



# Journal of Biological Sciences

ISSN 1727-3048

**science**  
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## Role of Physical Activity and Nutrition in Controlling Type 2 Diabetes Mellitus-2007

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**Abstract:** This interventional study was designed to evaluate the role of recommended physical activity and diet in control of type 2 diabetes in order to choose an appropriate strategy for controlling diabetes according to condition of our community. This study carried out in a time-period between 2006-2007 and study's community of this research was Persian Diabetes Clinic and Khorasan Diabetes Research Center: Mashhad, Khorasan Razavi. In this community based interventional study diabetic patients (type 2) with informed consent allocated randomized in one of the following groups, recommended physical activity, recommended both physical activity and diet, control group and laboratory test included: FBS, 2hpp, HbA1c and urinalysis before intervention and 2 months after intervention. Results were compared in four groups. Data were collected by a designed questionnaire and analyzed by SPSS 11.5 software. Comparison of 4 groups showed recommended physical activity has significant effect in decreasing FBS, 2hpp and HbA1c ( $p < 0.030$ ) Whereas the recommended diet led to merely significant decreasing in FBS ( $p = 0.032$ ). Diabetic patients who were recommended for both physical activity and diet have improved variables but they are not significant although they have decreased the weight and drug ( $p < 0.024$ ). It is considerable that in controlling group variables a significant increase in the drug usage is recommended ( $p = 0.001$ ). The result of the study show that simple and practical appropriate diet and physical activity is effective in control of diabetes. We suggest further consideration regarding this subject.

**Key words:** Control of diabetes, physical activity, diet

### INTRODUCTION

Whereas common infectious and parasitic diseases such as malaria and the HIV/AIDS pandemic remain major unresolved health problems in many developing countries, emerging non-communicable diseases relating to diet and lifestyle have been increasing over the last two decades that in this way diabetes mellitus is one of them (Amuna and Zotor, 2008). Diabetes is the most common endocrine disease and it is a major problem in medicine, not only for diabetic patients, but also as a general health problem (Zeqiri *et al.*, 2007). Diabetes is a syndrome of a relative or absolute lack of insulin resulting in hyperglycemia. Patients with type 1 diabetes need insulin to regulate their blood glucose levels, while for patients with type 2 diabetes, weight loss and dietary management may be sufficient in controlling blood glucose levels (Nair, 2007). The statistics show that, in 1997 approximately 124 million people had this disease (Amos *et al.*, 1997) and this number according to

estimation of WHO will reaches 300 million till 2025 (WHO, 1997). Disadvantages of diabetes with its side effects on life quality and life expectancy is 10-15 years lower than people without diabetes (Williams *et al.*, 2000). Global variation shows higher rates of prevalence in developing countries and in developed ones with groups of lower economical-social conditions (Harris, 2000). According to WHO prevalence of diabetes in Iran in 1995 and 2000 and 2025, respectively is 5.5, 5.7 and 6.8% this means we have respectively according to mentioned years 1.6, 1.9 and 5.1 million people with diabetes (King *et al.*, 1998). One of important factors of access and increase of diabetes are related to nowadays lifestyles like lack of activity, inappropriate nutrition habits which leads to increase obesity and also increase mental stresses. Appropriate physical activity is an important factor in preventing chronic diseases like diabetes. Even approximately 60% of world population neglect at least 30 min daily physical activities (Bouchard *et al.*, 1994). Daily physical activities and healthy diets are playing an

important role in prevention diabetes mellitus; according to WHO report in 2002 cause of 1.9 million mortalities worldwide is lack of physical activities which estimated 10 to 16% because of diabetes and 22% are because of heart ischemic diseases (American Diabetes Association, 1997). Aim of this study which is community-based one is to assess methods of simple diet and normal physical activities in controlling diabetes, because these simple and applicable recommendations are not limited to the period of this study but also guarantee the long term continuance of these methods whereas in type 2 diabetes beside medical treatment, other methods of control have great importance in controlling disease. Assessing the role of physical activities and diet in decreasing glucose and controlling diabetes mellitus can define proper options in controlling this disease.

### MATERIALS AND METHODS

This study carried out in a time-period between 2006-2007 and Study's community of this research was Persian Diabetes Clinic and Khorasan Diabetes Research Center: Mashhad, Khorasan Razavi. This study has conducted in community-based intervention method. Study's community of this research is diabetes clinic and diabetes studies center. Members of population are type 2 diabetic patients who were eligible to recruit in this study. Samples were selected by non-probable (aim-based) method, thus clientele which have the eligibility to recruit in this study, sample were selected after gaining written agreement, they were allocated randomly to one of 4 groups. Before any intervention, FBS test and 2 h postprandial blood sugar test, HbA1C and complete urine test for each patient have been made. Height, weight and blood pressure of patients were measured and data were recorded in questionnaire.

