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Physical Activity Pattern among Young Adults with Newly Detected Type 2 Diabetes Mellitus

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ABSTRACT

Background: Lack of physical activity and visceral obesity are considered to be the major contributors to the global diabetes epidemic. There is a progressive increase in the prevalence of early onset type 2 diabetes in the young. Physical inactivity and sedentary life style has been reported as a significant modifiable risk factor. Regular physical activity and exercise is a major component in the prevention and treatment of diabetes.
Methods: 117 consecutive subjects with new onset type 2 diabetes in the age group 18-44 years were included in the study. Socio demographic characteristics, anthropometric and biochemical measurements were carried out using standard techniques. Physical activity levels and sitting time were assessed by a validated and translated version of Global Physical Activity Questionnaire (GPAQ-WHO).
Results: 36.8% participants were having low physical activity and 63.2% were having moderate physical activity. 64.1% participants had regular aerobic exercise without gap of more than 2 days in a row between sessions and 35.9% had exercise with more than 2 days gap. 75% of males and 63.3% females had Physical activity time duration of less than 30 minutes. A break after 30 minutes of sedentary activity was reported by 30.8% subjects and no break by 69.2% subjects.
Conclusions: Since up to 80 % of type 2 diabetes is preventable, participation in regular physical activity and reduced sedentary time is highly recommended in order to reduce the burden of type 2 diabetes in young adults.

Keywords: Physical activity, Sedentary behaviour, New onset diabetes, Young adults.

INTRODUCTION

Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure. Exercise is a subset of physical activity that is planned, structured, repeated and has a final or an intermediate objective to the improvement or maintenance of physical fitness. [1] Regular exercise improves blood glucose control in type 2 diabetes, reduces cardiovascular risk factors, contributes to weight loss, and improves well-being. Regular exercise may prevent or delay type 2 diabetes development. [2,3] There is a 30% to 40% lower risk of metabolic syndrome and type 2 diabetes in at least moderately active people compared with those who are sedentary. Physical activity may reduce the risk for type 2 diabetes directly through improvements in insulin sensitivity. This may be independent of any effect of activity on weight loss and fat distribution. [4] However, a large portion of the effect of physical activity in decreasing insulin resistance is short lived and may last only few days. Thus, the consistency of an individual's activity throughout the years is essential to ensure getting the benefits of exercise on insulin sensitivity. [5, 6]

The physical activity programme should consist primarily of aerobic and

resistance training, as these have been shown to have clear benefits in prevention and management of diabetes and metabolic syndrome. [7,8] Structured lifestyle intervention trials that include physical activity at least 150–175 min/week and dietary energy restriction targeting weight loss of 5%-7% have demonstrated reductions of 40%-70% in the risk of developing type 2 diabetes in people with impaired glucose tolerance.

Sedentary behaviour has a ubiquitous and significant population-wide influence on cardiometabolic health. [9, 10] According to WHO, physical inactivity (lack of physical activity) has been identified as the fourth leading risk factor for global mortality and account for approximately 27% of diabetes burden? Higher amounts of sedentary time are associated with increased mortality and morbidity, mostly independent of moderate-to-vigorous physical activity participation. [11-15] In people with or at risk for developing type 2 diabetes, extended sedentary time is also associated with poorer glycemic control and clustered metabolic risk. [16-20] Prolonged sitting interrupted by brief (≤5 min) bouts of standing or light-intensity ambulation every 20–30 min improves glycemic control in sedentary overweight/obese populations and in women with impaired glucose regulation. [21-24] ADA recommends for all adults, and particularly those with type 2 diabetes, to decrease the amount of time spent in daily sedentary behaviour (B). Prolonged sitting should be interrupted with bouts of light activity every 30 min for blood glucose benefits, at least in adults with type 2 diabetes(C**).**The above two recommendations are additional to, and not a replacement for, increased structured exercise and incidental movement(C)**.**The objective of the study was to assess the pattern of Physical activity and sedentary behaviour among young adults with incident diabetes.

