

Predictors of regular physical activity among Type 2 diabetes mellitus patients in Wolaita Sodo University teaching hospital using the Trans-Theoretical Model

Getu Debalkie¹, Kassahun Alemu², Fira Abamecha³, Netsanet Fentahun⁴

Abstract

Background: Globally, 382 million people are estimated to have diabetes. To date there is paucity of evidence regarding predictor of regular physical activity among Type 2 diabetes mellitus patients with application of Trans-theoretical model. Therefore the objective of this study was to determine predictors of regular physical activity among type 2 diabetes mellitus patients in Wolaita Sodo University hospital using the Trans- theoretical model.

Method: Institutional based cross-sectional study was conducted on 400 systematic random selected Type 2 diabetes mellitus patients. One-way ANOVA was used to show mean scores differences of processes of change, decisional balance and self-efficacy across stages of change. Multivariable logistic regressions were also conducted.

Result: Of the participants, 34.3% were physically active. The processes of change, the pros and the self-efficacy significantly increased from precontemplation to maintenance stage while the cons decreased across the stages ($p < 0.05$). The result of multivariable logistic regression showed that pros, cons, self-efficacy, self-liberation and counter conditioning were predictors of physical activity.

Conclusion: Type 2 diabetes mellitus patients' physical activity was very low. Stage matched intervention should be designed to increase processes of change, pros and self-efficacy from precontemplation to maintenance stages. [*Ethiop. J. Health Dev.* 2018;32(2):97-103]

Key words: Physical activity, Type 2 diabetes mellitus, Transtheoretical model

Introduction

Diabetes mellitus is a chronic disease that occurs when the body cannot produce enough insulin or cannot use insulin effectively. Type 2 diabetes is the most common type in which the body is able to produce insulin which is either not sufficient or the body is unable to respond to its effects (1). Globally, 382 million people are estimated to have diabetes, and if current demographic trends continue, in 2035 more than 592 million people will be affected with diabetes (cite). The overwhelming burden of the disease continues to be shouldered by low and middle income countries, where four out of five people with diabetes are living (2).

People with diabetes are at an increased risk of cardiovascular, peripheral vascular and cerebrovascular diseases (3). Physical inactivity has been established as an important risk factor for the development of cardiovascular disease. There is an inverse association between increased physical activity levels and cardiovascular disease in the general population as well as in people with type 2 diabetes (4).

Physical activity in type 2 diabetes mellitus helps in glucose control and in reducing multiple cardiovascular risk factors (5). Clinical data also show that physical activity improves lipoprotein profile and reduces blood glucose in diabetic patients (6). The American Diabetic Association (ADA) recommends that persons with type 2 diabetes should undertake at least 150 min/week of

moderate physical activity for at least 5 days in a week (7).

The Trans-theoretical model (TTM) has two major dimensions: stages of change and processes of change. The model proposes that people make behavior changes in stages and move sequentially through the stages while experiencing the different processes of change. Stages of change represent a temporal dimension during which change may occur, while processes of change are strategies individuals use as they progress through the stages of change. These includes consciousness raising, dramatic relief, environmental re-evaluation, self re-evaluation, social liberation, counter conditioning, helping relationships reinforcement management, self-liberation and stimulus control each of which has its own characteristics (8).

Different studies support the use of TTM for promoting physical activity (9). Among these, a systematic review on the application of TTM suggest that individuals attempting to change their physical activity behavior move through a series of stages (10).

Predictors of regular physical activity among Type 2 diabetes mellitus patients in Wolaita Sodo University teaching hospital using the Trans-Theoretical Model.

Study Population: All sampled adult type 2 diabetes patients who visited the hospital's Diabetes Clinic at the time of data collection were included.

