data normality distribution.

Results

The number of students participating in the present study was 143 in two groups (70 in the intervention group; 73 in the control group). Students' mean age in the intervention group was 16.43 ± 0.67 and in the control group was 16.17 ± 0.65 years. Independent t-test showed a significant difference between the mean ages of the two groups ($p = 0.022$). Thirty-four fathers of students in the intervention group had secondary and diploma education levels, while, in the control group, 24 fathers of students had secondary and diploma education levels; this difference was significant according to the chi-square test ($p = 0.003$). Twenty-four mothers of students in the intervention group were illiterate, while, in the control group, 5 mothers were illiterate; this difference was significant according to the chi-square test ($p = 0.001$). However, no significant difference was observed between parents' job status, income status, the number of family members, and body mass index of the two groups ($P > 0.05$). 44.3% of the students in the intervention group had a normal body mass index, while, in the control group, 50.7% of the students had a normal body mass index; this difference was not significant based on the chi-square test ($p = 0.835$).

Changes in scores of awareness, HBM constructs, and preventive behaviors in the intervention group were significant according to the Repeated Measures ANOVA ($P = 0.0001$ [Table 1 and Fig. 1]). Also, the independent t-test showed a significant difference between the two groups immediately after the intervention in the constructs of awareness and HBM, except for perceived susceptibility and behavior ($P < 0.05$) [Table 1]. According to the results, three months after the intervention, only a significant difference was observed between the mean scores of awareness, perceived barriers, as well as cues to action and behavior in the two groups ($p < 0.05$) [Table 1].

Table 1

Comparison of mean score and standard deviation of Awareness, HBM constructs and behavior of high school male students in Khash regarding diabetes in the two groups before, immediately and three months after the intervention

Structure	the name of the group	Before intervention	Immediately	Three months later	P-Value*
		Mean ± Standard deviation	Mean ± Standard deviation	Mean ± Standard deviation	
Awareness 0-66	intervention	37.66 ± 5.92	49.41 ± 4.32	52.91 ± 3.33	0.0001
	Control	38.69 ± 7.24	38.00 ± 7.80	45.08 ± 7.22	0.001
P-Value 0.353 0.0001 0.0001**					
Susceptibility 8-40	intervention	27.57 ± 4.57	30.59 ± 4.02	30.15 ± 3.82	0.0001
	Control	29.26 ± 5.32	29.10 ± 5.32	28.75 ± 5.37	0.015
P-Value 0.040 0.066 0.075**					
Severity 7-35	intervention	25.30 ± 4.04	27.37 ± 3.45	26.77 ± 3.66	0.0001
	Control	25.81 ± 4.17	25.73 ± 4.09	25.61 ± 4.17	0.450
P-Value 0.381 0.015 0.081**					
Benefits 8-40	intervention	30.90 ± 3.13	32.60 ± 3.17	32.29 ± 2.91	0.0001
	Control	31.05 ± 5.33	31.11 ± 5.07	30.97 ± 5.00	0.018
P-Value 0.774 0.048 0.059**					
Barriers 10-50	intervention	25.44 ± 6.01	20.96 ± 5.16	22.41 ± 5.52	0.0001
	Control	26.59 ± 7.99	27.21 ± 8.15	26.89 ± 8.17	0.211
P-Value 0.336 0.0001 0.0001**					
Self-efficacy 12-60	intervention	47.14 ± 8.19	51.76 ± 5.05	48.16 ± 7.30	0.0001
	Control	47.23 ± 7.12	46.30 ± 6.53	45.88 ± 6.65	0.010
P-Value 0.944 0.0001 0.053**					
Cues to action 8-40	intervention	28.43 ± 5.89	31.40 ± 4.26	29.67 ± 4.88	0.0001
	Control	27.93 ± 6.92	28.07 ± 6.63	27.71 ± 6.70	0.135
P-Value 0.645 0.0001 0.049**					