MATERIALS AND METHODS

Inclusion Criteria

Adult men and women aged between 18 - 44 years who fulfil the American Diabetes Association (ADA) criteria for diagnosis of type 2 diabetes mellitus.

Exclusion Criteria

Type 1 diabetes, Gestational Diabetes, other specific types of diabetes, unclear types of diabetes and subjects with acute or chronic debilitating illness which affect their metabolic status or physical fitness. Participants who were physically or mentally challenged, bed ridden and those with incomplete data or unwilling to give written informed consent were also excluded from the study.

Study Period

January 2016 to January 2019.

Study Population

All consecutive subjects (adult men and women) aged between 18-44 years who have visited General Medicine or Diabetology departments of Sree Gokulam Medical College & Research Foundation with FPG > 126 mg/dL. Fasting was defined as no caloric intake for at least 8h.In the absence of unequivocal hyperglycemia, result was confirmed by repeat testing.

Data Collection Methods

117 consecutive subjects with new onset type 2 diabetes in the age group 18-44 years (early-onset type 2 diabetes) who visited a tertiary care hospital outpatient department were included in the study. The cases were ascertained using internationally accepted ADA criteria. The measurements were done by a qualified, trained, single investigator. After identification of eligible study participants, informed consent was taken and those who gave written informed consent were interviewed using a structured performa. Socio demographic characteristics, anthropometric and biochemical measurements were carried out using standard techniques.

Height was measured with the commercial fixed stadiometer corrected to 0.1cm with the subject standing with arms at the sides, heels touching the rod with head held erect and the plane passing through the lower border of orbit and Frankfurt plane

parallel. Digital scale weighing machine corrected to 0.5 Kg was used to measure body weight. Machine was checked for zero error prior to each measurement. BMI was calculated by dividing body weight in kg by height in meters squared.

Physical activity levels and sitting time were assessed by a validated and translated Global Physical Activity Questionnaire (GPAQ-WHO) Malayalam version. Estimates of leisure and occupational activity were calculated separately as hours per week averaged over the past year. Each activity was also weighted by its relative metabolic cost, referred to as a metabolic equivalent (MET), thereby deriving MET-hours per week as the final unit of expression. One MET represents the energy expenditure for an individual at rest whereas a 10-MET activity requires 10 times the resting energy expenditure. Guidelines have recommended using metabolic equivalent of task (METs) as reference thresholds of absolute intensities of physical activity.(light,<3.0 METs; moderate, 3.0–5.9 METs; vigorous ≥6.0 METs. The total sitting time accumulated during the weekdays was measured by time spent sitting in various domains (i.e., leisure, work, and recreation). Baseline physical activity (low, moderate, vigorous, and exercise-specific; metabolic equivalents of task-hours/week) and sedentary behaviours (television/mobile watching, reading; hours/day) were assessed by questionnaire.

Statistical Analysis

Data were entered in MS Excel spread sheet. The data was cleaned and completeness of data was checked. Continuous variables are represented as arithmetic mean ± standard deviation and categorical data as numbers (percentage). For comparing two qualitative variables, χ^2 test was used. Descriptive statistics were used to compare the baseline characteristics of participants using appropriate parametric or non-parametric tests for continuous variables, and the $\chi 2$ test for categorical variables. All analyses were performed using SPSS for Windows version 17. A two-tailed P value <0.05 was considered significant in all analyses.

