Health and Social Care in the community

Health and Social Care in the Community (2016) **24**(5), e92–e100 doi: 10.1111/hsc.12263

A cross-sectional study of barriers to physical activity among overweight and obese patients with type 2 diabetes in Iran

Faranak Halali MSc[1], Reza Mahdavi PhD[2], Mohammad Asghari Jafarabadi PhD[3], Majid Mobasseri MD[4] and Nazli Namazi MSc[2]

[1]Student Research Committee, Faculty of Nutrition, Tabriz University of Medical Sciences, Tabriz, Iran, [2]Nutrition Research Center, Faculty of Nutrition, Tabriz University of Medical Sciences, Tabriz, Iran, [3]Traffic Injury Prevention Research Center, Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran and [4]Bone Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Accepted for publication 5 May 2015

Correspondence
Reza Mahdavi
Nutrition Research Center,
Faculty of Nutrition
Tabriz University of Medical Sciences
Golgasht St., Attar Neishaboori Ave.
Tabriz 5166614711, Iran
E-mail: mahdavirez@hotmail.com

What is known about this topic

- There are barriers that negatively affect long-term adherence to physical activity recommendations in patients with type 2 diabetes.

What this paper adds

- Despite the results of the International Physical Activity Questionnaire, the level of physical activity to control diabetes was very low.
- Negative attitude towards physical activity, discouragement, physical problems and cost/environmental factors were barriers to physical activity practice.
- There was a negative relationship between physical problems and physical activity level.

Abstract

The objective of this study was to identify common barriers to physical activity practice among overweight/obese patients with type 2 diabetes in Iran and their associations with physical activity level. In this cross-sectional study, 146 overweight/obese volunteers with type 2 diabetes were recruited from diabetes clinics in Tabriz, Iran, between July 2012 and March 2013. A Persian version of the long-format International Physical Activity Questionnaire was used to assess physical activity level. A 12-item structured questionnaire was designed to assess physical activity barriers. The validity and reliability of the latter scale were assessed by related measures. An exploratory factor analysis with the principal component analysis extraction method and varimax rotation was performed to extract the underlying factors. Multivariate regression analysis was used to assess the relationship between barriers and physical activity level. About 73% of patients had moderate physical activity. Factor analysis yielded four factors as barriers to physical activity including: (i) negative attitude towards physical activity, (ii) discouragement, (iii) physical problems and (iv) cost/environmental factors. These factors explained about 51% of the total variance. There was a negative relationship between the factor 'physical problems' and physical activity level ($P = 0.024$). Overall, there were some barriers to physical activity. Health counsellors should address these barriers to increase the patients' adherence to physical activity recommendations. Physical conditions of the patients must be taken into account.

Keywords: adherence, barriers, diabetes, physical activity

Introduction

In patients with type 2 diabetes, doing regular physical activity can help them improve glycaemic control as measured by glycated haemoglobin (Goodpaster & Brown 2005). According to the American College of Sports Medicine and the American Diabetes Association, moderate physical activity performed five to six times a week for at least 30 min in one session (Di Loreto *et al.* 2005) in these patients can result in beneficial physiological changes such as increasing insulin sensitivity in muscles and liver, increasing glucose uptake by muscles, improving lipid profile, weight loss, reducing blood pressure and reducing overall risk of cardiovascular diseases (Haskell *et al.* 2007). In addition, long-term complications of diabetes such as nephropathy, retinopathy, neuropathy, and cardiovascular and peripheral vascular diseases can be prevented or delayed by doing regular physical activity (Nelson *et al.* 2007).

Despite recommendations of health professionals to increase physical activity, a high ratio of patients with type 2 diabetes is inactive/low-active, and long-term adherence to these programmes is a major health problem. It has been reported that about 61% and 68% of patients with type 1 and type 2 diabetes respectively are physically inactive (Thomas *et al.* 2004). Up to one-third of adults with diabetes are completely sedentary, and only a third exercise regularly (Nelson *et al.* 2002). In Iran, as a developing country, public physical activity level has also declined dramatically in recent years due to the increased dependency on cars and passive transportation. Results of the Third national Surveillance of Risk Factors of Non-Communicable Diseases showed that 40% of Iranian adults had low physical activity according to the global physical activity questionnaire (Esteghamati *et al.* 2009). Physical activity level has been reported to be high in some populations of developed countries – for example 81% in Danish women and 77% in Swedish men (Sisson & Katzmarzyk 2008). Even moderate increases in physical activity can improve glycaemic control, as well as benefiting cardiovascular health and promoting longevity (Hays & Clark 1999).

