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Comparison of physical activity level of type II diabetic patients with healthy controls

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The present study was conducted to compare the physical activity level of type II diabetic patients with healthy controls. A WHO valided Global Physical Activity Questionnaire was used to assess the physical activity level of 800 samples (400 cases and 400 controls). The study was prospectively conducted on 400 consecutive patients presenting with type II diabetes visiting the O.P.D Endocrinology of P.G.I.M.E.R sector-12, Chandigarh. The findings indicated that 40% cases follow sedentary lifestyle as compared to 22% controls .45.5 % of female patients followed sedentary lifestyle as compared to males (34.5%). Amongst the control group 41.5% men were indulged in vigorous activity and amongst women majority (57 %) were engaged in moderate activity. There was a statistical significant difference found amongst vigorously active male cases and controls and sedentary and moderately active female cases and controls. Based on the findings of the present work, it was felt that physical activity plays a key role in type II diabetes mellitus management. In addition to providing measurable psychological benefits, physical activity has been associated with decreased insulin resistance and increased insulin sensitivity, reduced body fat, decreased blood pressure and improvements in cardiovascular risk factors.

Keywords: physical activity, type II diabetes mellitus, controls, cases

Diabetes represents a spectrum of metabolic disorders, which has become a major health challenge worldwide. The unprecedented economic development and rapid urbanization in Asian countries, particularly in India has led to a shift in health problems from communicable to non-communicable diseases. Of all the non-communicable diseases, diabetes and cardiovascular diseases lead the list (Mehta, Kashyap & Das, 2009). Type 2 diabetes mellitus (T2DM) is a serious chronic disease. The World Health Organization (2008) estimated 180 million people worldwide with this condition and the number was expected to double in next 25 years (WHO, 2008).India has been ranked the top most country in numbers of people with diabetes followed by China, USA, Indonesia, Japan, Pakistan, Russia, Brazil, Italy and Bangladesh (Wild et al., 2004). According to the Diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India was around 40.9 million and was expected to rise to 69.9 million by 2050 unless preventive steps were taken (Shah et al., 2007).

Physical activity has long been recognized as one of the cornerstones of diabetes management (Sigal et al., 2004). Physical activity, including aerobic and resistance training, that assist individuals with type 2 diabetes in achieving a variety of goals including improved glycemic control, increased cardio respiratory fitness, decreased insulin resistance, improved lipid profile and weight management (Ivy, Zderic & Fogt, 1999). Moderate to high levels of cardio respiratory fitness in those with type 2 diabetes has been associated with a 4570% reduction in both cardiovascular and overall mortality (Stampfer et al., 2001)

The regular physical activity was found to be beneficial for the prevention and management of type II diabetes. It has been shown that physical activity improves glycemic control through increased insulin sensitivity and glucose intolerance (Burchfiel et al.,1995; Eriksson & Lindgarde ,1991).

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Mahan and Escott (2008) reported that in person with type 2 diabetes, blood glucose control can improve with exercise, largely because of decreased insulin resistance and increased insulin sensitivity, which resulted in increased peripheral use of glucose not only during but also after the activity. Exercise also decrease the effect of counter regulatory hormones, this in turn, reduce the hepatic glucose output contributing to improve glucose control (Mahan, Escott & Krause, 2008).

It has been reported that regular physical activity improves quality of life, reduces the risk of mortality from all causes (Klein et al., 2004; Thompson et al., 2003), and is particularly advantageous in subjects with impaired glucose tolerance (Knowleret al., 2002; Tuomiletho et al., 2001) or type 2 diabetes (Horton,1988; Kenny, Wassermann & Castaneda, 2004).

Data from 20 longitudinal cohort studies presented a consistent picture indicating that regular physical activity substantially reduces risk of type 2 diabetes. The data indicate that protection from diabetes can be conferred by a range of activities of moderate or vigorous intensity, and that regular light-intensity activity may also be sufficient, although the data for this are less consistent. Thus, while 150 minutes per week of moderate activity confers benefits, higher levels of activity may be necessary to maximize diabetes risk reduction in those at high baseline risk of the disease. In contrast, those at low baseline risk of type 2 diabetes, e.g. people with a very low body mass index and no family history of diabetes, will remain at low risk of developing diabetes whether they are active or not. Thus, the amount of physical activity required to confer low risk of diabetes differs according to an individual's level of baseline risk (Gill & Cooper, 2008).

The American Diabetes Association emphasizes the benefits of regular physical activity in the prevention and treatment of type 2 diabetes, referring to proposals given to the general population by several scientific societies (Klein et al., 2004; Thompsonet al.,2003; Kenny, Wassermann & Castaneda, 2004).These recommendations advise individuals to engage in 30 min moderate- intensity physical activity on most (preferably all) days of the week. To maintain long-

term weight loss, data from several studies suggest that more exercise (6075 min/day) is needed (Klein et al., 2004, Sigal, Kenny, Wassermann & Castaneda, 2004; Jakicic et al., 2001).

