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Sedentary Work-A Risk Factor for Diabetes with a Positive Family History

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Abstract: ***Background: The phrase "sedentary behaviour" comes from the Latin word "sedere" which means "to sit". Obesity and sedentary lifestyles are escalating national and global epidemics that warrant increased attention by physicians and other health care professionals. These intricately linked conditions are responsible for an enormous burden of chronic disease, impaired physical function and quality of life. Persons having sedentary work and lifestyle will be prone to type II diabetes. Sedentary work, which accelerates risk of diabetes, is least explored in the Indian population. Aim & Objective: To examine the relationship between sedentary job and the risk of obesity and diabetes. Methods: Data of age matched 50 subjects previously undiagnosed with diabetes from two occupational groups: the banking sector (Group 1) and computer professionals (Group 2) in Chennai, India were selected. The data for this pilot study were retrieved using a structured questionnaire which calculates the Indian Diabetic Risk Score (IDRS). The important explanatory variables were Body mass index (BMI), Waist circumference (WC), duration of physical activity, positive Family History of Diabetes (FHD), Random Capillary Blood Glucose level (RCBG) and systolic blood pressure(SP) and diastolic blood pressure(DP). Logistic regression analysis was done separately to identify the determents of diabetes in each group. Also a combined logistic regression was done to estimate the risk of diabetes among sedentary subjects with positive FHD. Results: Factors associated with elevated RCBG among bank employees were Indian Diabetic Risk Score (IDRS) and Systolic blood pressure, whereas among computer professionals pressure, IDRS was significantly associated with diabetes. Conclusion: Healthy diet and active life style reduces the risk of Diabetes, in spite of having a positive FHD. Effective health education programmes promoting healthy diet and regular exercise are needed to reduce the burden of diabetes.***

Keywords: Sedentary behavior; Diabetes; Random Capillary Blood Glucose; Positive Family History; Indian Diabetic Risk Score.

1. Introduction

Socioeconomic development, technological advancements and changes in lifestyles, behavioural patterns, demographic profile transition (aging population) lead to major health transition, causes rapidly raising the burden of the non communicable diseases and its burden overweight the communicable diseases. India has also experienced this health transition cause increase the burden of diabetes and other noncommunicable diseases [1-4]. Genetic and environmental factors are the two major factors contributing towards the increase in the number of people living with diabetes.

The phrase ~~–s~~edentary behaviour" comes from the Latin word ~~–s~~edere" which means ~~–t~~o sit." Sedentary work is defined as the job that demands that the majority of the time be spent in sitting with occasional walking and standing. Obesity and sedentary life styles are escalating national and global epidemics that warrant increased attention by physicians and other health care professionals. These intricately linked conditions are responsible for an enormous burden of chronic disease, impaired physical function and quality of life.

In general there are several studies to support the stronger association of sedentarism with the development of obesity and diabetes.[5-7] Recent epidemiologic evidence suggests that the metabolic and long-term health consequences of habitual sedentary behavior (too much sitting) are distinct from those associated with a lack of moderate-to-vigorous activity (too little exercise). [8, 9]

Diabetes is an emerging public health problem worldwide. About 70–80% of this burden is borne by the developing countries.[10] According to the International Diabetes Federation Atlas, the prevalence rate (adjusted to world population) of diabetes in India was 9% among adult population (20–79 years of age) in 2011, which is expected to increase to 10.6% by 2030.[11]

People who regularly exercise may think that they are immune to type 2 diabetes risks, but new research shows that they may still be prone to the condition if their lifestyle is otherwise sedentary. An individual could choose to religiously go to the gym for a 30-minute workout each night after work, but if their job involves long periods of sitting and the rest of their free time is consumed by inactive activities, they may be described as having a sedentary lifestyle.

In India, according to the 2001 census, the work force consisted of more than 400 million people, constituting about 40% of the total population. The economically productive age group spends most of their time in the workplace in India, with an average contractual weekly working time of 48 hours. [12]

By 2000, more than 4 in 10 adults were in light-activity jobs, whereas 2 in 10 were in high-activity jobs.[13] Moreover, during the past 20 years, total screen time (ie, using computers, watching television, playing video games) has increased dramatically. In 2003, nearly 6 in 10 working adults used a computer on the job and more than 9 in 10 children used computers in school (kindergarten through grade 12).[14] Between 1989 and 2009, the number of

households with a computer and Internet access increased from 15% to 69%.[15] Other significant contributors to daily sitting time—watching television and driving personal vehicles—are at all-time highs, with estimates of nearly 4 hours and 1 hour, respectively [16,17].