Various barriers can negatively affect adherence to physical activity recommendations. It has been demonstrated that people who perceived barriers towards physical activity, such as cost or distance, are less active than those who did not perceive any barriers (Godin *et al.* 2001). Other factors such as lack of time and lack of self-confidence have also been identified as barriers (Lawton *et al.* 2006).

Physical activity is an indispensable part of type 2 diabetes self-management behaviours and the rate of adherence to physical activity recommendations is very low among these patients. So, it seems necessary to identify factors that hinder doing physical activity to improve the effectiveness of management protocols. As cultural factors can be influential in physical activity barriers, these barriers should be examined thoroughly. To the best of our knowledge, this study is the first one on this topic in Iran. Therefore, the purpose of this study was to identify the barriers to adherence to physical activity recommendations and their associations with level of physical activity in patients with type 2 diabetes.

Methods

Subjects

In this cross-sectional study, at least 135 subjects with type 2 diabetes were needed based on Gorsuch's (1983) recommendation for sample size in factor analysis. Patients were selected from two outpatient diabetes clinics belonging to the Tabriz University of Medical Sciences during regular visits with their physician between July 2012 and March 2013. These two centres were similar to each other and supplied subjects with similar demographic characteristics, as they were formerly part of one larger endocrine and diabetes clinic. As there are just two centres for diabetes in Tabriz and their budget is supplied by the government, patients referred to them were mostly from low socioeconomic status. Patients with higher socioeconomic status visit physicians in private sections. Using the convenience sampling method, those patients who volunteered and met our inclusion criteria according to their medical records were considered as potential participants. Volunteer patients were eligible to participate in the study if they met the following criteria: being diagnosed with type 2 diabetes for at least 1 year, aged 30–60 years old, body mass index (BMI) $\geq$27 kg/m^2, taking oral anti-diabetic medications, not pregnant or lactating, and without severe diabetes complications. Patients taking insulin were not included because their lifestyle modifications were more complicated than patients taking oral anti-diabetic medications. Furthermore, the inclusion of patients taking insulin may not accurately reflect the perceived barriers (Wen *et al.* 2004). Written informed consent forms were obtained from all participants. The protocol of study was approved by the Ethics Committee of the Tabriz University of Medical Sciences.

Questionnaire development

Item extraction

In order to develop the questionnaire about barriers to physical activity, an extensive literature review was undertaken (identified by a search of the Medline database) using the keywords *diabetes, physical activity, barriers* and *adherence*. Items which seemed appropriate for our questionnaire were extracted from related articles and a primary questionnaire was designed. Then for translation of this scale, we used the procedure of forward–backward translation (Beaton *et al.* 2002). The translation process involved two independent bilingual translators who translated the questionnaire from English into Persian. One health education and one exercise sciences specialist blind to the original survey then translated the questions back from Persian to English. The translators and researchers both checked and agreed on the final version. It was then revised by an expert committee comprised of the translators and health and

language professionals inside the country. Panel members were asked to review each item and evaluate the appropriateness of translated items for face validity, in order to be understandable by the research target group.

Content validity of the questionnaire

To find out the content validity of this designed instrument, it was reviewed by a panel of 10 experts in the field of physical activity and health education. These experts were asked to fill in a form designed to assess the relevance, clarity, simplicity and necessity of the developed physical activity barrier questionnaire based on a 4-point scale. Two measures, content validity index (CVI) and content validity ratio (CVR), were used as quantitative evaluations of content validity to decide which questions to be included in the final questionnaire (Dehdari *et al.* 2014). CVI was calculated using the sum score of agreements for the first three items (relevance, clarity and simplicity) divided by the total number of panel experts. Questions with CVI <0.79 were excluded from the questionnaire (Polit & Beck 2004). CVR was calculated using the score of agreements for the fourth item (necessity) minus half of the total number of panel experts, all divided by half of the total number of panel experts. Questions with CVR <0.62 were excluded from the questionnaire (Lawshe 1975). Overall, three questions were dropped and the primary questionnaire was modified.