RESULTS

Among the 117 participants, 68(58.1%) were males and 49(41.9%) were females. Mean age of the participants was 36.6±5.96 years. Males developed type 2 diabetes at an earlier age than females.More than 93% the participants were educated 10thand standard& above and none were illiterate. Eighty one (69.2%) participants were employed and 36(30.8%) were unemployed. Seventy five (64.1%) participants were above poverty line and 42(35.9%) were below poverty line

Table 1 Distribution of baseline characteristics according to gender

Variable	Male	Female
Age (yrs)	35.4± 6.3	37.6±5.8
BMI (Kg/m^2)	26.47±3.47	28.35±4.47
Educational status		
10th Std. & above	63 (92.6%)	46 (93.9%)
Below 10th std.	5 (7.4%)	3 (6.1%)
Employment status		
Employed	64 (94.1%)	17 (34.7%)
Un employed	4 (5.9%)	32 (65.3%)
Income status		
APL category	47 (69.1%)	28 (57.1%)
BPL category	21 (30.9%)	21 (42.9%)

In the present study Mean BMI of the participants was 27.7±3.84 Kg/m^2). One hundred and eleven (94.9%) participants were either overweight or obese. Exercise time ranged from 0-480 minutes/week in males and 0-600 minutes/week in females. 43(36.8%) participants were having low physical activity and 74(63.2%) were having moderate – vigorous physical activity.75 (64.1% male32, female43) participants had regular aerobic exercise without gap of more than 2 days in a row between sessions and 42 (35.9% male 36, female 6) had exercise with more than 2 days gap.All the participants who were physically active were doing a combination of aerobic and flexibility exercise. No participants were doing regular yoga. One male and two female subjects were doing occasional yoga.

Table 2 Distribution of physical activity Level according to gender

Variable	Gender	
Physical activity	**Male No.(%)**	**Female No.(%)**
Mild	37 (86.0%)	6(14.0%)
Moderate-Vigorous	31 (41.9%)	43 (58.1%)

Total 6849

Mild physical activity was seen in 43(36.8%) subjects (male 37,86%, female 6,14.0%). Moderate physical activity was seen in 74(63.2%) subjects (male 31,41.9%, female 43,58.1%). Physical activity time of less than 30 minutes was seen in 51(75%) of males and 31(63.3%) females. 30-60 minutes physical activity was seen in 14(20.6%) males and 12(24.5%) females. More than 60 minutes physical activity was seen in 3(4.4%) males and 6(12.2%) females.

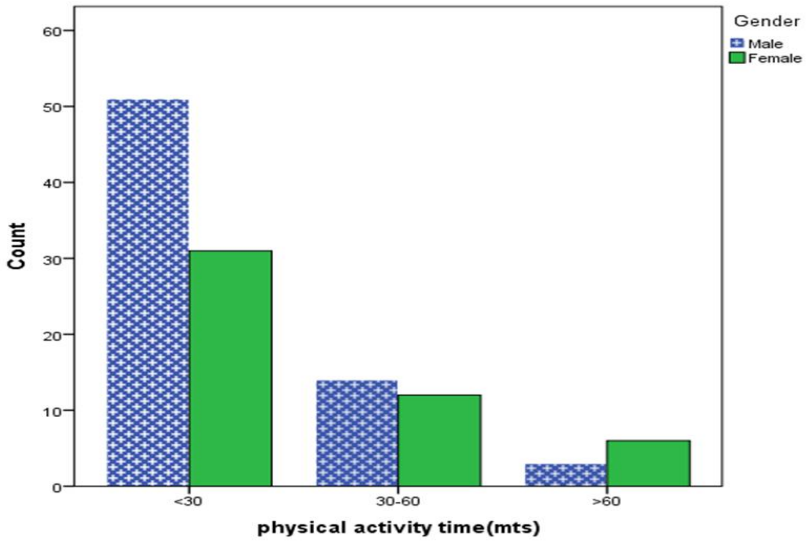

Fig 1: Distribution of physical activity time according to gender

Age(X^2 11.93 df2 p 0.003), gender (X^2 21.78 df1 p <0.001), education (X^2 10.11 df4 p 0.039), and occupation (X^2 4.72 df1 p 0.030) had significant association with physical activity level. Income had no significant association with levels of physical activity.