Scientists studying the ill effects of this decrease in physical activity have revealed a complex, multifaceted relationship among physical work, energy expenditure, and health.[18] About 1.2 million healthy U.S. individuals were followed up for a period of 14 years, and it was observed that the mortality rate was higher among those who spent sitting ≥ 6 hours/day in leisure time after adjusting for other associated factors such as body mass index and smoking.[18] Choi et al reported that a low physical activity level at the workplace was associated with increased prevalence of general as well as central obesity.[19]

Diabetes mellitus is not considered a professional illness, nor is it seen as specific to health workers. The lifestyle these workers adopt, however, can enhance the appearance of the disease.

Indian Diabetes Risk Score was developed by Madras Diabetes Research Foundation (MDRF) during Chennai Urban Rural Epidemiological Study (CURES) based on multiple logistic regression model using four simple parameters namely age, abdominal obesity, physical activity and family history. It is the cost effective method for early diagnosis of Diabetes. [20]

Aim & objective

The primary objective of this study was to assess whether prolonged sitting hours in work place predisposes individuals to risk of diabetes and also to estimate risk of diabetes in sedentary workers with a positive family history of diabetes (FHD) using the Indian Diabetic Risk score(IDRS).

2. Materials and Methods

The data for this pilot study were retrieved using a structured questionnaire which calculates the IDRS (Table1). The screening programs were conducted in two occupational groups: the banking sector (Group 1) and computer professionals (Group 2).

50 numbers of participants from each group participated in the study. Written consent was obtained from all the subjects at the time of screening, and from the Institutional Ethical committee for the study.

Armamentarium

- Weighing Scale
- Freemans measuring tape
- Tailor's Tape
- Green Cloth
- Portable Glucometer
- Portable BP monitoring device
- Computer

The information for the risk factors for IDRS can be obtained based on four simple questions and one anthropometric measurement namely waist circumference (in cm).

The four questions are:

1) What is your age?
2) Do you have a family history of diabetes? If yes, does your father or mother or both have diabetes?
3) Do you exercise regularly?
4) How physically demanding is your work [occupation]? (Sitting for ≥180 minutes continuously is considered as sedentary)

Table 1: Indian Diabetes Risk Score

Particulars	Score
Age [years]	
< 35 [reference]	0
35 – 49	20
≥ 50	30
Abdominal obesity	
Waist <80 cm [female], <90 [male] [reference]	0
Waist ≥ 80 – 89 cm [female], ≥ 90 – 99 cm [male]	10
Waist ≥90 cm [female], ≥ 100 cm [male]	20
Physical activity	
Exercise [regular] + strenuous work [reference]	0
Exercise [regular] or strenuous work	20
No exercise and sedentary work	30
Family history	
No family history [reference]	0
Either parent	10
Both parents	20
Minimum score	0
Maximum score	100

Subjects with IDRS <30 were categorized as low risk, 30-50 as medium risk and those with ≥ 60: Very high risk of having diabetes. The Body Mass Index was calculated by dividing body weight in kilograms by the squared height in meters (kg/m^2). The weight was measured using a weighing scale (Figure 1) and height was measured using Free mans measuring tape (Figure2). People with BMI ≥ 25 Kg/m2 were considered overweight.

Waist circumference was measured (in centimeter) using a non stretchable tailor's tape (Figure3) at a point mid way between tip of iliac crest and last costal margin in the back and at umbilicus in the front. The score given for the waist circumference was <80 cm for female, <90 for male was ―0, and for waist circumference ≥ 80 – 89 cm for female and ≥ 90 – 99 cm for male as ―10"; waist circumference ≥90 cm for female, and ≥ 100 cm for male the score was ―20" (Table 1).