Structure	the name of the group	Before intervention	Immediately	Three months later	P-Value*
		Mean ± Standard deviation	Mean ± Standard deviation	Mean ± Standard deviation	
Behavior 7-35	intervention	17.26 ± 4.95	22.96 ± 4.95	18.57 ± 3.45	0.0001
	Control	18.11 ± 5.81	16.40 ± 4.79	16.07 ± 4.51	0.001
P-Value 0.347 0.0001 0.0001**					
* Repeated Measures ANOVA **Independent T-test					

Discussion

In the present study, to increase awareness about diabetes, its types, risk factors, complications, and symptoms were discussed. In the Farahmand study, after the EI, the mean score of awareness, perceived susceptibility, severity, benefits, and barriers in type 2 diabetic patients increased significantly compared to the control group [15]. In the study of Bayat et al., after implementing the educational program, awareness in both intervention and control groups increased significantly, probably due to the implementation of regular training programs at the center. However, a significant increase in attitude and behavior was observed only in the intervention group [16]. Sadeghi et al.'s educational trial indicated the HBM's effectiveness in educating people over 30 years old referred for diabetes screening; they suggested the HBM be used alongside traditional education methods [17]. Moreover, Shojaeizadeh study showed that, in educating diabetic patients, the empowerment model had desirable potentials compared to the medical approach currently common in diabetes education, thus considering concepts, including patient empowerment and self-care behavior adoption, improve the results of interventions in chronic patients such as diabetes is inevitable. On the other hand, changing the approach in in-service education of people involved in educating diabetic patients in the field of health care is necessary [18].

As regards the construct of perceived susceptibility, acceptance-expression of susceptibility to the complications of diabetes, besides the prohibited foods causing complications of diabetes and the genetic factors involved in developing diabetes in other healthy members of the family, were discussed. Regarding the perceived severity construct, beliefs of students in that diabetes can lead to their death, serious complications in them (due to involvement of more organs), high economic costs on them and their families, as well as making them disabled were discussed. As regards the construct of perceived benefits, beliefs of students in that following nutritional principles (using recommended food groups) and doing adequate and appropriate physical activity results in self-confidence in maintaining their health were argued. For the construct of perceived barriers, beliefs of students in that unawareness of the nutritional principles should not result in nonadherence to them, and also that adherence to such principles does not cause them to stay away from their favorite foods were discussed. For perceived self-

efficacy, identification of beneficial and harmful foods, in general, was argued; according to the current program, a significant increase in the mean scores of constructs and behavior was observed.

Shabibi et al. and Dadkhah Tehrani et al. showed that the mean scores of perceived susceptibility, severity, benefits, barriers, and self-efficacy, as well as self-care behaviors, before the intervention, were at moderate and low levels. However, after the intervention, the mean score of each construct of the HBM and self-care behaviors increased significantly [8, 13]. In a systematic review of Zare et al., while emphasizing the use of behavior change models, such as social cognitive theory, HBM, and self-efficacy, mentioned promoting diabetes self-care behaviors, combining models, and considering other determinants at the community level to improve the effectiveness of interventions [19]. In their meta-analysis study, Dandan Liang et al., reviewing 17 studies, confirmed peer support for key variables in promoting self-management and self-efficacy in diabetes [20]. Ghoreishi et al., in their EI based on social cognitive theory on diabetes self-care behaviors, emphasized that emotional adjustment, self-efficacy to overcome barriers, and self-regulation can predict self-care and that the program promotes awareness and self-efficacy in diabetic patients [21].

Among the studies measured more objective aspects of the consequences of EI, a clinical trial of Shao et al. in 2018 showed that in the intervention group, diabetes education increased the average scores of HBM variables (perceived susceptibility, severity, barriers, and self-efficacy) and improved uric acid, physical activity, body mass index, and waist ratio after the intervention; while in the control group, between consecutive intervals and follow-up, no significant differences were observed [22]. In a study with a different research community, Karimi et al. examined the effect of education based on HBM on diet adherence in pregnant women with gestational diabetes; their research results indicated the usefulness and significant impact of such training on the constructs of the model [23]. In his study, Farahani Dastjani investigated the effect of HBM-based education on adherence to medication regime in patients with diabetes. According to their findings, three months after the EI, the constructs of perceived susceptibility, benefits, and self-efficacy, as well as cues to action and behavior in adherence to the medication regime, increased significantly compared to the pre-intervention. In contrast, the constructs of perceived barrier and severity showed insignificant differences compared to pre-intervention [24].