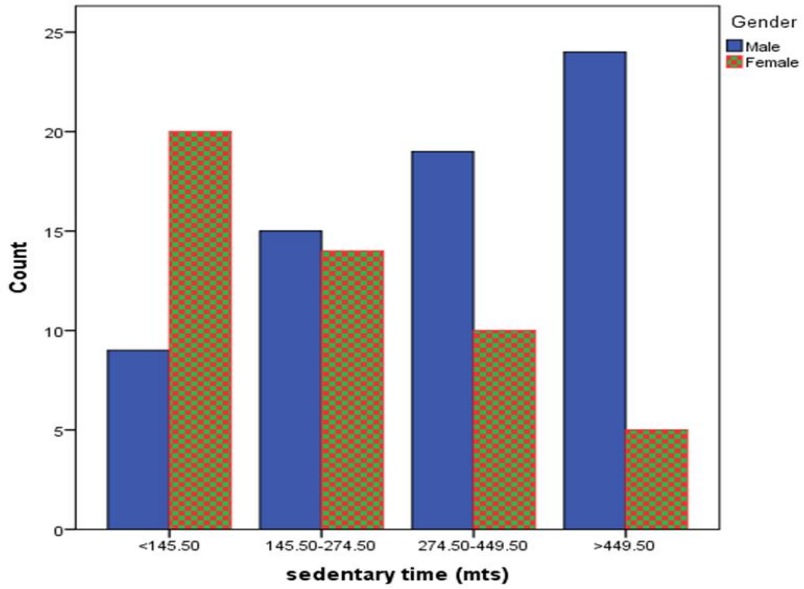

Fig 2: Distribution of sedentary time according to gender

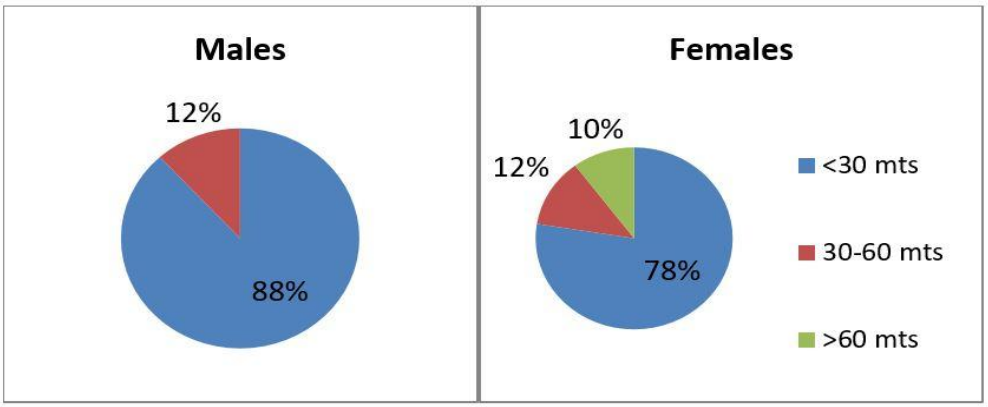

Fig No.3: Work related physical activity

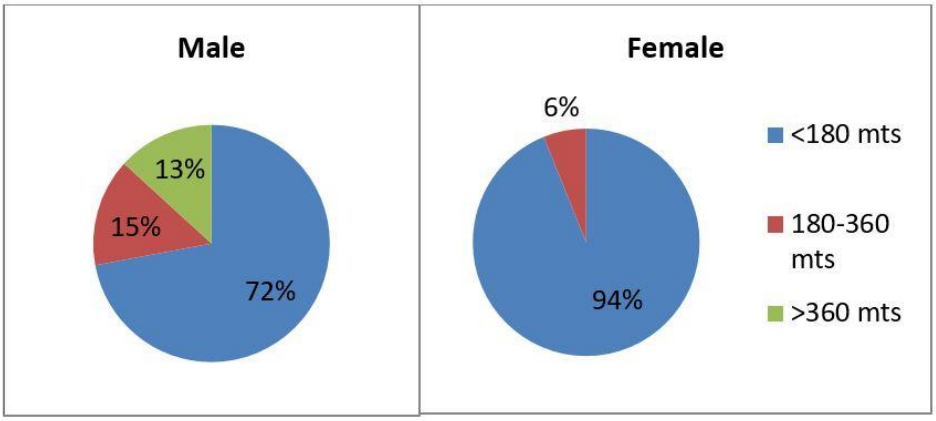

Fig No. 4: Leisure related physical activity

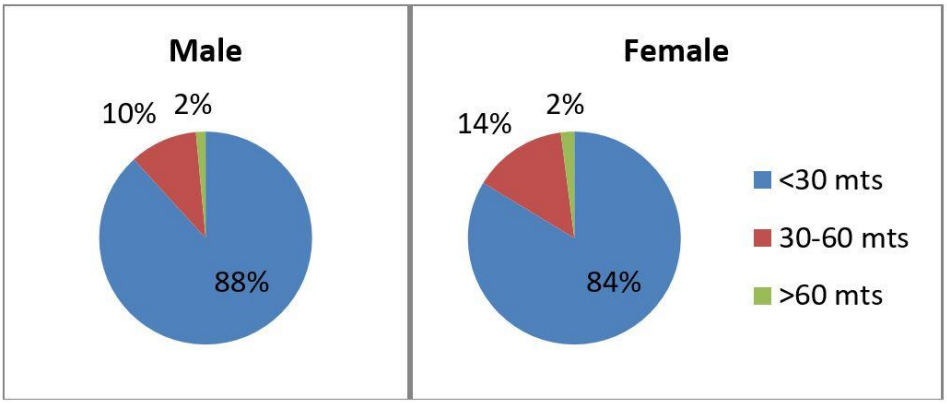

Fig No. 5: Sedentary time related to work

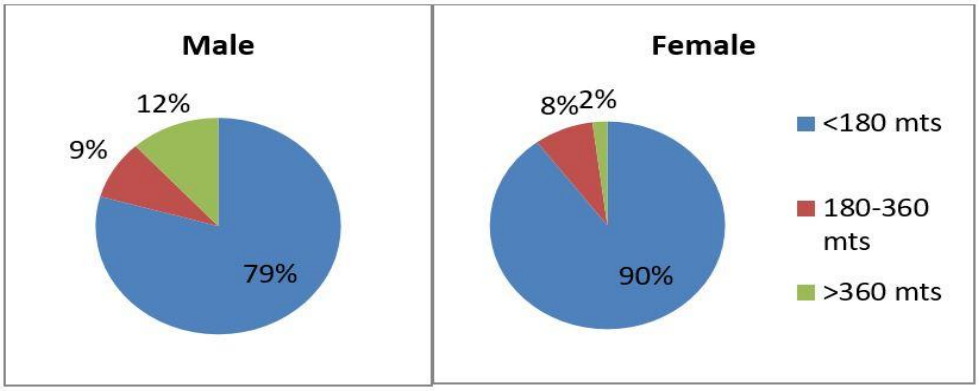

Fig No. 6: Sedentary time related to leisure

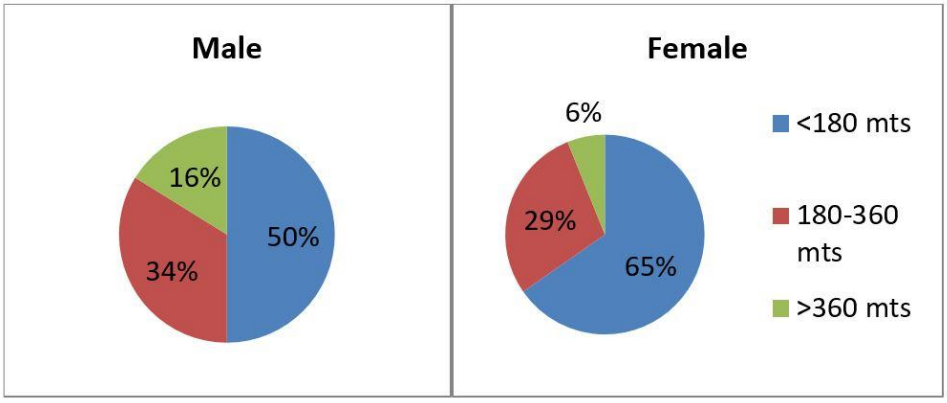

Fig No. 7: Sedentary time related to travel

Sedentary time ranged from 10-800 minutes/week in males and 15-540 minutes/week in females. Sedentary time is divided into quartiles and the distribution is given in Fig2. Snacking during watching television, Computer or Mobile was reported in 23(19.7%) [male 15, 21.4%, female 8, 17%} participants. A break after 30 minutes of sedentary activity was reported by 36(30.8%) subjects (19 male and 17 female) and no break by 81(69.2%) subjects (49 male and 32 female). More females (34.7%) had break in sedentary time compared with males (27.9%).

DISCUSSION

The purpose of this study was to identify the pattern of physical activity levels and sedentary behaviour in young men and women newly diagnosed with type 2 diabetes visiting a tertiary care hospital outpatient in south Kerala.

Susruta, the ancient Indian physician is the first to recommend exercise for health reasons roughly 2600 years ago. Being an expensive disease, the primary prevention of type 2 diabetes and its early treatment are necessary to avoid the later complications of type 2 diabetes and their related costs. Exercise, in addition to diet modification and medication, has been recommended as one of the three main components of diabetes therapy.