The World Health Organization advice individuals to engage in at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity. Data from several studies suggested that to maintain long-term weight one must engage in 60- 75 min/day of exercise (Loreto et al., 2005).It was also reported that physical activity was inversely and independently associated with the risk of developing diabetes. (Manson et al., 1992; US Department of Health and Human Services, 1996). Studies suggest that physical activity may reduce risk of type 2 diabetes, even the moderate-intensity activity such as walking. The Nurses' Health Study, a prospective cohort study that included detailed data for physical activity from women surveyed in 11 US states in 1986, with updates in 1988 and 1992 suggest that greater physical activity level is associated with substantial reduction in risk of type 2 diabetes, including physical activity of moderate intensity and duration (Weber, 2009).

Method

Participants

The present comparative study was conducted on a sample of 800 subjects, out of which 400 were diabetic and 400 were healthy controls. The mean age of controls was matched with the mean age of diabetic patients, which was between 22 81 years. The study was conducted on consecutive patients presenting with type II diabetes, visiting the O.P.D., Endocrinology Department, of P.G.I.M.E.R., sector 12, Chandigarh from March 10, 2010 to October 11, 2010.

The comparative study was carried out by using 2 questionnaires.

The first one was a self designed questionnaire. The questionnaire covered the following parameters:

- General Information
- Demographic information
- Anthropometric Measurements
- Clinical Analysis
- Biochemical Analysis
- Information on risk factors
- Lifestyle information

Instruments

A WHO valided Global Physical Activity Questionnaire was also used to assess the physical activity level.

Self designed Questionnaire: The self designed questionnaire was used to gather information regarding the parameters mentioned above. It comprised of questions which were discussed and edited and re-edited with the help of the respective guides. The questions were kept simple, unambiguous, and free from any kind of religious or cultural bias and suitable to Indian context. The questions were framed in such a manner such that the patients could answer them with free mind. Some questions were put to them in different manners so that accurate information could be obtained from them in a polite manner.

Global Physical Activity Questionnaires (GPAQ): The second version of the GPAQ was employed in the survey (WHO, 2008). This questionnaire, which has been developed by WHO, is composed of 16 questions about physical activity in a typical week and assesses physical activity in three domains, namely, work, transportation, and recreational activities. It also determines the intensity of activity (i.e., vigorous or moderate) in each domain as well as the time spent on sedentary behaviors such as watching TV. Sedentary behavior was defined as activities such as sitting at a desk, traveling in car/bus/train, and reading, working with computer, and watching television. In order to measure energy expenditure, the concept of metabolic equivalents (MET) was used. MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate. One MET is defined as the energy cost of sitting quietly, and is equivalent to a caloric consumption of 1 kcal/kg/h. It was estimated that a person's caloric consumption is four times as high when being moderately active, and eight times as high when being vigorously active. Therefore, when calculating a person's overall energy expenditure using the GPAQ data, four METs are assigned to the time spent on moderate activities, and eight METs to the time spent on vigorous activities. The total physical activity score (TPA) was calculated as the sum of all MET × minutes for moderate- or vigorous-intensity physical activity performed in work, commuting, and recreation.

Participants were classified into the following three categories, as defined by the GPAQ analysis framework:

- *High:* a person reaching any of the following criteria is classified in this category:
- Vigorous-intensity activity on at least 3 days a week achieving a minimum of at least 1500 MET-minutes per week, or
- Seven or more days of any combination of walking and moderate- or vigorous-intensity activities achieving a minimum of at least 3000 MET minutes per week.
- *Moderate:* a person not meeting the criteria for the "high" category, but meeting any of the following criteria is classified in this category:
- Three or more days of vigorous-intensity activity of at least 20 min per day, or
- Five or more days of moderate-intensity activity or walking of at least 30 min per day, or
- Five or more days of any combination of walking and moderate- or vigorous-intensity activities achieving a minimum of at least 600 MET minutes per week.
- *Low:* a person not meeting any of the above mentioned criteria falls in this category.

Statistical analysis

The data taken from every patient was recorded on a pre designed Performa as well as on the validated questionnaires. Before entering the data on an excel spread sheet, the Performa and the validated questionnaires were reviewed for any incomplete information. After filling the entries on the excel sheet, the data was checked again for any possible keyboard error.

The statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 15.0 for Windows). All quantitative variables were estimated using measures of central location (mean, median) and measures of dispersion (standard deviation and standard error). Means were compared using one-way ANOVA (analysis of variance) for more than two groups. For two groups t-test was applied. Qualitative or categorical variables were described as frequencies and proportions.

Proportions were compared using Chi square or Fisher's exact test whichever was applicable. All statistical tests were two-sided and performed at a significance level of α=.05.