These results show that health education interventions in the HBM framework are practical approaches in educating and promoting proper health behaviors concerning type 2 diabetes among students. Moreover, based on this study's results and other relevant evidence, this type of education may be included in diabetes-related health promotion programs among students, thus benefiting from its effects on maintaining and promoting students' health behaviors.

One of the strengths of the present study is considering students at risk and emphasizing the prevention and health promotion, especially in adolescents, conducting research in a border and less privileged city. One of the limitations of the present study is the study of behaviors abstractly, some of which can be examined objectively with parents' help; further, self-report and gender (male) can result in students'

carelessness in completing questionnaires. Thus, parental involvement is suggested to evaluate behaviors.

Conclusion

Overall, an EI based on the HBM has a significant impact on increasing the scores of awareness, perceived susceptibility, severity, benefits, and self-efficacy, cues to action and preventive behaviors and decreasing the score of perceived barriers among students. Health education interventions in the HBM are practical approaches in educating and promoting proper health behaviors concerning type 2 diabetes among students. Moreover, based on this study's results and other relevant evidence, this type of education can be included in diabetes-related health promotion programs among students, thus benefiting from its effects on maintaining and promoting students' health behaviors.

Declarations

Ethics approval and consent to participate

The present research was registered in the Iran National Committee for Ethics in Biomedical Research (IR.RUMS.REC.1398.110). Written informed consent were obtained from all participants' parents.

Consent for publication

Not applicable.

Availability of data and material

The datasets generated and analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The project was supported by Deputy of Research and Technology, Rafsanjan University of Medical Sciences.

Authors' contributions

SS and MR and MN conceptualized, designed and managed the study. SS Performed the study. MR performed the data analysis. MN and YS were involved in drafting the manuscript. MR and YS and MN critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Acknowledgments

We express our gratitude for the cooperation and participation of educators and students who helped the team conduct the research and the Vice-Chancellor for Research and Technology of Rafsanjan University of Medical Sciences for financial support.

References

1. Ryan CM, van Duinkerken E, Rosano C. Neurocognitive consequences of diabetes. *Am Psychol*. 2016;71:7.
2. Mayer-Davis EJ, Lawrence JM, Dabelea D, Divers J, Isom S, Dolan L, et al. Incidence trends of type 1 and type 2 diabetes among youths, 2002–2012. *N Engl J Med*. 2017;376:15.
3. Orouji R, Nakhjavani Mk, shaban khamseh ah. The effects of supplement french pine bark extract (oligopin) on ldl and hdl in selected women with type ii diabetic. *J Diabetes Nurs*. 2020;8:3.
4. Alirezai Shahraki R, Aliakbari Kamrani A, Sahaf R, Abolfathi Momtaz Y. Effects of nationwide program for prevention and control of diabetes initiated by the ministry of health on elderly diabetic patients' knowledge, attitude and practice in isfahan. *Salmand: Iranian Journal of Ageing*. 2019;14:1.
5. World Health Organization (WHO). Diabetes, Key facts. <https://www.who.int/news-room/fact-sheets/detail/diabetes> Accessed 8 Jun 2020.
6. Dadkhah Tehrani B, Tavakoli R, Jazayeri SA. The Effect of an EI Based on Health Belief Model on Nutritional Behaviors in Type 2 Diabetics. *Mil Caring Sci*. 2019;5:4.
7. IDF Diabetes Atlas (9th Ed.). Brussels, Belgium: International Diabetes Federation. 2019. <http://www.diabetesatlas.org>. Accessed 2020 May 20.
8. Centers for Disease Control and Prevention (CDC). what is the prevention?. https://www.cdc.gov/pictureofamerica/pdfs/picture_of_america_prevention.pdf Accessed 2020 May 25.
9. Dehghani Tafti A, Rahaei Z, Askar Shahi M, Hakimi T. The Effect of Educational Program on the Prevention of Pediculosis in Primary School Fifth Grade Students: An application of the Health Belief Model. *Social Behavior Research Health*. 2018;2:1.
10. Dashti S, Peyman N, Tajfard M, Esmaeeli H. E-Health literacy of medical and health sciences university students in Mashhad, Iran in 2016: a pilot study. *Electron Physician*. 2017;9:3.
11. Glanz K, Rimer BK, Viswanath K. *Health Behavior: Theory, Research, and Practice*. Hoboken: John Wiley & Sons; 2015.
12. Asadpour M, Nasirzadeh M, Pourhashem N, Peimani A. Effect of education based on health belief model on observation of standard precautions by dental students in Rafsanjan in 2019. *J Edu Health Promot* 2020;9.
13. Shabibi P, Zavareh MSA, Sayehmiri K, Qorbani M, Safari O, Rastegarimehr B, et al. Effect of educational intervention based on the Health Belief Model on promoting self-care behaviors of type-2