Lack of physical activity and visceral obesity are considered to be major contributors to the global diabetes epidemic. In the present study even though 95 percent of the participants were either overweight or obese, more than 63 percent were physically active. Physical activity has been shown to be beneficial in the prevention of type 2 diabetes independent of weight loss. [25] Nurses' Health Study also showed that obesity and physical inactivity independently are found to contribute to the development of type 2 diabetes. The reduction in relative risk for type 2 diabetes ranged from 15%–60% for those that are physically active compared with their more inactive peers across populations and different age groups. Despite modest changes for adiposity, lifestyle modification interventions in high-risk South Asian populations resulted in a clinically important 35% relative reduction in diabetes incidence. [26] Physical activity is inversely related to the incidence of type 2 diabetes among male alumni from the University of Pennsylvania.[27] Similar findings are observed between exercise and incidence of type 2 diabetes in a 5-year prospective study of US male physicians. [28]

This study also shows long periods of sedentary behaviour in both genders with divergent pattern with no adequate frequent breaks.It has been shown that the general population spends most of their awake time in sedentary behavior. [29] As a result, 9.4% of the world population death rate is due to increased sedentary lifestyles. According to recent studies, when the daily average sitting time is exceeded, positive health outcomes provided by regular exercise

disappear and can cause the chances of chronic illness to increase. [30]