¹Department of Health Education and Behavioral Science, University of Gondar, Ethiopia. Corresponding Author: Getu Debalkie, E-mail getud2006@gmail.com, <https://getu.debalkie@uog.edu.et>, P. O. Box 196: Mob: 251916747030

²Department of Epidemiology and Biostatistics, University of Gondar, Ethiopia;

³Department of Health Education and Behavioral Sciences, Jimma University, Ethiopia;

⁴Nutrition Unit, School of Public Health, Bahir Dar University, Ethiopia

Inclusion criteria: Type 2 diabetes mellitus patients aged 18 years and above who were on follow-up and in the study area were included.

Exclusion criteria: Type 2 diabetes mellitus who were seriously ill and unable to communicate and patients who had two follow up appointments within a month were checked and excluded.

Sample size and sampling procedure: Since there has been no similar previous study in the country, the final sample size 422 was determined using single population proportion formula by assuming the proportion of being physically active as 50 % ($P=0.5$), level of significance 5% ($Z_{\alpha/2}=1.96$), margin of error 5 % ($d=0.05$) and 10% non-response rate. Systematic random sampling was employed to identify the participants. The first type 2 diabetic patient was selected randomly out of those who came to the clinic; then, every other patient coming to the follow up clinic was interviewed.

Measurement: A face to face exit interview was conducted using a structured pretested standard questionnaire. Seven-day physical activity recall interview questionnaire was used to measure physical activity (14). The stages of change, the processes of change, and self-efficacy were measured using the adapted questionnaire developed by Bess H. Marcus (15). The decisional balance was measured using the adapted questionnaire developed by Plotnikoff R. (16). Internal consistency was measured by Cronbach alpha to determine the extent to which the items in each scale measured the same construct and a cutoff value greater than 0.7 was considered (17).

Stages of change: After explaining the ADA recommendation for physical activity, the participants were placed in one of the five stages. 1 = Pre-contemplation (I am not currently physically active, and I do not intend to start in the next 6 months), 2 = contemplation (I am not currently physically active, but I am thinking about becoming physically active in the next 6 months), 3 = preparation (I am currently physically active sometime, but not regularly) 4 = action (I am currently physically active regularly, but I have only begun doing so in the last 6 months). 5 = maintenance (I am currently physically active regularly, and have done so for longer than 6 months). Finally, regular physical activity status classified as physically active and physically inactive. Study participants belonging to action and maintenance stages were defined as active regular physical activities. Study participants belong to pre-contemplation, contemplation and preparation stages were considered as inactive participants.

Processes of Change: The questionnaire comprised of 40 items which sought to measure the 10 hypothesized processes of change, four items for each processes. Participants were asked to recall how frequently they

used each of the processes during the past one month and each item was rated on a 5-point Likert type scale, ranging from 1 (never) to 5 (repeatedly) (15). The reliability test was done (Cronbach alpha for the processes of change sub-scales in the current study ranged from 0.88-0.98).

The self-efficacy measured with 5-item self-efficacy scale which measures an individual's confidence to participate in physical activity in certain circumstances, and the 5-point Likert scale was; 1 (being not at all confident) and 5 (being very confident) (15). Finally the reliability test was done (Cronbach alpha for the sub-scales was 0.98).

In the study, decisional balance was measured using the 10-item decisional balance scale. There were five «pros» and five «cons» items on the measure, and each item was rated by the participants using a 5-point Likert-type scale, ranging from 1 (not at all important) to 5 (extremely important) (16). Cronbach alpha for pros and cons were 0.95 and 0.78 respectively.

Data quality assurance: The questionnaire was translated from English to Amharic, the local language, and back to English by different experts familiar to the field. A training was given to data collectors before the process.

Data Processing and Analysis: Data were coded and entered into Epi Data version 3.1 after checking for completeness and consistency and were analyzed using SPSS version 20. The spearman correlation analysis was used to show the strength of relationships among TTM stages and (process of change, decisional balance and self-efficacy). One-way ANOVA was computed to examine the mean differences in the process of change use, self-efficacy, and decisional balance across the stages. Multivariable logistic regression analysis was conducted to identify the predictors of physical activity behavior by using Transtheoretical model components.