Reliability of the questionnaire

A pilot study was performed with 30 patients with type 2 diabetes through a face-to-face interview exactly like the main study. At this step, internal consistency of the questionnaire was approved by the calculation of Cronbach's alpha (0.70). Afterwards, a test–retest was performed for the same patients after a 2-week interval, and the reliability and stability of the instrument were assessed by calculation of the Spearman–Brown index and the intraclass correlation coefficient. The Spearman–Brown index was 0.75 and the intraclass correlation coefficient was 0.72, 95% CI [0.46, 0.83].

Data collection

A questionnaire describing personal and demographic information was filled in through face-to-face interviews with a trained nutritionist. Physical activity was measured using the Persian version of the long format International Physical Activity Questionnaire (IPAQ) that measures the frequency and duration of moderate-to-vigorous-intensity physical activity undertaken for more than 10 continuous minutes across four domains (work, transportation, indoor and leisure-time activities) over a 7-day period. Based on calculation of self-reported mean of MET-minutes/week, IPAQ categorises physical activity level into three groups: low physical activity (<600 MET-minutes/week), moderate physical activity (600–2999 MET-minutes/week) and high physical activity (≥3000 MET-minutes/week). METs are multiples of the resting metabolic rate and a MET-minute is computed by multiplying the MET score of an activity by the minutes performed. MET-minutes/week is computed by multiplying the MET-minutes of a physical activity by the days performed in a week. Finally, an overall total physical activity MET-minutes/week score for a person is equivalent to the sum of all domains' MET-minutes/week scores. Participants were then asked to complete the developed barrier questionnaire and determine the impact of each item on their daily physical activity. In this questionnaire, each item was rated on a 5-point Likert scale (1 = no impact, 2 = low impact, 3 = moderate impact, 4 = high impact and 5 = very high impact). The total score ranged from a minimum score of 12 to a maximum score of 60. It is worth noting that the interviewer was not known to the subjects as this could influence their responses.

Statistical analysis

An exploratory factor analysis using the principal components analysis extraction method and varimax rotation was performed with the items considered as common barriers to the practice of physical activity. Based on the Kaiser (1960) rule, only eigenvalues over 1 were acceptable for extraction of factors. A cut-off of 0.45 was considered for factor loadings and items with factor loading higher than that were included. The use of the cut-off was both for the interpretation of the loadings and the scoring. The overall Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was used to assess model adequacy. The KMO value was 0.61 (values higher than 0.5 are acceptable). No variable was excluded from the size of its individual KMO measure. The Bartlett test of sphericity was also significant ($P < 0.05$). Each factor was scored using the weighted mean of factor loadings for items loaded on it. Multivariate regression analysis was used to assess the relationship between physical activity barriers and the level of physical activity. Associations between the barrier scores and level of physical activity were adjusted for age, sex, education, income and

BMI. The multivariate regression analysis was not adjusted for duration of diabetes because there was no significant association between this variable and the barrier scores. Appropriate linear regression model diagnostics were checked and all were satisfied. All statistical analyses were performed using SPSS (SPSS for Windows Release 15.0, released 2006; SPSS Inc., Chicago, IL, USA).

Results

A total of 186 patients with type 2 diabetes were eligible to participate in the study, but 146 patients (122 females and 24 males) completed the study. Thirty-one subjects (6 females and 25 males) did not volunteer to participate and 9 subjects (4 females and 5 males) dropped out during the study because of relatively long interview duration and not completing the related questionnaires. The mean (SD) age of participants was 52.3 (6.6) years. Women comprised 83.6% of the sample as most of the patients attending those two clinics were women. The median (interquartile range) duration of diabetes was 6 (3–9) years. Participants had a mean (SD) BMI of 31.9 (4.2) kg/m^2. Table 1 represents the characteristics of the participants.

Physical activity level and perceived barriers to physical activity

According to the IPAQ questionnaires, the mean physical activity value for all the participants was 1986.9 (761.2) MET-minutes/week which showed moderate physical activity. By frequency, about 73% of patients had moderate physical activity (Table 2). As presented in Table 3, factor analysis of perceived barriers to physical activity practice revealed four factors that accounted for about 51% of the total variance. Percent of variance explained by each factor is as follows: Factor 1 (Negative attitude towards physical activity) = 19.14%, Factor 2 (Discouragement) = 11.82%, Factor 3 (Physical problems) = 10.3%, Factor 4 (Cost/environmental factors) = 9.88%.