Diagnosis of the diabetes was done by Random Capillary Blood glucose (RCBG) examination by ―Accucheck" portable glucometer (Figure 4) with aseptic precaution. Subjects with an RCBG level ≥60mg/dl were considered as low sugar level, 80-140mg/dl as normal and of ≥ 140 mg/dl were considered to be in the high-risk group for the present study.

Blood pressure measurements were taken using Omron one touch BP monitoring device (Figure5) and recorded the

systolic and diastolic blood pressure. The Systolic Pressure (SP) ≥140 mm Hg and Diastolic Pressure (DP) ≥ 90 is considered as high.

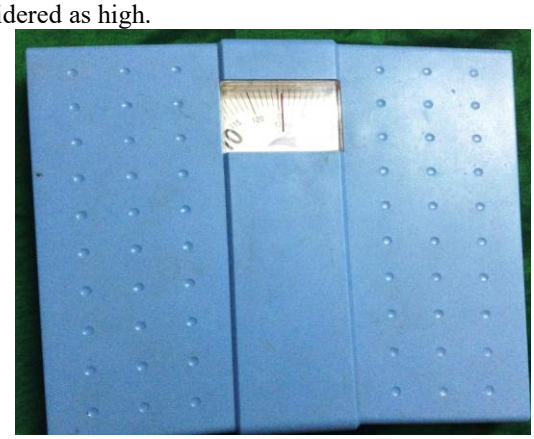


Figure 1: Weighing Scale

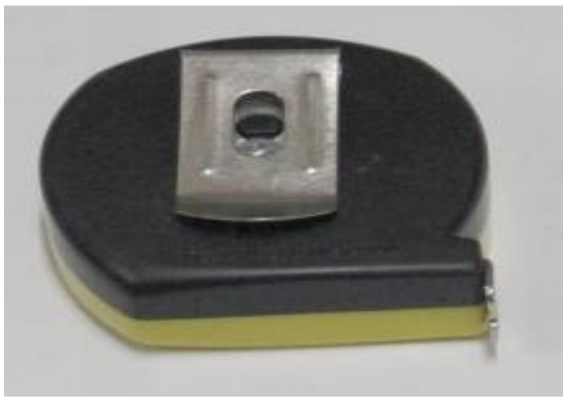


Figure 2: Freemans measuring tape

Figure 3: Inch Tape

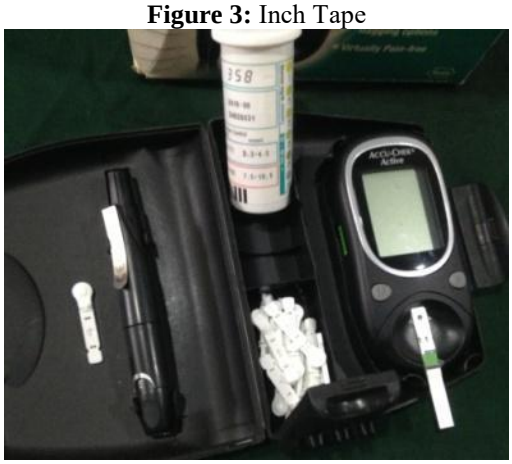


Figure 4: Portable Glucometer

Figure 5: One Touch Portable BP Monitoring Device

Statistical Analysis

The collected data were thoroughly screened and entered into MS-Excel spread sheets and analysis was carried out. Descriptive statistics such as mean with Standard Deviation (SD) and proportions were reported for continuous and categorical values, respectively. Logistic regression analysis was performed separately for each group with RCBG level of ≥ 140 mg/dL as the dependent variable and with RCBG level of < 140 mg/dL as the reference group. The independent variables entered were age, gender, IDRS score, systolic and diastolic blood pressure measurements and BMI. Mini Tab 14 software was used for performing all statistical analyses. A value of $P < 0.05$ was considered as statistically significant.

