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## A CROSS SECTIONAL STUDY ON RISK FACTORS OF TYPE 2 DIABETES AMONG SEDENTARY MALE OFFICE WORKERS

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### ABSTRACT

**Introduction:** Although many studies have focused on studying risk factors of diabetes, this study has highlighted the presence of modifiable risk factors of type 2 diabetes (T2DM) among young adults whose age range from 30 and so on. In addition to other possible risk factors, the current study has thrown a light on unhealthy waist stature ratio among office workers who spend more time as couch potatoes.

#### Objectives

- To describe the proportion of various modifiable and non-modifiable risk factors of T2DM among sedentary male office workers
- To explore the distribution of diabetic risk factors with respect to HbA1c categories

**Material and Methods:** After considering the non-modifiable risk factors such as age, gender, ethnicity and family history, the current study has addressed all possible modifiable risk factors of T2DM. Based on selection criteria, 146 office workers with the age of 30 years and above were considered for this cross sectional study.

**Statistical Methods:** Simple percentage and confidence interval (for large proportion) were used to describe the data.

**Results:** After grouping the subjects' data based on their extent of risk factors, they were categorized under HbA1c level such as normal (13%), prediabetic (65.8%) and diabetic (13%) groups. The high proportion of prediabetes (65.8%) in younger age group than older adults (8.2%) is an unusual startling finding. While considering the anthropometric factors of office workers, 73.9 % showed their waist circumference in high risk zone, 44.5% had risky waist hip ratio, 78.1% of subjects with abnormal waist stature ratio and 93.2% were above the recommended cut off value of body mass index (30 kg/m<sup>2</sup>).

**Conclusion:** The current study concluded that there were 73.97% of young prediabetic subjects among sedentary male office workers which is of paramount importance as a critical health risk to the community. With a concomitant hike in sedentary lifestyle, younger adults are in the serious development of debilitating lifestyle diseases such as T2DM, heart attack, stroke and so on. Hence this study recommends a systematically designed, effective and economically feasible approach to reverse these risk factors in order to prevent or delay T2DM.

**Keywords:** Cross sectional study, type 2 diabetes, risk factors, sedentary and office workers

### INTRODUCTION

Every mankind wishes to be in a comfort zone within which human feels an anxiety-neutral state.

Unbelievable growth of science and technology has put forth a not an invisible but a visible trap, if it is not for all, at least for those in sedentary.

By seeking calm and stress-free environment, our physique strives hard for comfort position. Undoubtedly, people spend more time in sitting and sleeping which is really a predisposing factor of many detrimental lifestyle diseases such as diabetes, stroke, heart attack and so on. World Health Organization (WHO) and International Diabetes Federation (IDF) state that "Diabetes is a life-threatening condition, a major threat to global public health that is rapidly getting worse and its frequency is dramatically rising all over the world. The biggest impact is on adults of working age in developing countries and in many cases, diabetes can be prevented"<sup>1</sup>.

Although many studies have focused on prevalence of diabetic risk factors<sup>2-4</sup>, the current study had explored the proportionate distribution of T2DM risk factors under the categories of glycosylated hemoglobin levels (HbA1c) among young adults whose age range from 30 years. According to IDF, in South East Asia (SEA), the proportion of mortality due to diabetes in people under 60 years of age is 55% (for the year 2013) and out of 382 million of total diabetic people in the world, SEA has 72 million which urges us to think seriously about the silently killing disease diabetes<sup>5</sup>. Moreover, out of this 72 million, 46% are undiagnosed and as of 2013, being the second of top ten countries having diabetic citizens (20 to 79 years), India has 65.1 million diabetic people<sup>5</sup>. Whilst considering the Tamilnadu state of India, the prevalence of total diabetes (known and unknown) is around 10.4% and 8.3% of pre-diabetic subjects<sup>6</sup>.

While comparing with other ethnic groups, Indians have a strong genetic susceptibility of getting diabetes and lower cut-off values of demographic and anthropometric risk factors such as 30 years of age, 90 cms of waist circumference (WC), and 0.90 cms of waist-hip ratio (WHR) and with  $\geq 23$  kg /m<sup>2</sup> of body mass index (BMI)<sup>7</sup>. Surprisingly, diabetes is no longer considered as rich people's disease; rather it has now received a notation, 'the disease of poor'<sup>8</sup>. Due to the impact of rapid

urbanization and sedentary lifestyle, even the people from lower economic status are quietly getting into the dreadful morbidity of life style diseases like diabetes and other<sup>9</sup>. Thus it is wise to think of reversing the modifiable risk factors since it is feasible than to treat it once it has already affected a person<sup>10</sup>. In such contemplation, as a first move to trigger primary prevention, the current study has described the proportionate existence of T2DM risk factors among office workers who spend more time in sitting posture i.e. as couch potatoes<sup>11</sup>.