Relationship between barriers to physical activity and physical activity level

According to the results of regression analysis, there was only a significant negative relationship between Factor 3 (physical problems) and physical activity level ($P = 0.024$), that is, the lower the physical activity level, the more score in barrier factor 'physical problems' (Table 4). Patients who had physical problems had lower level of physical activity.

Table 1 Participants' baseline characteristics ($N = 146$)

Continuous variables	
Age (years), mean (SD)	52.3 (6.6)
BMI (kg/m^2), mean (SD)	31.9 (4.2)
Diabetes duration (years)	
Median (interquartile range)	6 (3–9)
Categorical variables	Frequency (%)
Sex	
Female	122 (83.6)
Male	24 (16.4)
Education	
Elementary and lower	111 (76)
Higher elementary to high school	7 (4.8)
Diploma and higher	28 (19.2)
Income	
Low	110 (75.3)
Medium	28 (19.2)
High	8 (5.5)
Afflicted with other diseases	
Yes	87 (59.6)
No	59 (40.4)

BMI, body mass index.

Table 2 Level of physical activity in study participants ($N = 146$)

MET-minutes/week*	Frequency	%
<600†	13	8.9
600–2999‡	107	73.3
≥3000§	26	17.8

*MET level of activity × minutes of activity per day × days of activity performed in a week.
†Low physical activity.
‡Moderate physical activity.
§High physical activity.

Discussion

In this study, most of the patients had a moderate level of physical activity, but physical activity level aimed at managing the glycaemic condition was very low. Four factors were extracted as the barriers to physical activity practice: (i) negative attitude towards physical activity, (ii) discouragement, (iii) physical problems and (iv) cost/environmental factors. As seen in the regression analysis, higher factor score of the factor 'physical problems' was related to lower levels of physical activity.

Physical activity level

Generally, the level of physical activity is low among patients with diabetes. In the study by Mynarski *et al.* (2012), about 52% of patients with type

Table 3 Perceived barriers to physical activity practice and items loaded onto them ($N = 146$)*

Barriers to physical activity	Factor loadings†	Variance explained (%)
Factor 1. Negative attitude towards physical activity (eigenvalue = 1.63)		
I don't exercise because of fear of injury	0.78	19.14
I don't exercise because of fear of hypoglycaemia	0.70	
I don't exercise because of fear of increase in my blood pressure	0.54	
I think physical activity is monotonous and boring	0.50	
Factor 2. Discouragement (eigenvalue = 1.52)		
I don't have enough willpower to do physical activity	0.77	11.82
I don't exercise because I'm alone	0.69	
I think physical activity will not improve my diabetes condition	0.59	
Factor 3. Physical problems (eigenvalue = 1.50)		
I get tired soon during physical activity	0.75	10.30
I feel pain during physical activity	0.73	
Factor 4. Cost/environmental factors (eigenvalue = 1.42)		
I can't exercise because of high costs of sport equipments	0.77	9.88
I don't know suitable place to do physical activity	0.61	
I can't do physical activity in poor weather conditions	0.59	

*Factors extraction procedure: principal component analysis; component rotation procedure: varimax rotation.
†Cut-off point: 0.45.

2 diabetes with mean age of 54 years and mean BMI of 29 kg/m^2 had low physical activity according to the analysis of the IPAQ questionnaires. In another study, 61% and 68% of patients with type 1 and type 2 diabetes respectively were categorised as inactive (Thomas *et al.* 2004). In 2010 in the United States, a study revealed that less than 33% of patients with type 2 diabetes had at least 30 minutes of physical activity (Jordan & Jordan 2010). In recent years, the level of physical activity in Iran has dramatically declined due to modernisation and increase in welfare facilities. Living in apartments, using elevators in almost all buildings and the development of public transportation systems have all led to a reduction in physical activity level. In addition, the number of markets and shopping centres has increased. However, most people have become more dependent on their private cars even for short distances. As women comprised the larger percentage of the participants in the present study, their reported levels of activity in the section of 'house chores' in the IPAQ (which were also high) might influence the overall mean of physical activity level. Setting realistic and achievable goals for practice of physical activity can play an effective role in patients' behavioural changes.

Barriers to physical activity practice

As physical activity plays an important role in diabetes management, it is necessary to identify the factors preventing these patients from appropriate adherence to physical activity recommendations in order to improve the effectiveness of disease management protocols.

Four factors were extracted through factor analysis as the barriers to physical activity practice in patients with type 2 diabetes in this study. As studies using factor analysis were limited and most of the studies used frequency (percentage) to report barriers, we attempted to discuss factors based on their items.