3. Results

These data collected from the 100 subjects in the study group (59 males and 41 females) were analyzed. There were 50 subjects in each group. Group I consists of Bank Employees (Male: Female 28:22) and Group II consists of Software Employees (Male: Female 31:19). The general characteristics of the study subjects are given in Table 2

Table 2: General Characteristics of the Study Subjects

	Group 1 bank employees		Group 2 (IT Employee)	
	n=50 (M:F=28:22)		n=50 (M:F=31:19)	
	male	female	male	Female
Age	44 ± 7.78	40 ± 7.6	36 ± 5.207	34 ± 4.92
BMI	24.7 ± 1.34	25.41 ± 2.78	24.17 ± 1.237	24.97 ± 2.05
Waist circumference	93.98 ± 12.02	87.63 ± 7.97	91.44 ± 6.813	86.36 ± 8.09
IDRS Score	70 ± 20.965	70 ± 24.67	50 ± 17.840	60 ± 19.43
Blood Pressure				
Systolic	137 ± 12.11	130 ± 12.16	135 ± 11.45	137 ± 14.18
Diastolic	87 ± 4.26	87 ± 4.85	87 ± 3.79	88 ± 4.65
RCBG Level	141 ± 17.101	144 ± 20.698	135 ± 14.39	142 ± 16.94
Diabetes[(a)] RCBG Level≥ 140mg/dl[(a)]	14-(50%)	13 (59%)	14 (45.16%)	11 (57.89%)
Hypertension				
SP[(a)]	11 -(39%)	5 (23%)	7 (23%)	3 (16%)
DP[(a)]	8 (29%)	5 (23%)	4 (13%)	8 (42%)

Data are mean and ± SD values
[a] Values are n (%).
BMI body mass index; F female; M male; RCBG, random capillary blood glucose, SP systolic pressure and DP diastolic pressure

The mean age group of the males in Group 1is 44 and that of Group 2 is 36 whereas the mean age group of the females in Group 1 is 40 and that of Group 2 is 34. The mean IDRS also is more in Group 1(70) for both males and females compared to Group2, 50 for males and 60 for females respectively. Among the Group1 68% of male and 73% of female were in the high risk group with score ≥ 60; 18%of male and 5% of female were in the medium risk group with a score 30-50; 14% of males and 23% of females were in the low risk group with a IDRS <30 . In Group 2, 48% of male and 58% of female were in the high risk group with score ≥ 60; 29%of male and 11% of female were in the medium risk group with a score 30-50; 23% of males and 32% of females were in the low risk group with a IDRS <30. IDRS was higher for sedentary employees with positive FHD

A comparison graph of the IDRS between males and females in Group 1(Bank Employees) and Group 2(Software Employees) are given in Graph 1& 2.

The mean systolic pressure for the males in Group 1 and females in Group 2 were 137mmHg while that of females in Group 1 were 130 mmHg and males in Group 2 were 135 mmHg.

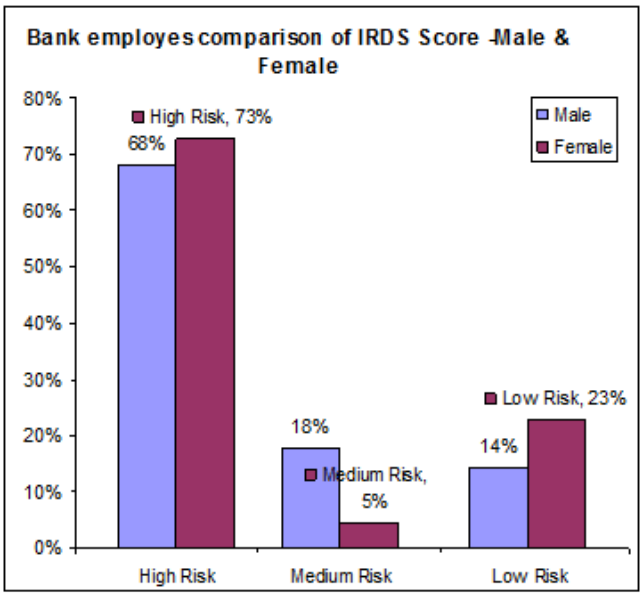
The percentile of males having RCBG ≥ 140mg/dl in both groups were 50%and 45.16% respectively. The females in Group 1 and Group 2 having RCBG ≥ 140mg/dl were 59% and 57.89%, respectively. A comparison of RCBG, SP and DP for females and males in the 3 risk groups formulated based on the IDRS in both Group 1 and Group 2 is shown in Graph 3&4.