Considered groups include:

- Group 1:** Under train people who were recommended to do physical activities
- Group 2:** Under train people who were recommended to respect diet
- Group 3:** Under train people who were recommended to do both physical activity and respect diet
- Group 4:** Control group

FBS, 2 h postprandial blood sugar and HBA1C tests had repeated after 2 months.

Exclusion criteria were as follows: FBS more than 250 and less than 126, age more than 60 and less than 35, gestation, cardiovascular diseases, persons who had severe physical activity, BMI less than 20.

Below formula has been used to determine the sample size:

$$n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2 (s_1^2 + s_2^2)}{(\bar{x}_1 - \bar{x}_2)^2}$$

According to available information in decreasing FBS, HBA1C, sample size has estimated in binary compare ( $\beta = 20\%$  and  $\alpha = 5\%$ ) and sample size in any of groups were determined less than 50 which in this research for any groups 50 patients were considered. Before gathering data, explanatory meetings for personnel of diabetes centers and questioners have been done.

In this study to compare results before and after intervention, Wilcoxon test specified for even sampling data was used. Using even sampling t-test was not applicable, whereas difference numbers was not in a normal distribution. Kolmogorov test was used to control the normal distribution. ANOVA was also used to compare the difference numbers in four groups. In this study SPSS 11.5 software package was used. In order to control the homogeneity of people in test, people in different groups were investigated by ANOVA for age and  $\chi^2$  test for sex. Meaningful level in all tests ( $p < 0.05$ ) was considered.

### RESULTS AND DISCUSSION

Several studies have been done in the field of the effect of physical activity and diet in controlling the diabetes. In these studies the interventions have been precise control on physical activities or diet. They were scientifically planned and patients usually used it during the study but because of the limitation it made for them, they frequently stopped it after research period. In this study, comparison of 4 groups showed recommended physical activity has significant effect in decreasing FBS, 2hpp and HbA1c ( $p < 0.030$ ). Whereas the recommended diet led to merely significant decreasing in FBS ( $p = 0.032$ ). Diabetic patients who were recommended for both physical activity and diet have improved variables but they are not significant although they have decreased the weight and drug ( $p < 0.024$ ). It is considerable that in control group variables decrease with increasing the drug usage.

Findings of research showed that recommended physical activities have great role in decreasing important variables such as: FBS test, 2 h postprandial blood sugar test and hemoglobin rate of A1C. Interesting point in regard to this matter that intake medicine and insulin didn't have significant difference (i.e., consumption of medicine didn't differ) but doing physical activity

**Table 1: Comparing studied variables before and after physical activity changes**

Variables	Num	Before	After	Wilcoxon test
FBS (mg)	46	180.91±47.12	162.91±70.27	0.032
2hpp	46	252.89±92.88	231.80±99.87	0.108
HbA1c	45	7.91±1.70	7.80±1.97	0.362
Weight (kg)	42	77.71±10.51	77.36±10.14	0.180
Blood pressure (systolic)	41	126.17±19.75	125.10±15.60	0.936
Blood pressure (diastolic)	41	83.78±12.12	82.20±10.31	0.475
Insulin	46	5.52±14.84	5.50±14.41	0.686
Glibenclamide (num)	44	1.01±1.02	0.94±1.00	0.357
Metformin (num)	43	1.57±1.18	1.58±1.16	0.750

**Table 2: Comparing studied variables before and after diet changes**

Variables	Num	Before	After	Wilcoxon test
FBS (mg)	44	162.70±44.08	150.70±45.56	0.021
2hpp	44	228.30±78.98	203.66±70.69	0.028
HbA1c	42	7.84±1.86	7.21±1.69	0.021
Weight (kg)	37	74.80±8.35	74.61±9.11	0.486
Blood pressure (systolic)	38	123.18±14.39	116.18±28.97	0.126
Blood pressure (diastolic)	38	83.18±19.50	76.43±19.37	0.159
Insulin	43	1.67±7.10	1.67±7.10	1.000
Glibenclamide (num)	40	1.16±1.12	1.10±1.17	0.131
Metformin (num)	42	1.51±1.34	1.44±1.30	0.414