Table 4 Multivariate regression analysis for the relationship between barriers to physical activity (independent variables) and physical activity level (dependent variable) ($N = 146$)

Factor	*B* (SE)*	95% CI	*P*-value
1. Negative attitude towards physical activity	1125.8 (2426.2)	−3726.5, 5978.2	0.713
2. Discouragement	−727.6 (2417.5)	−5562.6, 4107.4	0.838
3. Physical problems	−186.9 (89.8)	−366.5, −7.3	**0.024**
4. Cost/environmental factors	161.3 (110.1)	−58.9, 381.5	0.266

B (SE) and *P*-value for the association between education and factor 'Cost/environmental factors': 1.088 (0.514), 0.036.
B (SE) and *P*-value for the association between income and factor 'Cost/environmental factors': 1.179 (0.441), 0.008.
B (SE) and *P*-value for the association between body mass index (BMI) and factor 'Cost/environmental factors': 0.430 (0.277), 0.043.
P-value= 0.024 indicates a significant relationship between the factor 'physical problems' and physical activity level.
*Adjusted for age, sex, education, income and BMI.

Negative attitude towards physical activity

Negative attitude towards physical activity was the first extracted factor. Studies on patients with diabetes have shown that fear of hypoglycaemia and fear of injury during exercise are important barriers to physical activity practice (Dubé *et al.* 2006, Brazeau *et al.* 2008). Also, fear of an increase in blood pressure has been reported as another important barrier to physical activity practice in patients with diabetes (Dubé *et al.* 2006). It is possible that the occurrence of one of these conditions during exercise may prevent patients from undertaking future physical activity. Therefore, programmes intended to increase physical activity in patients with diabetes should include diabetes-specific actions to prevent such adverse conditions.

Regarding the monotony of physical activity, our results are in line with the results of a study by Ziebland *et al.* (1998) that revealed monotony and not enjoying exercise were important internal barriers to physical activity practice and those who selected only internal barriers were less likely to exercise more. Shultz Armstrong *et al.* (2001) have reported that disliking exercise was an important perceived barrier to physical activity among patients with type 2 diabetes. It seems explaining the health benefits of physical activity can somehow overcome this negative attitude.

Discouragement

Discouragement was the second extracted factor. Lack of motivation was reported as a barrier to regular exercise among patients with type 2 diabetes (Korkiakangas *et al.* 2009). In a study on patients with type 2 diabetes and/or cardiovascular disease, laziness was an important barrier to physical activity practice (White *et al.* 2007). Allison *et al.* (1999) have shown that not being in the mood and a lack of energy are important barriers to engaging in physical activity. Regarding the belief in health benefits of physical activity, our results were in line with the results of Thomas *et al.* (2004). In their study, 63% of non-active patients aged over 60 years thought that their diabetes would get worse with physical activity. One possibility for lack of motivation and energy in patients with type 2 diabetes may be psychological problems, such as depression, which have high prevalence in this population (Peyrot *et al.* 2005). Loneliness and being shy have also been reported as barriers to physical activity, especially for women, and is intensified by cultural issues (Dutton *et al.* 2005, Korkiakangas *et al.* 2009). Being lonely was reported by our women participants. Although there are some sport facilities in parks, women mentioned that they could not use them because of their shyness. However, it is essential to emphasise on the key role of physical activity in diabetes management and to encourage patients, especially women in our country, to exercise on their own. Also, counsellors should consider patients' psychological conditions and refer to other health professionals if necessary.

Physical problems

Physical problems was the third extracted factor. Reichert *et al.* (2007) have reported that feeling tired was associated with physical inactivity in persons aged 20 years and older. In a study on women with type 2 diabetes, getting tired easily when exercising was a barrier to physical activity practice (Van Rooijen *et al.* 2002). Being overweight or obese might be one of the causes for getting tired in our patients as this has been reported previously (Shultz Armstrong *et al.* 2001, Mier *et al.* 2007). It seems sensible for overweight and obese patients to begin physical activity for short periods and at low intensities, and to increase gradually in order to adapt and feel less tired.