### Objectives

- To describe the proportion of various modifiable and non-modifiable risk factors of T2DM among sedentary male office workers
- To explore the distribution of diabetic risk factors under HbA1c categories

### MATERIALS AND METHODS

An awareness campaign was conducted for the office workers in and around Dharapuram urban area of Tamilnadu state, India who were in sitting posture in their office hours (6 to 8 hours). In order to emphasize the emerging life style diseases such as diabetes, stroke and heart attack, this study specifically targeted the employees who are being engaged in clerical and administrative work called office workers. In the current study, excluding the age, sex (male), ethnicity (Asian) and family history, all other factors considered were non modifiable risk factors<sup>12,13</sup>. Since it is well known that the males are highly susceptible to type 2 diabetes than females, the author focused 273 male office workers and they were screened for baseline assessment<sup>14</sup>. Based on the selection criteria, about 127 subjects with known history of hypertension, diabetes and regular physical activity (>2 days consecutively) were excluded and 146 office workers with the age of 30 years and above were considered for the study. The current study adopted single group cross sectional study design and the formula  $(Z_{\alpha/2})^2 pq / d^2$  was used to calculate the sample size (n) of the study<sup>15</sup>.

Although the estimated sample size was 117, since there was a plan of administering interventions and conducting an experimental study with the same subjects in future, 146 office workers were randomly selected and analyzed for the current study.

Since the study used glycosylated haemoglobin (HbA1c) level to categorize the subjects, they were grouped based on the specifications of American Diabetic Association (ADA) such as those with  $\leq 5.6\%$  were considered under normal group, 5.7% to 6.4% were in prediabetic group and diabetic group included those with 6.5% and above<sup>16</sup>. In addition to HbA1c level, all 146 subjects were screened for demographical, anthropometrical, physiological, familial and behavioral risk factors of T2DM. The anthropometric measures such as WC, hip circumference (HC), WHR and waist stature ratio (WSR) were taken based on WHO standards<sup>17</sup>. A digital weighing scale (Camry ® EF432, ISO 9001:2008 certified by SGS) was used to measure the weight of the subjects and the Blood Pressure was measured by a digital blood pressure monitor (OMRAN HM 780). Moreover details regarding family and behavioral history were noted by one to one interaction between researcher and the subjects.

Subjects who had  $<90$  cms of WC and 0.90 of WHR were grouped in low risk and rest of them were in high risk group<sup>13</sup>. The WSR of 0.5 and above was noted as high risk<sup>14</sup>. The range of BMI between 23.0 and 24.9  $\text{kg}/\text{m}^2$  was considered as overweight and the subjects who had their BMI  $\geq 25.0$   $\text{kg}/\text{m}^2$  were specified as clinically obese. Subjects with the BMI ranged from 18.5 to 22.9  $\text{kg}/\text{m}^2$  were grouped in ideal category<sup>13</sup>. Subjects who had their systolic blood pressure (SBP) between 110 to 129 mmHg and/ diastolic blood pressure (DBP) between 70 to 79 mmHg were categorized as normal. Office workers with the blood pressure between 130 to 139 mmHg and/ 80 to 89 mmHg as SBP and DBP respectively were considered in pre-hypertension group<sup>16</sup>. Whilst

focusing the subjective assessment of familial and behavioral history, subjects were not involved for a detailed report on smoking, alcohol and diet knowledge since it was beyond the scope of the current study<sup>12</sup> & <sup>18-20</sup>. The basic knowledge on food components and their gross calorie values (High/Low) were considered to categorize the subjects on diet knowledge (Yes/No). Subjects who are not participating in regular physical activity (more than two consecutive days) were considered as sedentary<sup>21</sup>. Subjects who were sleeping less than 6 hours and more than 9 hours/day were noted as high risk group<sup>22</sup>.

### Statistical Methods

The data of current study were described using simple percentage. Moreover the confidence interval for a large sample proportion was calculated using the following formula with 95% of confidence level to estimate the proportionate values for population.

Confidence Interval (CI) is  $p \pm Z_{\alpha/2} \sqrt{pq/n}$ .