Ethical clearance: Ethical clearance was obtained from the Jimma University, College of Health Sciences, and institutional Review Board with the letter of Reference No RPGC/1033/2016 on February 5, 2016. Informed verbal consent was obtained from each study participant prior to the interview.

Results

Socio-demographic characteristics: Four hundred type 2 diabetic mellitus patients (response of 95 %) were interviewed. Of these participants, 282(70.5%) were male. The mean age of the respondents was 48.9 (SD \pm 10.8) years. Most of the respondents, 384(86.5%) were married. One hundred thirty-seven participants (34.3%) were physically active (action and maintenance stages). Chi-square analysis showed that educational level, occupational status and residence had significant association with physical activity status ($P<0.05$) (Table1).

Table 1: Socio-demographic characteristics and association with physical activity status among Type 2 DM patients at Wolaita Sodo Hospital, Ethiopia, March 2016

	Physically Activity Status			P-value
	Active No (%)	Inactive No (%)	Total	
Sex				
Male	101(35.8)	181(64.2)	282(70.5)	0.37
Female	36(30.5)	82(69.5)	118(29.5)	
Marital Status				
Married	118(34.1)	228(65.9)	346(86.5)	0.64
Divorced	10(41.7)	11(58.3)	24(6)	
Single	6(37.5)	10(62.5)	16(4)	
Widowed	3(21.4)	11(78.6)	14(3.5)	
Age				
20-39	20(33.3)	40(66.7)	60(15)	0.98
40-59	87(34.4)	166(65.6)	253(63.3)	
60-80	30(34.5)	57(65.5)	87(21.7)	
Educational Level				
Illiterate	12(21.8)	43(78.2)	55(13.8)	0.008*
Read and write	15(35.7)	27(64.3)	42(10.5)	
Primary education	16(21.9)	57(78.1)	73(18.2)	
Secondary School	29(37.3)	48(62.3)	77(19.2)	
Hither (Diploma and above)	65(42.5)	88(57.5)	153(38.2)	
Occupational Status				
Government	66(41.8)	92(58.2)	158(39.5)	0.015*
Farmer	7(14.9)	40(85.1)	47(11.8)	
Merchant	36(34.3)	69(65.7)	105(26.5)	
Housewife	15(29.4)	36(70.6)	51(12.8)	
Others#	13(33.3)	26(66.7)	39(9.4)	
Residence				
Urban	125(36.8)	215(63.2)	340(85)	0.012*
Rural	12(20)	48(80)	60(15)	
Income (ETB)*				
200-1000	37(34.3)	71(65.7)	108(27)	0.69
1001-1927	16(32.7)	33(67.3)	49(12.2)	
1928-3425	33(40.2)	49(59.8)	82(20.5)	
3426-10000	1117(37)	199(63)	77(19.2)	

*Income is categorized in quartile

In Occupational status, "Others" included drivers, students and retired employees.

Distribution of participants in physical activity behavior in each stage of change

Almost half of the respondents belonged to the pre-contemplation stage and fewer number of respondents belonged to the maintenance stage (Figure 1).

Processes of change

All processes of change had strong positive linear relationship with the stages of change. One-way

ANOVA result showed that there were significant differences in the use of each of the processes of change among the stages of change. The use of the processes was characterized by a significant increase as individuals go up in almost all stages of change (Table 2).