Pain, especially back pain and knee pain, was a serious barrier to exercise reported by our patients. Previous studies have shown that pain, especially in joints, is a major barrier to physical activity (Dutton *et al.* 2005, Dunton & Schneider 2006). Arthritis is a common health problem in patients with diabetes that prevents them from doing exercise or causes pain and mobility restriction after exercise (Centers for Disease Control and Prevention 2008). Therefore, strategies to increase physical activity in patients with diabetes and those with arthritis should consider such exercises that impose less pressure on their joints.

Cost/environmental factors

Cost/environmental factors was the last extracted factor. Several studies have reported 'high cost' as a major barrier to physical activity (Ziebland *et al.* 1998, Reichert *et al.* 2007, Ibrahim *et al.* 2013). High cost could refer to both transportation costs and cost of sport equipments. The role of cost as a barrier may be due to several causes such as the low level of country development, low priority of health/physical activity in general policies and the low proportion of budget allocated to sports and public physical activities. It is worth noting that about 75% of our patients had a low socioeconomic status. In addition, the other 25% with a slightly better socioeconomic status also reported 'cost' as a barrier. This could be the result of a sudden sharp increase in living costs in recent decade. So the 'cost' barrier may be over-reported. In a study on low-income patients with

type 2 diabetes in the United States, 'cost' was not reported as a barrier to physical activity (Dutton *et al.* 2005). With regard to sport facilities, our results were in line with the findings of previous studies which reported lack of sport facilities as another barrier to physical activity practice (Thomas *et al.* 2004, Dutton *et al.* 2005, Wilcox *et al.* 2006). Patients should be educated that physical activity does not require spending a lot of money or access to high-quality facilities. Simply walking indoors can be of great benefit to their diabetes management.

Poor climatic conditions were reported by our patients as preventing them from doing physical activity. Serour *et al.* (2007) showed that poor climatic conditions and hot summers were major barriers to exercise among patients with type 2 diabetes. Several other studies have reported poor weather as a barrier to exercise (Lawton *et al.* 2006, Wilcox *et al.* 2006, Ibrahim *et al.* 2013). High reports of this item may be partially explained by the sampling period, as 5 months of sampling in the present study occurred in autumn and winter, and Tabriz is one of the coldest cities of Iran in these seasons. Therefore, counsellors and health educators should convince patients to continue their physical activity programme indoors when the weather becomes poor.

Relationship between barriers to physical activity and physical activity level

As mentioned before, all of the patients in the present study had BMI $\geq$27 kg/m^2. As overweight and obesity and their related health problems can decrease patients' capability in doing physical activity, the negative relationship between the barrier factor 'physical problems' and physical activity level was expected. Overweight/obesity is closely related to poor health conditions such as pain, psychological diseases, sleep disorders, cardiovascular diseases, respiratory/digestive diseases and endocrine problems (Mauro *et al.* 2008). One of the most common problems among overweight/obese people is muscular and skeletal pain. There is a close association between overweight/obesity and osteoarthritis and back pain. Pain in different parts of the body or chronic fatigue can result in a decreased feeling of wellness, a decrease in quality of life and finally a decrease in the level of physical activity (Flamme 2005).

Before recommendations for physical activity, patients' attitudes towards physical activity and its health benefits for disease management should be assessed. In the case of negative attitude, referring to a psychologist or health educator may be beneficial. Also, recommendations should consider the cultural issues of the community. For example, the basics of exercise recommendations may differ with regard to patients' gender. Assessments should be done to check the patients' general health, both physical and psychological, and decide whether it is necessary to consider special treatments before starting physical activity. As socioeconomic status may play an important role in patients' adherence to physical activity, recommendations should conform individually to the patients' economic status. Overall, health practitioners should ensure patients and their families that doing physical activity to control diabetes does not necessarily require special places or equipment, and that they can easily do proper physical activity merely through taking certain recommendations into account.

Our study had some limitations. Although our sample size was statistically large enough to perform a factor analysis, there were some concerns about the results' ability to be generalised to a larger community. The collected data were self-reported, which is always subject to bias as participants may not respond according to their true beliefs. As most of the patients attending diabetes clinics were women and also because women were more co-operative, the larger number of women could influence our results to some extent. Subjects may not represent all patients with type 2 diabetes as sampling was conducted in two diabetes clinics in Tabriz and patients referred to the private section were not included. Some barriers, for example 'cost', might be over-reported because of the low socioeconomic status of most of the patients. This study assessed barriers to physical activity practice only from the patients' point of view and patients taking insulin were not included. Regarding the above-mentioned limitations, the generalisability of our results to a larger community remains uncertain.