- diabetes patients. *Electron Physician*. 2017;9:12.
14. Niazi S, Ghafari M, Noori A, Khodadoost M. Impacts of a health belief model-based education program about osteoporosis prevention on junior high school students' physical activity, Kalaleh, Iran, 2012. *Jorjani Biomed J*. 2014;1:1.
 15. Farahmand Z, Shojaeizadeh D, Tol A, Azam, KJJoSoPH, Research IoPH. The impact of an educational program based on the health belief model on diabetic foot care in type-2 diabetic patients. *Journal of School of Public Health Institute of Public Health Research*. 2017;15:2.
 16. Bayat F, Shojaezadeh D, Baikpour M, Heshmat R, Baikpour M, Hosseini MJJod, et al. The effects of education based on extended health belief model in type 2 diabetic patients: a randomized controlled trial. *J Diabetes Metab Disord*. 2013;1:1.
 17. Sadeghi R, Rezaeian M, Khanjani N, Iranpour A. The applied of health belief model in knowledge, attitude and practice in people referred for diabetes screening program: an educational trial. *Journal of Rafsanjan University of Medical Sciences*. 2015;13:11.
 18. Shojaezadeh D, Tol A, Sharifirad G, Alhani FJRJoMS. Effect of education program based on empowerment model in promoting self-care among type 2 diabetic patients in Isfahan. *Razi Journal of Medical Sciences*. 2013;20:107.
 19. Zare S, Ostovarfar J, Kaveh MH, Vali M. Effectiveness of theory-based diabetes self-care training interventions; A systematic review. *Diabetes Metab Syndr*. 2020;14:4.
 20. Liang D, Jia R, Zhou X, Lu G, Wu Z, Yu J, Wang Z, et al. The effectiveness of peer support on self-efficacy and self-management in people with type 2 diabetes: A meta-analysis. *Patient Educ Couns*. 2020;104:4.
 21. Ghoreishi MS, Vahedian-Shahroodi M, Jafari A, Tehranid H. Self-care behaviors in patients with type 2 diabetes: Education intervention base on social cognitive theory. *Diabetes Metab Syndr*. 2019;13:3.
 22. Shao C, Wang J, Liu J, Tian F, Li HJPP, adherence. Effect of a Health Belief Model-based education program on patients' belief, physical activity, and serum uric acid: a randomized controlled trial. *Patient Prefer Adherence*. 2018;12:1239.
 23. Karimy S, Mansouri A, Shahdadi H, Pakizeh-Del P. The effect of health belief model-based education on adherence to the dietary regimen in pregnant women with gestational diabetes. *J Diabetes Nurs*. 2016;4:4.
 24. Farahani dastjani. f, shamsi m, khorsandi m, ranjbaran m, rezvanfar m. Evaluation of the effects of education based on health belief model on medication adherence in diabetic patients. *Int J Endocrinol Metab*. 2016;18:2.