Table 3 shows the results of logistic regression analysis estimating the risk for subjects with high IDRS. In the logistic regression significant association were with: IDRS (P=0.001) and SP (P=0.032) for Group1. For Group 2 significant association was with only IDRS (P=0.00).

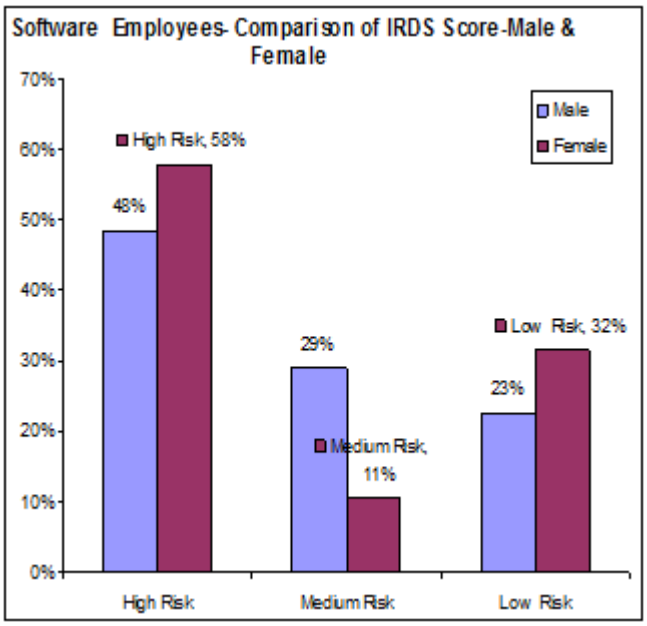
Table 3: Results of Logistic Regression Showing the Factors Associated with Elevated Random Capillary Blood Glucose in Sedentary Employees

Group, Significant	Unstd.	SE	T	P
For Bank Employees				
IDRS	0.38426	0.082	4.6	0.0
BMI	-0.01521	0.030	-	0.6
Systolic Pressure	0.3245	0.146	2.2	0.0
Distolic Pressure	0.1571	0.126	-	0.2
For S/W Employees				
IDRS	0.58225	0.067	8.5	0.0
BMI	0.00026	0.027	0.0	0.9
Systolic Pressure	-0.1919	0.119	-	0.1
Distolic Pressure	0.0642	0.106	0.6	0.5

The dependent variable was random capillary blood glucose level ≥ 140 mg/dL versus < 140 mg/dL.
[(a)]Variables that were not significant were age, gender, diastolic pressure, body mass index, waist circumference.
[(b)]Variables that were not significant were age, gender, systolic pressure and diastolic pressure