We recommend future researchers to include equal numbers of male and female participants to obtain more valid and generalisable results. Both patient-related and healthcare provider-related barriers can be studied with larger sample sizes. Studies should include patients from different socioeconomic levels to see whether or not there are differences. Also, assessing facilitators of adherence to physical activity in future research can assist health professionals in designing more feasible recommendations.

Acknowledgements

The authors are grateful for the financial support provided by the Nutrition Research Center, Tabriz

University of Medical Sciences. The authors are also deeply indebted to all patients who participated in this study. This article was written based on a data set of an MSc Thesis (Faranak Halali) registered in Tabriz University of Medical Sciences.

Conflict of interest

No conflicts of interest have been declared.

References

Allison K.R., Dwyer J.M. & Makin S. (1999) Perceived barriers to physical activity among high school students. *Preventive Medicine* **28** (6), 608–615.

Beaton D., Bombardier C., Guillemin F. & Ferraz M.B. (2002) Recommendations for the cross-cultural adaptation of health status measures. New York: American Academy of Orthopaedic Surgeons, Institute for work and health.

Brazeau A.S., Rabasa-Lhoret R.E., Strychar I. & Mircescu H. (2008) Barriers to physical activity among patients with type 1 diabetes. *Diabetes Care* **31**, 2108–2109.

Centers for Disease Control and Prevention (2008) Arthritis as a potential barrier to physical activity among adults with diabetes—United States, 2005 and 2007. *Morbidity and Mortality Weekly Report* **57**, 486.

Dehdari T., Rahimi T., Aryaeian N. & Gohari M.R. (2014) Effect of nutrition education intervention based on Pender's Health Promotion Model in improving the frequency and nutrient intake of breakfast consumption among female Iranian students. *Public Health Nutrition* **17**, 657–666.

Di Loreto C., Fanelli C., Lucidi P. *et al.* (2005) Make your diabetic patients walk. *Diabetes Care* **28**, 1295–1302.

Dubé M.C., Valois P., Prud'homme D., Weisnagel S.J. & Lavoie C. (2006) Physical activity barriers in diabetes: development and validation of a new scale. *Diabetes Research and Clinical Practice* **72**, 20–27.

Dunton G.F. & Schneider M. (2006) Perceived barriers to walking for physical activity. *Preventing Chronic Disease* **3** (4), A116.

Dutton G.R., Johnson J., Whitehead D., Bodenlos J.S. & Brantley P.J. (2005) Barriers to physical activity among predominantly low-income African-American patients with type 2 diabetes. *Diabetes Care* **28** (5), 1209–1210.

Esteghamati A., Meysamie A., Khalilzadeh O. *et al.* (2009) Third national Surveillance of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007) in Iran: methods and results on prevalence of diabetes, hypertension, obesity, central obesity, and dyslipidemia. *BMC Public Health* **9** (1), 167.

Flamme C.H. (2005) [Obesity and low back pain: biology, biomechanics and epidemiology]. *Orthopade* **34**, 652–657.

Godin G., Valois P. & Desharnais R. (2001) A typology of stages of adherence to exercise behavior: a cluster analysis. *Journal of Applied Social Psychology* **31** (9), 1979–1994.

Goodpaster B. & Brown N. (2005) Skeletal muscle lipid and its association with insulin resistance: what is the role of exercise? *Exercise and Sport Sciences Reviews* **33**, 150–154.

Gorsuch R.L. (Ed.) (1983) *Factor Analysis*, 2nd edn. Lawrence Erlbaum Associates, Hillsdale, NJ.

Haskell W.L., Lee I.M., Pate R.R. *et al.* (2007) Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise* **39**, 1423–1434.

Hays L.M. & Clark D.O. (1999) Correlates of physical activity in a sample of older adults with type 2 diabetes. *Diabetes Care* **22**, 706–712.

Ibrahim S., Karim N.A., Oon N.L. & Ngah W.Z. (2013) Perceived physical activity barriers related to body weight status and sociodemographic factors among Malaysian men in Klang Valley. *BMC Public Health* **13**, 275.

Jordan D. & Jordan J. (2010) Self-care behaviors of Filipino-American adults. *Journal of Diabetes and its Complications* **24**, 250–258.

Kaiser H.F. (1960) The application of electronic computers to factor analysis. *Educational and Psychological Measurement* **20**, 141–151.