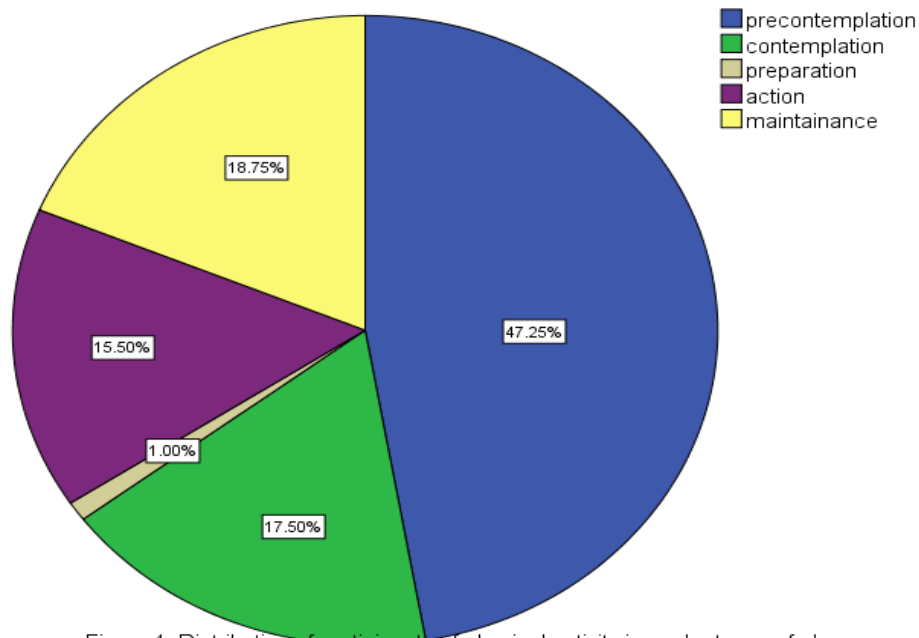


Figure 1: Distribution of participants of physical activity in each stages of change

Table 2: **Processes of change across the stages of change at Wolaita Sodo University teaching Hospital, Southern Ethiopia, March 2016**

	Pre- contemplation Mean(SD)	Contemplation Mean(SD)	Preparation Mean(SD)	Action Mean(SD)	Maintenance Mean(SD)	P-value
Consciousness raising	5.3(1.5)	11.3(2)	13.3(2.6)	14.7(2)	16.8(2.3)	.001
Dramatic relief	4.3(1.3)	10(2.2)	12.8(2.7)	14.6(2.4)	17(2.4)	.001
Environmental reevaluation	4.5(1.3)	8.8(3.4)	8.8(4.1)	12.4(4.5)	15.2(3.8)	.001
Self-reevaluation	5.1(1.5)	10.2(3)	12.5(3)	15(3)	16.5(2.6)	.0001
Social liberation	5.8(1.6)	9.2(2.6)	10.8(5.4)	13(3.5)	14.8(3.5)	.001
Stimulus control	4.3(1)	5.5(2.6)	8(6.7)	14.6(3)	16(2.7)	.001
Helping relationships	4.3(1)	6.3(2.9)	6.3(4.5)	14(3.6)	13.9(3.4)	.001
Reinforcement management	3.0(0.7)	3.6(1.8)	5.5(4.4)	10.7(2.4)	11.7(2.2)	.001
Self-liberation	4.2(0.9)	5.8(2.6)	8.8(3.4)	14(3)	16.3(2.7)	.001
Counter conditioning	4.1(0.4)	4.8(2)	5.0(2)	10.4(3.8)	11.4(4.7)	.001

Decisional balance, Self- efficacy and Physical activity

Pros ($\rho = .91, p < .001$) and self-efficacy ($\rho = .88, p < .001$) had positive linear relationship with stages of change. However, Cons had an inverse relationship

with stages of change ($\rho = -0.61, p < 0.001$). Regular physically active participants (participants at action and maintenance stages) have more pros and fewer cons than inactive participants (pre-contemplation, contemplation and preparation stages) (Table 3).

Table 3: **Decisional balance, self-efficacy and physical activity across stages of change among Type 2 DM patients at Wolaita Sodo University teaching hospital, Ethiopia, March 2016**

	Precontemplation Mean(SD)	Contemplation Mean(SD)	Preparation Mean(SD)	Action Mean(SD)	Maintenance Mean(SD)	p-value
Pros	7.0(1.7)	13.4(3)	16.5(4.4)	19.3(2.7)	21(2.4)	.001
Cons	12.3(2.6)	11.6(3.2)	9.5(3.3)	7.1(2.8)	7.0(2.6)	.001
DB(Pros-Cons)	-5.39(0.2)	1.8(0.5)	7(0.8)	12.1(1.1)	13(2.1)	.001
Self-efficacy	5.1(1.2)	8.7(4.1)	10.3(7.5)	17.8(4.3)	20.6(4.1)	.001
PA7-day recall(min/week)	-----	-----	30(8.2)	145(118.8)	163(49.7)	.001