### RESULTS

After grouping the subjects' data based on their extent of risk factors, they were categorized under HbA1c level such as normal (13%), prediabetic (73.9%) and diabetic (13%) groups (Table 1 to 4). The high proportion of prediabetes (65.8%) in younger age group, i.e. 30 to 45 years than older adults, i.e. 46 to 60 years (8.2%) is an unusual startling finding (Table 1 & Figure 1). In the anthropometric factors, 41.8 % showed their waist circumference in high risk zone, 44.5% had risky waist hip ratio, 78.1% of subjects with abnormal waist stature ratio. 93.2% were observed under overweight & clinically obese category  $\geq 25$   $\text{kg}/\text{m}^2$  (Table 1 & Figure 1). The diagram shows the proportion of physiological factors such as systolic (73.9%) and diastolic blood pressure (94.5%) was also observed in risk zone, i.e., in prehypertensive state (Table 2 & Figure 2). Even though 73.3% of subjects showed negative family history, 73.9% of office workers were found in prediabetic category (Table 3 & Figure 3).

Moreover there were 40.4% of smokers and subjects with the habit of alcohol consumption were about 36.9% (Table 4 & Figure 4(a)). The average time spent in watching television varied from half an hour to 3.5 hours per day. Among this, the subjects who spent half an hour to 3 hours time in front of television were found in prediabetic group (72.6%) (Table 4 & Figure 4(a)). In addition, 54.8% of office workers had disturbed sleep and 34.2% of subjects had had less than six hours of sleep/day where as 11% of subjects had  $\geq 9$  hours of sleep with prediabetes (Table 4 & Figure 4(b)).

## DISCUSSION

While reviewing the findings of recent research, it is undeniably known that prediabetic subjects will develop T2DM within a decade time and specifically those who have their HbA1c level between 6 and 6.4 will develop diabetes in five years<sup>16</sup>. Moreover there are ample evidence which walk around the possibility of reversing or delaying the risk of T2DM<sup>16</sup>. Hence to reverse the prediabetic state to normal state, it is of paramount importance to explore the existence of T2DM risk factors.

The current study cross matched all the possible risk factors of T2DM with three groups namely normal, prediabetic and diabetic subjects which is truly a novel approach in describing especially the sedentary male office worker population. By focusing on the demographic factor such as age, 65.8% of younger age group subjects (30 to 45 years) were found in prediabetes group, but there were only 8.6% of subjects seen between 46 and 60 years of age. The rising prevalence of T2DM risk in young age group of Tamilnadu had already been addressed by Ram Weiss et al, 2003<sup>23</sup>.

Out of 146 office workers, the WC of 61 subjects was found in high risk group. Further 48% of subjects who had abnormal WC were seen in prediabetic group. Likewise 46% with high risk WHR and 89% with abnormal WSR were observed in prediabetic group (Table 1 & Figure

1). Among the study group, 77% of prediabetic and 12% of diabetic group were found to be with obesity (Table 1 & Figure 1). Manisha Chandalia et al found that there was a strong association between obesity and development of type 2 diabetes<sup>24</sup>. While focusing physiological factors such as systolic and diastolic blood pressure, 75% of subjects' SBP and 76% of subjects' DBP were seen in prediabetic group<sup>25&26</sup>. The high proportion of prehypertension was observed by Alok K Gupta et al and also by Rekha Govindan in a different study while addressing the prevalence of prehypertension in Tamilnadu. Evidence of relationship between positive family history and risk of diabetes are very obvious. In this study, 26.7% of subjects had positive family history. Aravindalochanan et al stated that subjects with positive family history were having three fold high risk of getting diabetes<sup>12</sup>. Kolappan Chockalingam stated that tobacco use prevalence was significantly higher in rural areas, slum dwellers and males<sup>18</sup>. It was observed that 17% of smokers in normal, 61% in prediabetic and 22% in diabetic category.

In addition, table 4 showed that 37% of subjects with alcoholism, 19% with sedentary lifestyle, 54.8% with disturbed sleep and 11% with less than six hours and 12.3% with greater than or equal to nine hours sleep/day. The association between sleep hours, sleep quality and risk of developing type 2 diabetes had been observed by Peter M. Nilsson et al<sup>27</sup> and also by Helaine E. Resnick et al<sup>28</sup> in a separate study. Further Amy E. Mark et al concluded that there was an association between screen time (TV watching time) and metabolic risk factors<sup>29</sup>. The prevalence and association of BMI, decreased physical activity (sedentary lifestyle)<sup>21</sup> and positive family history with glucose intolerance<sup>12</sup> had been remarkably addressed.