Korkiakangas E.E., Alahuhta M.A. & Laitinen J.H. (2009) Barriers to regular exercise among adults at high risk or diagnosed with type 2 diabetes: a systematic review. *Health Promotion International* **24** (4), 416–427.

Lawshe C.H. (1975) A quantitative approach to content validity. *Personnel Psychology* **28** (4), 563–575.

Lawton J., Ahmad N., Hanna L., Douglas M. & Hallowell N. (2006) 'I can't do any serious exercise': barriers to physical activity amongst people of Pakistani and Indian origin with Type 2 diabetes. *Health Education Research* **21** (1), 43–54.

Mauro M., Taylor V., Wharton S. & Sharma A.M. (2008) Barriers to obesity treatment. *European Journal of Internal Medicine* **19**, 173–180.

Mier N., Medina A. & Ory M.G. (2007) Mexican Americans with type 2 diabetes: perceptives on definitions, motivators, and programmes of physical activity. *Preventing Chronic Disease* **4**, 1–8.

Mynarski W., Psurek A., Borek Z., Rozpara M., Grabara M. & Strojek K. (2012) Declared and real physical activity in patients with type 2 diabetes mellitus as assessed by the International Physical Activity Questionnaire and Caltrac accelerometer monitor: a potential tool for physical activity assessment in patients with type 2 diabetes mellitus. *Diabetes Research and Clinical Practice* **98** (1), 46–50.

Nelson K.M., Reiber G. & Boyko E.J. (2002) Diet and exercise among adults with type-2 diabetes (findings from NHANES III). *Diabetes Care* **25**, 1722–1728.

Nelson M., Rejeski W.J., Blair S.N. *et al.* (2007) Physical activity and public health in older adults: recommendations from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise* **39**, 1435–1445.

Peyrot M., Rubin R., Lauritzen T., Snoek F., Matthews D. & Skovlund S. (2005) Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabetic Medicine* **22**, 1379–1385.

Polit D.F. & Beck C.T. (2004) *Nursing Research: Principles and Methods*, 7th edn. Lippincott, Williams & Wilkins, Philadelphia, PA.

Reichert F.F., Barros A.J., Domingues M.R. & Hallal P.C. (2007) The role of perceived personal barriers to engagement in leisure-time physical activity. *American Journal of Public Health* **97** (3), 515.

Serour M., Hanadi A., Sawsan A., Abdel-Rahman M. & Abdulla B. (2007) Cultural factors and patients' adherence to lifestyle measures. *The British Journal of General Practice* **57**, 291–295.

Shultz Armstrong J., Sprague M.A., Branen L.J. & Lambeth S. (2001) A comparison of views of individuals with type 2 diabetes mellitus and diabetes educators about barriers to diet and exercise. *Journal of Health Communication* **6**, 99–115.

Sisson S.B. & Katzmarzyk P.T. (2008) International prevalence of physical activity in youth and adults. *Obesity Reviews* **9** (6), 606–614.

Thomas N., Alder E. & Leese G.P. (2004) Barriers to physical activity in patients with diabetes. *Postgraduate Medical Journal* **80**, 287–291.

Van Rooijen A.J., Rheeder P., Eales C.J. & Molatoli H.M. (2002) Barriers to and expectations of performing physical activity in female subjects with type 2 diabetes. *South African Journal of Physiotherapy* **58**, 3–10.

Wen L.K., Parchman M.L. & Shepherd M.D. (2004) Family support and diet barriers among older Hispanic adults with type 2 diabetes. *Family Medicine* **36**, 423–430.

White K.M., Terry D.J., Troup C. & Rempel L.A. (2007) Behavioral, normative and control beliefs underlying low-fat dietary and regular physical activity behaviours for adults diagnosed with type 2 diabetes and/or cardiovascular disease. *Psychology Health and Medicine* **12**, 485–494.

Wilcox S., Der Ananian C., Abbott J., Vrazel J., Ramsey C., Sharpe P.A. & Brady T. (2006) Perceived exercise barriers, enablers, and benefits among exercising and nonexercising adults with arthritis: results from a qualitative study. *Arthritis Care & Research* **55** (4), 616–627.

Ziebland S., Thorogood M., Yudkin P., Jones L. & Coulter A. (1998) Lack of willpower or lack of wherewithal? "Internal" and "external" barriers to changing diet and exercise in a three year follow-up of participants in a health check. *Social Science & Medicine* **46** (4), 461–465.