Breaks in sitting time have been associated with improvements in waist circumference, triglycerides, and two-hour plasma glucose levels. [31] Large cohort studies have observed that each two-hour increment per day in watching TV, as a proxy measure of sitting time, is associated with a 14%-20% increase in diabetes incidence, even after adjustment for physical activity participation. [13,14] ADA recommends three or more minutes of light activity, such as walking, leg extensions or overhead arm stretches, every 30 minutes during prolonged sedentary activities for improved blood sugar management, particularly for people with type 2 diabetes.

Several trials demonstrate that lifestyle modification combining weight loss and physical activity reduces the short-term and long-term incidence of type 2 diabetes in high-risk participants. [32-35] Schulz et al have shown that, levels of physical activity are considerably higher in the Mexican Pima Indians than in those in the US. Thus, even in populations genetically prone to type 2 diabetes, its development is determined mostly by environmental circumstances, thereby suggesting that type 2 diabetes is largely preventable. [36]

In the Indian Diabetes Prevention Program, the relative risk reduction is 28.5% with lifestyle modification (95% CI: 20.5–37.3; P =0.018) 26.4% with metformin alone (95% CI: 19.1–35.1; P =0.029) and 28.2% with lifestyle modification and metformin combined (95% CI: 20.3–37.0; P =0.022) compared with the control group. [37] In those at high risk of developing type 2 diabetes, lifestyle interventions, including diet and physical exercise, results in a 50% reduction in diabetes incidence that persists for several years after the supervised lifestyle intervention has stopped.