Results and Discussion

A total of 800 samples, comprising of 400 cases and 400 controls were taken for the study. A standardized WHO Global Physical Activity Questionnaire (GPAQ) was used. For the assessment of physical activity in three domains, namely, work, transportation, and recreational activities, the total time spent in physical activity during a typical week, the number of days as well as the intensity of physical activity were taken into account. The intensity of activity was expressed in METs (Metabolic Equivalents). One MET is defined as the energy cost of sitting quietly, and is equivalent to a caloric consumption of kcal/kg/hour. It was estimated that, compared to sitting quietly, a person's caloric consumption is four times as high when being moderately active, and eight times as high when being vigorously active. Therefore, when calculating a person's overall energy expenditure using GPAQ data, 4 METs get assigned to the time spent in moderate activities, and 8 METs to the time spent in vigorous activities. The criteria used for classification of subjects into three levels of physical activity i.e. sedentary, moderate and vigorous were:-

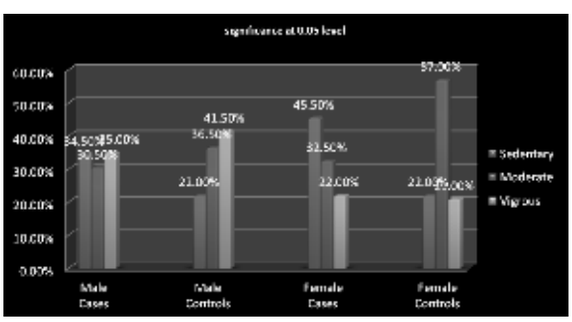
- Vigorous- >=1500 MET-minutes/week
- Moderate-<1500-600 MET-minute/week
- Vigorous->600 Met-minute/week

2.1 Distribution of samples on the basis of level of physical activity

Sex	Group	Level of physical activity						Total (N=200)	P Value
		Sedentary (METs <600 min/week)		Moderate (METs <1500-600 min/week)		Vigorous (METs> 1500 min/week)			
		N	%	N	%	N	%	%	
Cases	Males (N=200)	69	34.5%	61	30.5%	70	35.0%	100.0%	
	Females (N=200)	91	45.5%	65	32.5%	44	22.0%	100.0%	.341 (NS)
	Total (N=400)	160	40.0%	126	31.5%	114	28.5%	100%	
Controls	Males (N=200)	44	22.0%	73	36.5%	83	41.5%	100.0%	
	Females (N=200)	44	22.0%	114	57.0%	42	21.0%	100.0%	.026*
	Total (N=400)	88	22.0%	187	46.8%	125	31.3%	100.0%	

Males	Sed		.176 (NS)
	Mod	Pearson Chi-Square	.234(NS)
	Vig		.008*
Females	Sed		.015*
	Mod	Pearson Chi-Square	.066 (NS)
	Vig		.003*

NS-NON SIGNIFICANT



*significant At 0.05 Level,

** Highly Significant At 0.001 Level

Figure 5 Distribution of samples on the basis of level of physical activity

As seen from the above table, it was evident that more number of cases (40%) follow sedentary lifestyle; as compared to controls (22%). More number of female patients (45.5%) followed the sedentary lifestyle as compared to males (34.5%). Amongst the control group (41.5%) men were indulged in vigorous activity and amongst women (57.0%) majority were engaged in moderate activity. There was a statistical significant difference found amongst vigorously active male cases and controls and sedentary and moderately active female cases and controls.

Conclusion

Thus, from this study, it was concluded that males were physically more active than female cases. The non diabetic males and females were physically more active as compared to the patients. The urban patients were almost double as compared to the rural, and majority of males had higher qualification as compared to females. Majority of the female cases were housewives and followed a sedentary lifestyle. Maximum numbers of patients were in the age group of 50 years and above and males in this group engaged in vigorous activity whereas females followed a sedentary lifestyle. As the duration of diabetes increased, it was observed that the physical activity levels increased amongst the patients. Higher percentages of patients were obese with their BMI greater than 25 kg/m2 and had higher waist hip ratio and followed a sedentary lifestyle. A decrease in physical activity was observed among cases as their total cholesterol levels and LDL levels increased.

References

Boule, N., Haddad, E., Kenny, G., Wells, G., & Sigal, R. (2001). Effects of exercise on glycemic control and body mass in type 2 diabetes: a meta-analysis of controlled clinical trials. *JAMA, 286,* 1218-1227.

Burchfiel, C. M., Sharp, D. S., Curb, J. D., Rodriguez, B. L., Hwang, L., Marcus, E. B., & Yano, K. (1995). Physical activity and incidence of diabetes: the Honolulu heart program. *Am J Epidemiol; 141,* 360-368.