Predictors of Physical activity: The result of multivariable logistic regression showed that, self-liberation, counter conditioning, pros, cons and self-efficacy were predictors of physical activity. For a unit increase in total score of self-liberation, the probability to be physically active increased by 1.5 (AOR=1.5, 95% CI (1.05, 2.01)). For a unit increase in total score of counter conditioning, the probability to be physically active increased by 1.9 (AOR=1.9, 95% CI

(1.11, 3.11)). For a unit increase in total score of pros, the probability to be physically active increased by 1.7 (AOR=1.7, 95% CI (1.03, 2.70)). For a unit increase in total score of self-efficacy, the probability to be physically active increased by 1.3 (AOR=1.3, 95% CI (1.01, 1.69)). For a unit increase in total score of cons, the probability to be physically active decreased by 44%. (AOR=0.56, 95% CI (0.40, .711) (Table 4).

Table 4: Multivariable logistic regression analysis of physical activity behavior among Type 2 DM Patients at Wolaita Sodo Hospital, Ethiopia, March, 2016

Variables	COR(95% CI)	AOR(95% CI)
Consciousness raising	2.3(1.89,2.81)**	0.82 (0.43,1.5)
Dramatic relief	2.5(1.98,3.17)**	1.2(0.58,2.4)
Environmental reevaluation	1.56(1.44,1.68)**	0.74 (0.49,1.1)
Self-reevaluation	1.95(1.69,2.23)**	0.29(0.07,1.3)
Social liberation	1.92(1.69,2.19)**	0.74(0.44,1.25)
Counter conditioning	2.1(1.79,2.41)**	1.9(1.11, 3.11)*
Helping relationships	2.1(1.79,2.73)**	0.83 (0.47,1.45)
Reinforcement management	2.93(2.33,3.67)**	0.79(0.41,1.51)
Self-liberation	2.3(1.89,2.78)**	1.5(1.05, 2.01)*
Stimulus control	2.6(2.13,3.17)**	1.2(0.80,1.70)
Pros	2.19(1.79,2.67)**	1.7 (1.03, 2.70)*
Cons	0.57(0.51,0.61)**	.56 (0.40, .711)**
Self-efficacy	1.67(1.51,1.86)**	1.3 (1.01, 1.69)*
Education		
Below Secondary(Reference)	1	1
Above Secondary	2.04(1.32,3.15*)	2.32(0.14,38.2)
Residence		
Urban(Reference)	1	1
Rural	0.43(0.22,0.84)*	0.62(0.01,116.01)

*Significant at $p < 0.05$ **Significant at $p < 0.001$

Discussion

The aim of this study was to determine factors related to intention for physical activity behavior among type 2 DM patients using the Transtheoretical model. The study revealed that only 34.3% of the studied subjects (action and maintenance stages) met the ADA recommendation for physical activity behavior, while 47% of participants were at precontemplation stage (had no intention to start physical activity in the next six months).

This study is almost similar to that conducted in USA and Harari (Ethiopia) in which 30% and 31.1% of the participants were physically active respectively (18, 19). This finding is higher than that of a study conducted in the United Arab Emirates, in which only 3% of the type 2 DM patients met the recommended

physical activity (20), but lower than that of a study conducted in Hamadan (Iran), in which 74.1% of the type 2 DM patients practiced the recommended physical activity (21). This study is also similar to a study conducted in Iran, where 48% of the participants were at the pre-contemplation stage (22).

Although the importance of physical activity in controlling diabetes is unquestionable, type 2 DM patients often choose sedentary lifestyle which has resulted in a great burden on health, social, and economic terms more physically active people with Type 2 diabetes could reduce health care burden and expenditure relating to the disease (23). Given the current epidemic nature of Type 2 diabetes mellitus, physical activity is the major therapeutic strategy if it is

based onstage matched interventions with evidence based strategies (24).