**Table 3: Comparing studied variables before and after both physical activity and diet changes**

Variables	Num	Before	After	Wilcoxon test
FBS (mg)	54	152.64±50.56	148.46±45.51	0.389
2hpp	53	218.15±83.25	208.11±82.17	0.524
HbA1c	54	7.79±1.78	7.45±1.74	0.062
Weight (kg)	48	77.74±11.10	76.98±11.07	0.024
Blood pressure (systolic)	50	127.08±17.44	124.67±22.18	0.534
Blood pressure (diastolic)	50	83.02±10.10	81.56±14.12	0.566
Insulin	54	2.61±9.63	2.65±10.33	1.000
Glibenclamide (num)	51	1.19±0.99	0.97±0.98	0.021
Metformin (num)	52	1.03±1.10	0.92±1.09	0.174

according to the recommended pattern caused the above variables to have significant decrease ( $p < 0.030$ ); so it seems that physical activity and exercise are critical components of diabetes management (Kollipara and Warren-Boulton, 2004) (Table 1). Some studies put the role of physical activity in debt (National Institutes of Health, 1998) but studies of Harry *et al.* (2002) showed that patients without physical activity have chance of 2.71 times lack of control of diabetes mellitus. In another meta-analysis which results of 89 studies were analyzed, results indicate physical activity has significant role in decreasing weight (1.55 kg) and hemoglobin A1C (0.8%) (Brown *et al.*, 1996). Also in other meta-analysis which concluded from 14 studies (11 randomized clinical training and 3 non-randomized clinical training) showed physical activity decreases the rate of hemoglobin A1C significantly (Boule *et al.*, 2001). Further studies devote that even if exercising does not lead to loss of weight, it can still decrease the plasmid level of glucose and increase the insulin-sensitivity (Udezue *et al.*, 2005). In this way doing aerobic sports such as trotting, biking, swimming and jogging can also be effective in controlling the disease (Snowling and Hopkins, 2006).

Another result concluded from research is that considering the food pattern only decrease the FBS test ( $p = 0.032$ ) (Table 2). Strano and his coworkers believe that with sustaining a pattern of an appropriate and modified diet, they can partly succeed in controlling the diabetes (Strano-Paul and Phanumas, 2000). Also by comparing two presented methods it is concluded that the role of physical activity in compare with food diet is more significant because it can play more active role in decreasing 2 h postprandial blood sugar and Hemoglobin in A1C. A remarkable point is that respecting the recommended nutrition pattern play a great role in controlling the medicine consumption and stops the increase of it also but it doesn't decrease other variables significantly.

Investigating the role of both respecting the recommended food pattern and having physical activity more than before methods simultaneously, indicate that this method will lead to significant decrease in consumption of Glibenclamide ( $p = 0.021$ ) and also the weight of patient only ( $p = 0.021$ ) (Table 3). Although in this section positive changes in second level has been made comparing with first level but these changes were

Table 4: Comparing the changes of studied variables before and after intervention

Variables	Physical activity	Diet	Both physical activity and diet	Control	ANOVA test
FBS (mg)	12.00±37.85	18.00±65.76	4.170±50.63	9.64±60.23	0.522
2hpp	24.68±80.22	21.08±95.78	10.037±79.71	15.55±77.70	0.740
HbA1c	0.63±1.59	0.11±1.36	0.340±1.29	0.30±2.06	0.048
Weight (kg)	0.19±1.75	0.36±1.87	0.760±2.28	0.57±2.17	0.726
Blood pressure (systolic)	75.60±22.14	1.58±11.19	1.460±12.38	2.38±8.84	0.762
Blood pressure (diastolic)	7.00±24.72	1.07±16.60	2.410±20.05	1.96±14.70	0.547
Insulin	0.00±0.00	0.02±2.11	0.040±3.91	0.44±1.53	0.109
Glibenclamide (num)	0.06±0.28	0.07±0.50	0.220±0.66	0.16±0.53	0.001
Metformin (num)	0.07±0.51	0.01±0.62	0.110±0.59	0.28±0.57	0.002

not significant. Maybe results show that concentration of patients on two methods and recommend them doesn't effect well and thus recommending a one method have much significant effect. Comparing the changes of studied patients before and after intervention indicate the insensible decrease in some variables after intervention (Table 4).