## CONCLUSION

In a nutshell, there are 73.97% of young prediabetic subjects among sedentary male office workers which has to be alerted as a critical health

risk to the community. With a concomitant hike in sedentary lifestyle, younger adults are silently developing the debilitating lifestyle diseases such as type 2 diabetes, heart attack, stroke and so on. Many diabetic prevention studies have explored evidence that T2DM is reversible when serious steps are taken at the acute stage such as incorporating adequate physical activity in daily routine and behavioral modification. By highlighting the remarkable proportion of T2DM risk factors, the current study recommends a systematically designed, effective and economically feasible approach to reverse the risk factors and thereby to prevent or delay T2DM.

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**Table 1: Proportion of Demographic and Anthropometric Risk Factors among Male Office Workers**

#	Demographic & Anthropometric Factors	Category	Normal			Pre-diabetic			Diabetic			Total
			N	%	CI	N	%	CI	N	%	CI	
1	Age	30 – 35	3	6.3	0, 13.2	41	85.4	16.4, 100	4	8.3	0.5, 16.1	48
		36 – 40	3	7.1	0, 14.9	34	81	69.1, 92.9	5	11.9	2.1, 21.7	42
		41 – 45	3	10.7	0, 22.1	21	75	59, 91	4	14.3	1.3, 27.3	28
		46 – 50	6	42.9	25.9	7	50	23.8, 76.2	1	7.1	6.4, 20.6	14
		51 – 55	2	25	0, 55	4	50	15.4, 84.6	2	25	0, 55	8
		56 – 60	2	33.3	0, 71	1	16.7	0, 46.5	3	50	10, 90	6
2	Waist Circumference	Low Risk	13	15.3	7.6, 23	60	70.6	60.9, 80.3	12	14.1	7.1, 21.1	85
		High Risk	6	9.8	2.3, 17.3	48	78.7	68.4, 80	7	11.5	3.5, 19.5	61
3	Waist Hip Ratio	Low Risk	10	12.3	5.1, 19.5	62	76.5	67.3, 85.7	9	11.1	4.3, 17.9	81
		High Risk	9	13.8	5.4, 22.2	46	70.8	59.8, 81.8	10	15.4	8.5, 22.3	65
4	Waist Stature Ratio	Low Risk	7	21.9	7.6, 36.2	19	59.4	42.4, 76.4	6	18.8	5.3, 32.3	32
		High Risk	12	10.5	16.1, 15.7	89	78.1	69.2, 87	13	11.4	17.2, 5.6	114
5	Body Mass Index	Ideal	4	40	70.4, 9.6	2	20	4.8, 44.8	4	40	9.6, 70.4	10
		Overweight	2	10.5	0, 24.3	16	84.2	67.8, 100	1	5.3	0, 15.3	19
		Obese	13	11.1	5.4, 16.8	90	77	70.4, 84.6	14	12	6.1, 17.9	117

**Table 2: Proportion of Physiological Risk Factors among Male Office Workers**

#	Physiologic al Factors	Catego ry	Normal			Pre-diabetic			Diabetic			Total
			N	%	CI	N	%	CI	N	%	CI	
1	Systolic BP	Normal	6	15.8	4.2, 27.4	27	71	56.6, 85.4	5	13.2	2.4, 24	38
		Pre-HT	13	12	5.9, 18.1	81	75	66.8, 83.2	14	13	6.7, 19.3	108
2	Diastolic BP	Normal	1	12.5	0, 35.4	3	37.5	4.1, 70.9	4	50	15.3, 84.7	8
		Pre-HT	18	13	7.4, 18.6	105	76	68.9, 83.1	15	10.9	5.7, 16.1	138

**Table 3: Proportion of Familial Risk Factors among Male Office Workers**

#	Familial Factor	Presence	Normal			Pre-diabetic			Diabetic			Total
			N	%	CI	N	%	CI	N	%	CI	
1	Presence of Diabetic Family History	Yes	17	43.6	28, 59.2	8	20.5	7.8, 33.2	14	35.9	21.3, 50.5	39
		No	2	1.9	0, 4.5	100	93.5	88.2, 98.2	5	4.7	0.7, 8.7	107