In this study, type 2 DM patients who were in the precontemplation stage used each process of change significantly less than patients in all other later stages. This finding is in agreement with other studies which demonstrated that there were significant differences in using the processes of change across stages of change (4). This study also specifically revealed that self-liberation and counter-conditioning were identified as positive predictors of physical activity. A study from Italy documented similar finding (25). Therefore, by measuring and understanding individual use of the processes of change for physical activity behavior, clinicians can assist by designing and giving specific processes of change interventions to move more quickly from one stage to the next.

In this study, individuals in the action/maintenance stages perceived significantly more pros and fewer cons than those in the precontemplation and contemplation stages. A significant difference between pros and cons was first observed in the preparation stage, whereby irregular physical activity patterns were initiated. These findings indicate that active individuals may value more the importance of physical activity and seek further information about its benefits than inactive individuals. This finding is supported by other studies which suggest that to advance from one stage to the next, the pros of involving in regular physical activity must increase and the cons must decrease (26).

The study also revealed that participants in the action/maintenance stages showed significantly high self-efficacy than those in the earlier stages of change (pre-contemplation, contemplation and preparation stages). This indicates that type 2 diabetes patients who feel more confident about physical activity showed more active participation than those who do not. This is in line with other studies which explored that people with a high level of physical activity behavior had higher level of self-efficacy (25). Albert Bandura (cite) also confirms that self-efficacy is a strong factor for predicting behavior (27). Therefore, the strength of the belief that one can make oneself exercise regularly in the face of obstacles, is believed to have the greatest effect on physical activity adherence.

The differences of psychological factors in participants at different stages of change further imply that health education aimed at increasing physical activity behavior for Type 2 diabetes mellitus patients should be stage matched.

Limitation

The Transtheoretical model has its own limitations like the lines between the stages can be arbitrary with no set criteria for how to determine a person's stage of change and it also assumes that individuals make coherent and logical plans in their decision-making process which is not always true (28). Being a cross-sectional study no conclusion can be drawn for causality. Additionally,

samples were taken from only one hospital which may make generalization difficult.

Conclusion:

Physical activity status of Type 2 diabetes mellitus patients was very low. Pros, cons, self-efficacy, counter conditioning and self-liberation were predictors of physical activity behavior. Therefore, in designing interventions to increase and maintain physical activity behavior in Type 2 diabetes mellitus patients, an individual's stage of change needs to be assessed and stage matched intervention concentrating on the benefits of physical activity, commitment and self-efficacy is commendable.

Declaration competing interests

The authors declare that they have no competing interests

Funding

Jimma University, College of Health Sciences

Authors' contributions

Getu Debalkie designed the study, analyzed the data and drafted the manuscript. Kassahun Alemu was involved in the design and reviewed the article. Fira Abamecha and Netsanet Fentahun were involved in the design, analysis of the data and critically reviewed the article.

Acknowledgement

We would like to thank Jimma University, College of Health Sciences for funding this thesis research. The researchers gratefully acknowledge the study participants for their cooperation.

References

1. Gan D. International Diabetes Federation report. 2nd ed. Diabetes. 2003.
2. Guariguata L, Whiting D, Hambleton I, Beagley J. Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Res Clin Pract.* 2013;103(2):137–49.
3. WHO. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. 1999.
4. Kirk A. Promoting and Maintaining Physical activity in People with Type 2 Diabetes. *J Diabetes Cardiovasc Dis.* 2003; 2:211-3.
5. Marwick T, Hordern M, Miller T, Chyun D. Exercise Training for Type 2 Diabetes Mellitus Impact on Cardiovascular Risk Z: A Scientific Statement from the American Heart Association. *Circulation.* 2009; 119:3244–62.
6. Boule N, Haddad E, Kenny G. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. *JAMA.* 2001; 286:1218 -27.
7. Sheri R, Bari B. Exercise and Type 2 Diabetes, The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care.* 2010;33(12):e147-67.
8. O'Connor MJ. Exercise Promotion in Physical Education: Application of the Transtheoretical