**CONCLUSION**

Totally what should be conveyed is that the recommended physical activity can affect most in controlling the diabetes mellitus. If any individual in regard to his physical condition can not do physical activity, respecting a proper food pattern is in the second place of importance. Comparing the different physical activities such as, walking, track and field and etc., considering the individual's physical conditions, can be a better solvent for controlling this disease. Besides from the stress-controlling viewpoint studies over changing the life style can be suggested to be able to evaluate the role of this feature of life style in controlling the diabetes. Prosecution of recent study-groups can also indicate the proceeding of each recommended method and its influence on controlling the considered variables.

**ACKNOWLEDGMENTS**

I would like to acknowledge the institutes which helped us in this study, Endocrine and metabolism diseases Center in Tehran University of Medical Sciences, Endocrine and metabolism diseases Center in Mashhad University of Medical Sciences, Persian Diabetes Clinic and Khorasan Diabetes Research Center.

**REFERENCES**

American Diabetes Association, 1997. Diabetes mellitus and exercise. *Diabetes Care*, 20 (12): 1998-2012.

Amos, A.F., D.J. McCarty and P. Zimmet, 1997. The rising global burden of diabetes and its complications: Estimates and projections to the year 2010. *Diabetes Med.*, 14 (Suppl. 5): S1-S85.

Amuna, P. and F.B. Zotor, 2008. Epidemiological and nutrition transition in developing countries: Impact on human health and development. School of Science, University of Greenwich, Medway Campus, Chatham Maritime, Kent ME4 4TB, UK., 67 (1): 82-90.

Bouchard, C., R.J. Shephard and T.E. Stephens, 1994. Physical Activity Fitness and Health: International Proceedings and Consensus Statement. Champaign, Ill, Human Kinetics Publishers.

Boule, N.G., E. Haddad, R. Sigal and G. Kenny, 2001. Exercise for Type 2 diabetes mellitus. (Cochrane Review). In: *The Cochrane Library*, Issue 3. Oxford: Update Software. [Protocol-no abstract available].

Brown, S.A., S. Upchurch, R. Anding, M. Winter and G. Ramirez, 1996. Promoting weight loss in Type 2 diabetes. *Diabetes Care*, 19 (6): 613-624.

Harris, M.I., 2000. Definition and Classification of Diabetes Mellitus and the New Criteria for Diagnosis. In: *Diabetes Mellitus: A Fundamental and Clinical Text*, LeRoith, D., S.I. Taylor and J.M. Olefsky (Eds.). Philadelphia: Lippincott Williams and Wilkins, pp: 326-334.

Harry, T.P., D.X. Gan and A. Marie *et al.*, 2002. Role of exercise for type 2 diabetic patient management. *South Med. J.*, 95 (1): 72-77.

King, H., R.E. Aubert and W.H. Herman, 1998. Global burden of diabetes. 1995-2025. *Diabetes Care*, 21 (9): 1414-1431.

Kollipara, S. and E. Warren-Boulton, 2004. Diabetes and physical activity in school. Kaiser Permanente Medical Center, Sacramento, CA, USA., 21 (3): 12-16.

Nair, M., 2007. Nursing management of the person with diabetes mellitus. Part 2. Department of Nursing and Midwifery, University of Hertfordshire, 7 16 (4): 232-235.

- National Institutes of Health, 1998. National Heart Lung and Blood Institute. Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. The Evidence Report.
- Snowling, N.J. and W.G. Hopkins, 2006. Effect of different modes of exercise training on glucose control and risk factors for complications in type 2 diabetic patients: A meta-analysis. *Diabetes Care*, 29 (11): 2518-2527.
- Strano-Paul, L. and D. Phanumas, 2000. Diabetes Management, Analysis of the American Diabetes Associations clinical practice recommendations. *Geriatrics*, 55 (4): 57-62.
- Udezue, E., R. Nashwan, A.A. Azim, M. Hasweh, A. Al Nua'im and I. Al Dossary, 2005. The impact of a multi-disciplinary management approach on diabetic control in young Saudi patients. *Ann. Saudi Med.*, 25 (2): 85-89.
- WHO, 1997. World Health Report. World Health Organization. Geneva.
- Williams, R., J. Tuomilehto and S. Bjork, 2000. *The Economics of Diabetes Care: An International Perspective*. Blackwell Science, UK.
- Zeqiri, S., A. Ylli and N. Zeqiri, 2007. The effect of physical activity in glycemia in patients with diabetes mellitus. *Clinic of Physiatry and Orthopedics, University Clinical Centre of Kosova, Prishtina, Kosovo*, 61 (3): 146-149.