Figures

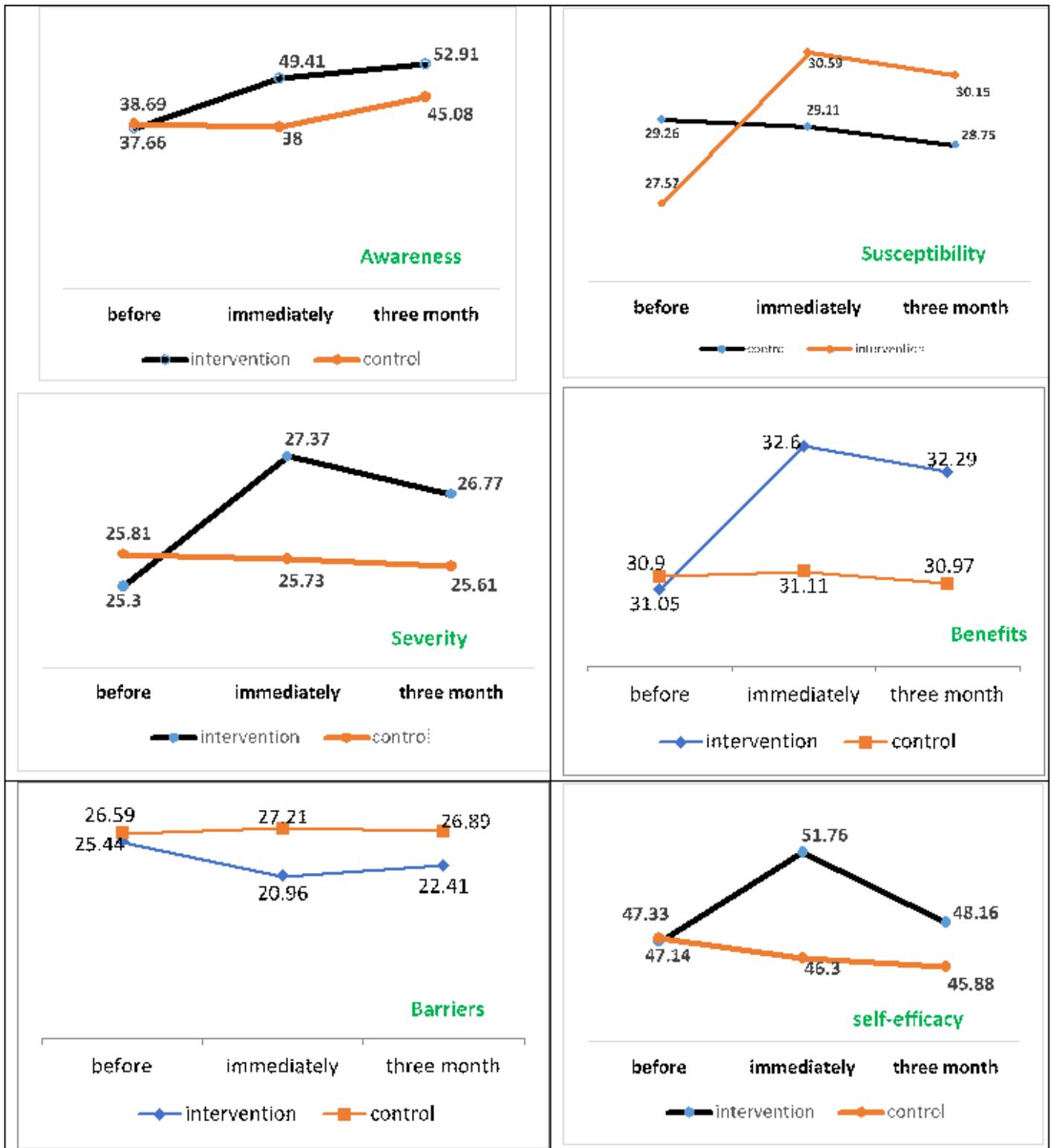


Figure 1

Comparison of mean awareness score, model constructs and behavior of high school male students in Khash regarding diabetes in the two groups before, immediately and three months after the intervention