- Model. *Journal of teaching in physical education*. 1994;14:2-12.
9. Kim C, Hwang A, Yoo J. The impact of a stage-matched intervention to promote exercise behavior in participants with type 2 diabetes. *Int J Nurs Stud*. 2004;41:833–41.
 10. Spencer L, Adams T, Malone S, Roy L, Yost E. Applying the Transtheoretical Model to Exercise: Review of the Literature. *Health Promot Pract*. 2005;7(4):428–43.
 11. Karen G, Barbara K. *Health Behavior and Health Education : Theory, Research, and Practice*. . 4th ed. ed2008.
 12. Prochaska JO, Velicer WF. Stages of change and decisional balance for 12 problem behaviors. *Health psychology*. 1994;13(1):39-46.
 13. Girma E, Assefa T, Deribew A. Cigarette smokers' intention to quit smoking in Dire Dawa town Ethiopia: An assessment using the Transtheoretical Model. *BMC Public health*. 2010;10(320).
 14. Sallis F, James F. Seven -Day Physical Activity Recall. *J Am Coll Sport Med*. 1985;29(6).
 15. Bess H, Marcus, Legih Ann B. *Motivating People to Be Physically Active*. 2nd ed. 2003.
 16. Plotnikoff R. Factor structure and measurement invariance of a 10-item decisional balance scale. Canada 2001.
 17. Dewberry C. *Statistical methods for organizational research*. 2004.
 18. Zhao G, Ford E, Li C, Balluz L. Physical Activity in U.S. Older Adults with Diabetes Mellitus: Prevalence and Correlates of Meeting Physical Activity Recommendations. *J Am Geriatr Soc*. 2011;59(1):132–7.
 19. Ayele K, Tesfa B, Abebe L, Tilahun T, Girma E. Self Care Behavior among Patients with Diabetes in Harari, Eastern Ethiopia: The Health Belief Model Perspective. *PLoS One*. 2012;7(4):e35515.
 20. Al-kaabi J, Al-maskari F, Saadi H, Afandi B. Physical Activity and Reported Barriers Among Type 2 Diabetic Patients in the United Arab Emirates. *Rev Diabet Stud*. 2009;6:271-8.
 21. Fattahi A, Barati M, Bashirian S, Moghadam R. Physical Activity and Its Related Factors Among Type 2 Diabetic Patients in Hamadan. Iran. *J DIABETES Obes* 2014;6(2):85-92.
 22. Heydari H, Baharvand F, Mohebi S, Pournia Y, Kamran A. Predictive Power of the trans-theoretical model of Physical Activity in Patients with Type-2 Diabetes. *Bull Env Pharmacol Life Sci*. 2014;3:141-51.
 23. Sigal R. Physical activity and Type 2 Diabetes, A consensus statement from the American Diabetes Association. *Diabetes Care*. 2006;29(6):1433-8.
 24. Kirk AF, Barnett J, Mutrie N. Physical activity consultation for people with Type 2 diabetes. Evidence and guidelines. *Diabetic Medicine*. 2007;24:809–16.
 25. Marco G, Chiara A, Lucina C, Adele P, Matteo P. Type 2 diabetes mellitus , physical activity , exercise self-efficacy , and body satisfaction . An application of the trans theoretical model in older adults. *Heal Psychol Behav Med Taylor & Francis*; . 2014;2(1):748-58.
 26. Kirk A, Macmillan F, Webster N. Application of the Transtheoretical model to physical activity in older adults with Type 2 diabetes and / or cardiovascular disease. *Psychol Sport Exerc Elsevier Ltd*; . 2010;11(4):320-24.
 27. Albert B. Health promotion by social cognitive means. *Heal Educ Behav* 2004;31(2):143-64.
 28. The Transtheoretical Model (Stages of Change):<http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/SB721-Models/SB721-Models6.html>.