In the current study, more than two third of the participants were having physical activity duration and intensity less than required. ADA's recommendations on physical activity include, 1)structured lifestyle interventions that include at least 150 min/week of physical activity and dietary changes resulting in weight loss of 5%-7% to prevent or delay the onset of type 2 diabetes in populations at high risk and with prediabetes(A), 2)daily exercise, or at least not allowing more than 2 days to elapse between exercise sessions, to enhance insulin action(B), and 3) adults with type 2 diabetes should ideally perform both aerobic and resistance exercise training for optimal glycemic and health outcomes (C). For glycemic control, combined training is superior to either type of training undertaken alone. Therefore, adults with type 2 diabetes should ideally perform both aerobic and resistance exercise training for optimal glycemic and health outcomes. Minimum 60 min/day of moderate-to-vigorous physical activity, including strength-related exercise at least 3 days/week is recommended.

Only one male participant was doing vigorous physical activity. For a meaningful comparison, it was clubbed with moderately intense physical activity group. Seventy five subjects (64.1%)had regular exercise without gap of more than 2 days, which is needed to reduce insulin resistance. No one was doing regular yoga. Only 3 subjects were doing occasional yoga, which combine flexibility, balance, and resistance activities.

Even though numbers of males doing physical activity were more, females were spending more time on more intense physical activity. More females were doing exercise without gap of more than 2 days in a row between sessionswhen compared to males. Females were also having less sedentary time, with more frequent breaks which may be a reason for less incident diabetes in females compared to males in spite of having a higher BMI than males.

Thirty six percentages of participants were doing daily movement not amounting to exercise. Increasing unstructured physical activity has been shown to increase daily energy expenditure and assists with weight management. Unstructured activity also reduces total daily sitting time. Increasing

non exercise activity, even in brief (3−15 min) bouts, is effective in acutely reducing postprandial hyperglycemia and improving glycemic control in those with prediabetes and type 1 and type 2 diabetes, most prominently after meals.

None of the participants were engaged in exercise under supervision. Individuals undertaking supervised aerobic and resistance exercise are shown to achieve greater improvements in A1C, BMI, waist circumference, blood pressure, fitness, muscular strength, and HDL cholesterol. Thus, supervised training is recommended whenever feasible, at least for adults with type 2 diabetes.

A UK based study in 2004, which studied both type 1 and type 2 diabetes patients, found that only 34% of patients took some form of physical activity and only 9% of these patients exercised sufficiently to achieve a large change in heart rate or breathing. [38] Higher physical activity and lower leisure sedentary behaviours are inversely associated with incident type 2 diabetes in this multi ethnic analysis. The associations between physical activity/sedentary behaviours and incident type 2 diabetes may vary by race/ethnicity with most associations only being significant in non-Hispanic whites.

According to MESA study, [39] the associations between physical activity and incident type 2 diabetes may vary by family history of diabetes, with most associations being only significant in stratified analysis in participants without a family history of diabetes, although formal interaction testing was non-significant except for television viewing time. Such an association has not seen in the present study.

Females were spending more time for physical activity than males and the number of patients with sedentary time greater than 275 minutes were more in males. So the physical activity time is less and sedentary time is more in males. This might be one reason that the present study identified 16% more male diabetes patients.

Limitation of the study was, questionnaire-based information has been known to overestimate the general physical activity level, and this could result in an underestimation of the effect of physical activity on diabetes risk. GPAQ has been found to be reliable for persons with stable physical activity pattern and unreliable in those with variable physical activity pattern.

CONCLUSION

A relatively low intensity and duration physical activity compared to their BMI status coupled with a long sedentary time may be contributing in the background of high ethnic susceptibility for rising incidence of type 2 diabetes in the young.

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