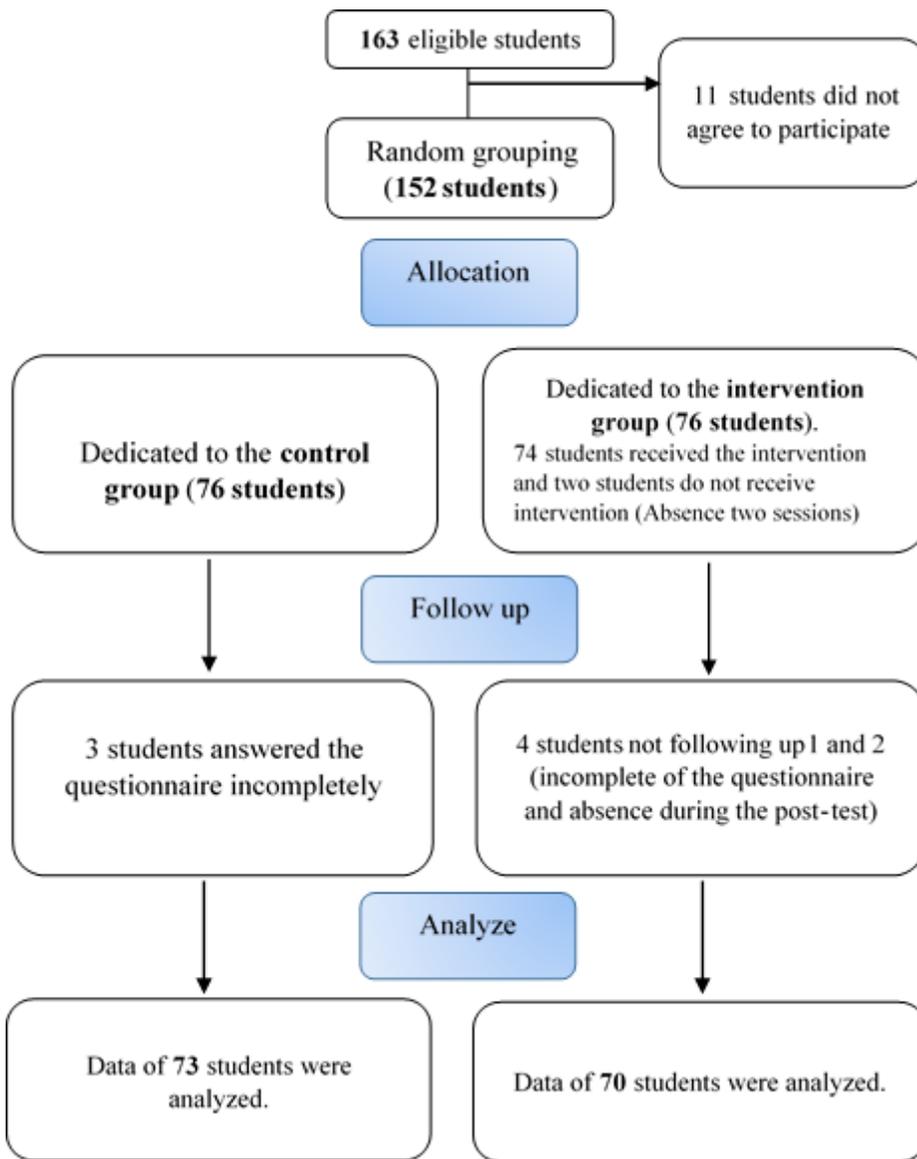


Figure 2

Consort flow diagram of HBM based Intervention on diabetes