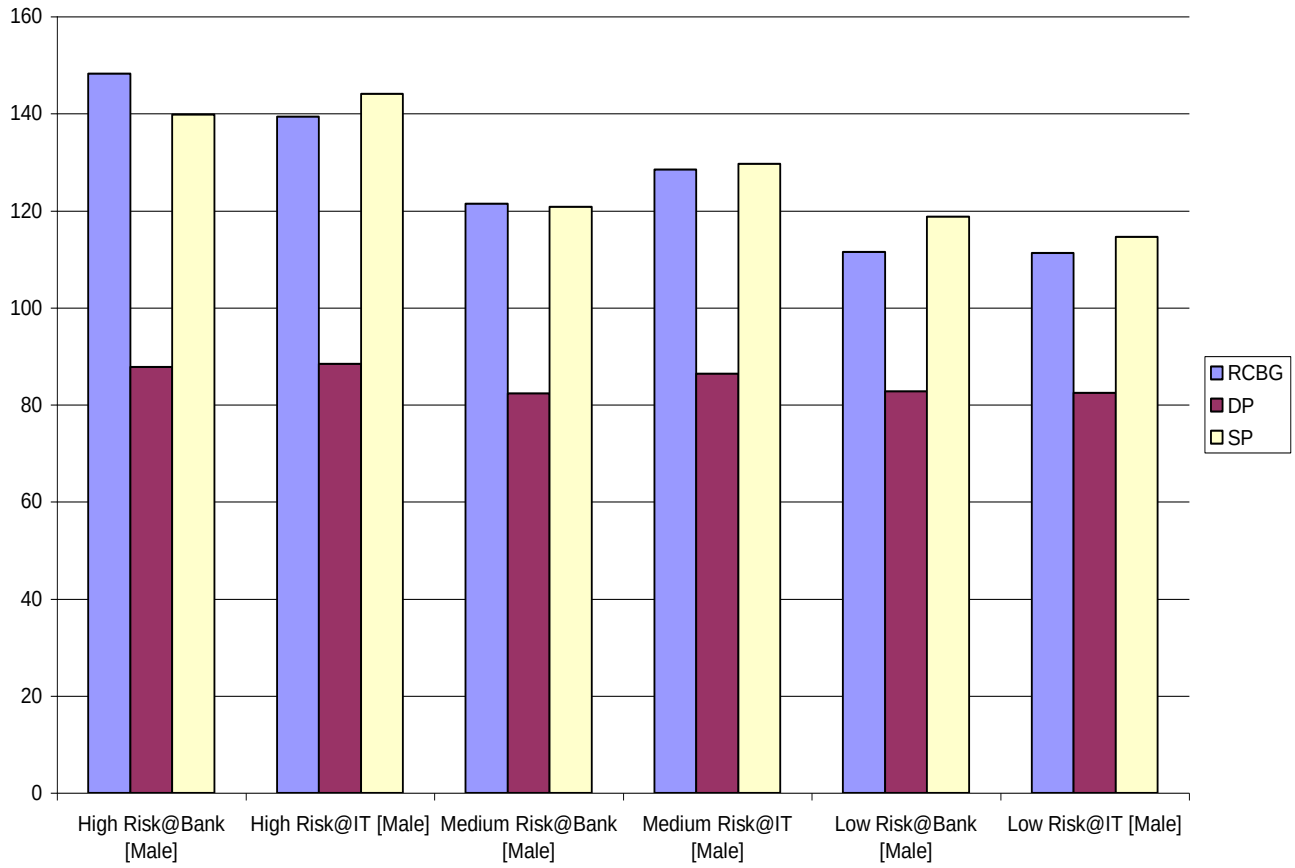


Graph 1

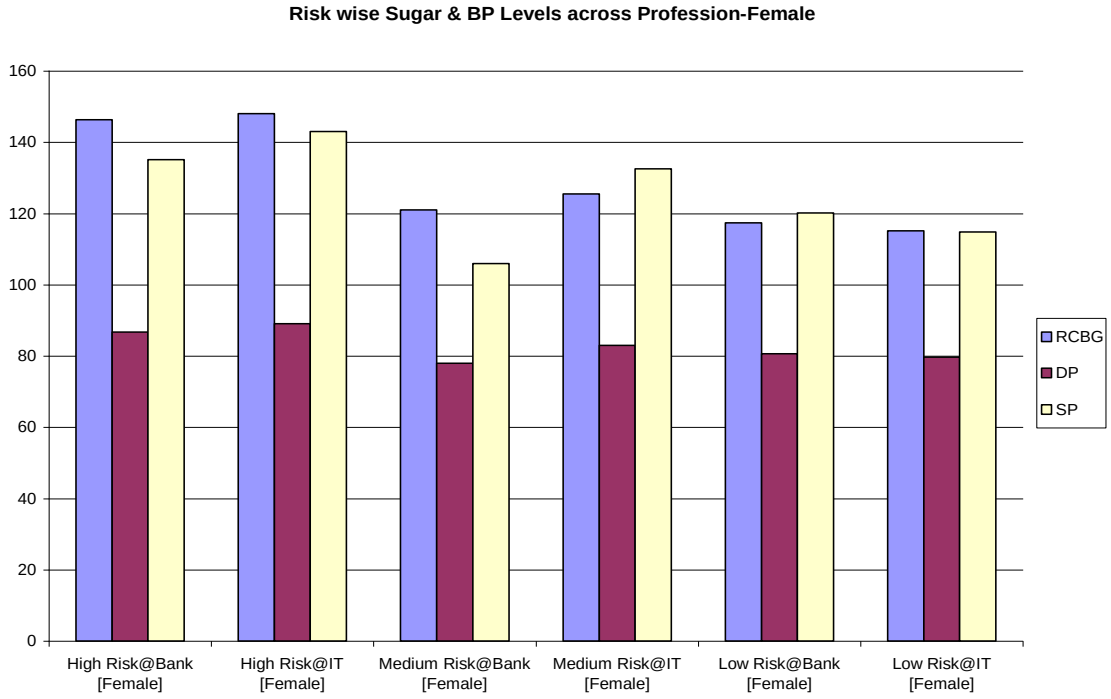


Graph 2

Risk wise Sugar & BP Levels across Profession-Male



Graph 3



Graph 4

4. Discussion

This study shows higher risk of diabetes for subjects with IDRS higher. IDRS is dependent of age, waist circumference, positive FHD, and sedentary job. In the current study two occupational groups differed in demand of physical activity in the work place. But both groups were sedentary as they were sitting continuously for >180minutes.

Diabetes was seen to be more prevalent among those having sedentary occupation having family history of diabetes mellitus, with higher waist circumference (Group 1 M: F=93.98:87.63, Group 2 M: F=91.44: 86.36) and SP (M: F Group1-39%:23%, Group 2-23%:16%). Among the Group1 68% of male and 73% of female were in the high risk group with score ≥ 60; 18%of male and 5% of female were in the medium risk group with a score 30-50; 14% of males and 23% of females were in the low risk group with a IDRS <30 . In Group2 48% of male and 58% of female were in the high risk group with score ≥ 60; 29%of male and 11% of female were in the medium risk group with a score 30-50; 23% of males and 32% of females were in the low risk group with a IDRS <30. Present study shows RCBG was higher for sedentary employees with positive FHD (IDRS higher) similar trend reported in Ramaiya *et al* in Mauritius and Swai *et al* among Indian Muslim of Tanzania reported a positive association[21,22].

In this study, we observed that hypertension and family history of diabetes mellitus had a probability of having increased risk of diabetes mellitus. This trend was significantly higher among the Group 1. Other researchers also reported comparable positive associations. [23, 24]

Similar to the findings in the current study, a cross-sectional study conducted among the bank employees in Surat, North India showed a higher prevalence of hypertension and obesity. Moreover, the authors reported that male gender had a higher likelihood for prevalence of hypertension. [25]

In the present study, separate regression analyses for the two groups showed systolic blood pressure measurement, positive FHD, and sitting duration at the workplace as the factors associated with higher RCBG values in subjects with sedentary jobs (bank employees and software employees).