Di Loreto, C., Fanelli, C., Lucidi, P., Murdolo, G., De Cicco, A., Parlanti, N., Santeusanio, F.,Brunetti, P., & De Feo, P. (2003).Validation of a counseling strategy to promote the adoption and the maintenance of physical activity by type 2 diabetic subjects. *Diabetes Care, 26,* 404-408.

Eriksson, K. F., & Lindgarde, F. (1991). Prevention of type 2 (non-insulin-dependent) diabetes mellitus by diet and physical exercise. *Diabetologia, 34,* 891-898.

Gill, J. M., & Cooper, A. R. (2008*). Physical activity and prevention of type 2 diabetes mellitus.* Institute of Diet, Exercise and Lifestyle, Faculty of Biomedical and Life Sciences, University of Glasgow, Glasgow, UK. j.gill@bio.gla.ac.uk.Sports Med.38(10):807-24.

Horton, E.S .(1988). Role and management of exercise in diabetes mellitus. *Diabetes Care 11*, 201-211.

Ivy, J. L., Zderic, T. W., & Fogt, D. L. (1999). Prevention and treatment of non-insulin-dependent diabetes mellitus. *Exercise & Sport Sciences Reviews, 27,* 1-35.

Jakicic, J. M., Marcus, B. H., Gallagher, K.I., Napolitano, M., & Lang, W. (2001) .Effect of exercise duration and intensity on weight loss in overweight, sedentary women. *JAMA 290,* 1323-1330.

Kirk, A., Mutrie ,N., MacIntyre, P., & Fisher, M.(2004) .Effects of a 12-month physical activity counseling intervention on glycaemic control and on the status of cardiovascular risk factors in people with type 2 diabetes. *Diabetologia 47,* 821-832.

Klein, S., Sheard, N F., Pi-Sunyer, X., Daly, A., Wylie-Rosett, J., Kulkarni, K., & Clark, N G. (2004). American Diabetes Association, North American Association for the Study of Obesity, American Society for Clinical Nutrition: Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies. *Diabetes Care, 27,* 2067-2073.

Knowler, W.C., Barrett-Connor, E., Fowler, S.E., Hamman, R.F., Lachin, J.M., Walker, E. A., Nathan, D.M. (2002).Diabetes Prevention Program Research Group: Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med 346,* 393-403.

Manson, J. E., Nathan, D. M., Krolewski, A. S., Stampfer, M. J., Willett, W. C., & Hennekens, C. H. (1992). A prospective study of exercise and incidence of diabetes among US male physicians. *JAMA 268,* 63-67.

Mehta, S. R., Kashyap, A. S., & Das, S. (2009). Diabetes mellitus in India: The modern scourge. *MJAFI,; 65,* 50-54.

Mohar, V., Sandeep, S., Deepa R., Shah, B., & Varghese, C. (2007).Epidemiology of type 2 diabetes: Indian journal of medical research.

Sigal, R. J., Kenny, G. P., Wasserman, D. H., & Castaneda-Sceppa, C. (2004). Physical activity/exercise and type 2 diabetes. *Diabetes Care, 27*, 2518-2539.

Smith, S. A., & Vickers, K. S.(2003). A counseling strategy was better than usual care for adopting and maintaining physical activity in type 2 diabetes (Letter). *ACP Journal Club 139,* 69.

Stampfer, M. J., Solomon, C., Liu, S., Colditz, G. A., & Speizer, F. E. (2001). Physical activity and risk for cardiovascular events in diabetic women. *Annals of Internal Medicine, 134,* 96-105.

Thompson, P.D., Buchner, D., & Pina, I. L. (2003). American Heart Association Council on Clinical Cardiology Subcommittee on Exercise, Rehabilitation, and Prevention, American Heart Association Council on Nutrition, Physical Activity, and Metabolism Subcommittee on Physical Activity: Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: a statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation, 107,* 3109-3116.

Tuomiletho, J., Lindstrom, J., Eriksson, J.G., Valle, T. T., Hamalainen, H., Ilanne-Parikka, P., Keinanen-Kiuaanniemi, S., Laasko, M., Louheranta, A., Rastas, M., Salminen, V., & Uusitupa, M. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med 344,* 1343-1350.

US Department of Health and Human Services.(1996). Physical Activity and Health: A Report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

Weber, C. (2009, July 23). *Being a Diabetic May Mean Struggling With Hypertension, Too. Diabetics and High Blood Pressure.* Retrieved January 23,2010,fromhttp://highbloodpressure.about.com/od/highbloodpressure101/a/diabetes-hbp.htm

Wild, S., Roglic, G., & Green, A. (2004). Global prevalence of diabetes. *Diabetes Care, **27,*** 1047-1053.

World Health Organization. (2008): *Diabetes/ the cost of diabetes.* Reterivedfrom: http:www.who.int/mediacentre/factsheets/fs312/en/index.html.