A previous report from Brazil also showed that compared with other occupational groups such as physicians, higher education professionals, and general and administrative service personnel in a healthcare center, nurses and health workers had a higher prevalence of diabetes, and increased waist circumference and sedentariness were the factors associated with them.[26]

The association of duration of sitting at the workplace for more than 3 hours causes an increased IDRS and development of diabetes indicate that this particular high risk group should focus on breaking the continuous sitting duration at the workplace and ought to be encouraged to participate in more physical activity, especially those with a positive FHD. Several studies have demonstrated that breaking long sitting hours resulted in the reduction of waist circumference, BMI, 2-h plasma glucose level, and triglyceride levels, to an improvement in insulin levels, and also a reduction in back and neck pain with an improvement in self perceived health status. [27, 28, 29]

There are a few limitations in the present study, such as the use of IDRS for categorizing the group as at risk for diabetes and the self-reported duration of activities. However, an RCBG level of ≥ 140 mg/dl was considered as the cutoff value, as it had the higher sensitivity and specificity for the fasting and postprandial glucose estimations from venous

blood samples of an adequate number of people residing in the same region. [30]

The present study can be improved by increasing the sample size and adding more groups and comparing groups with more physical activity. The key factor to prevent diabetes mellitus is that we have to generate awareness among our peers, public health experts, health services researchers, healthcare providers and planners to consider the higher prevalence and associated risk factors of diabetes mellitus as a public health problem in the developing countries such as ~~–d~~iabetic capital" India

5. Conclusion

The systolic and the diastolic blood pressure, the sitting duration at the workplace and positive family history were significantly associated with the development of diabetes in subjects involved in a sedentary profession based on IDRS. Enhancing leisure time physical activity and taking mobility breaks in between long sitting hours in the workplace should be recommended and encouraged among these high-risk groups.

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