**Table 4: Proportion of Behavioral Risk Factors among Male Office Workers**

#	Behavioral Factors	Category	Normal			Pre-diabetic			Diabetic			Total
			N	%	CI	N	%	CI	N	%	CI	
1	Smoking	Yes	10	17	7.4, 26.6	36	61	48.5, 73.5	13	22	11.4, 32.6	59
		No	9	10.3	3.9, 16.7	72	82.8	74.9, 90.7	6	6.9	1.6, 12.2	87
2	Alcoholism	Yes	10	18.5	8.1, 28.9	30	55.6	42.3, 68.9	14	26	14.3, 31.7	54
		No	9	9.8	3.7, 15.9	78	84.8	77.5, 92.1	5	5.4	0.8, 10	92
3	TV Watching Hours	0	2	40	0, 82.9	2	40	0, 82.9	1	20	0, 55.1	5
		0.5	1	12.5	0, 40.4	7	87.5	64.6, 100	0	0	0	8
		1	3	10	0, 20.7	19	63.3	46, 80.6	8	26.7	10.9, 42.5	30
		1.5	5	18.5	0, 94.6	18	66.7	49.2, 84.2	4	14.8	1.4, 28.2	27
		2	7	12.3	3.8, 20.8	45	79	68.4, 89.6	5	8.8	1.4, 16.2	57
		2.5	0	0	0	13	100	0	0	0	0	13
		3	1	20	0, 55	3	60	17.1, 100	1	20	0, 55.1	5
4	Diet Knowledge	Yes	6	26.1	8.2, 44	12	52.2	31.8, 72.6	5	21.7	5, 38.4	23
		No	17	13.9	0, 26.8	108	83.1	72.6, 98.2	20	15.7	0, 31.7	145



		No	13	10.6	5.2, 16	96	78	70.7, 85.3	14	11.4	5.8, 17	123
5	Sleep Quality	Good	8	12.1	0, 76	53	80.3	70.7, 89.9	5	7.6	1.2, 14	66
		Disturbed	11	13.8	11.1, 16.5	55	68.8	58.6, 79	14	17.5	9.2, 25.8	80
6	Sleeping Hours/Day	Five	3	18.8	0, 37.9	11	68.8	46.1, 91.5	2	12.5	0, 28.7	16
		Six	6	10.7	2.6, 18.8	39	69.6	57.5, 81.7	11	19.6	9.2, 30	56
		Seven	6	26.1	8.2, 44	13	56.5	36.2, 76.8	4	17.4	1.9, 32.9	23
		Eight	3	9.1	0, 18.9	29	87.9	76.8, 99	1	3	0, 8.8	33
		Nine	1	5.6	0, 16.2	16	88.9	75.1, 100	1	5.6	0, 16.2	18

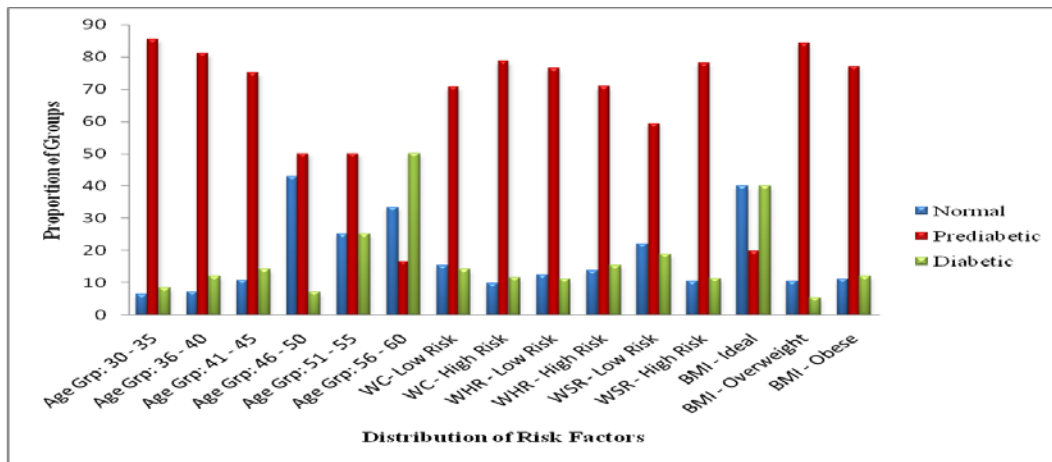


Figure 1: Proportion of Demographic and Anthropometric Risk Factors among Male Office Workers

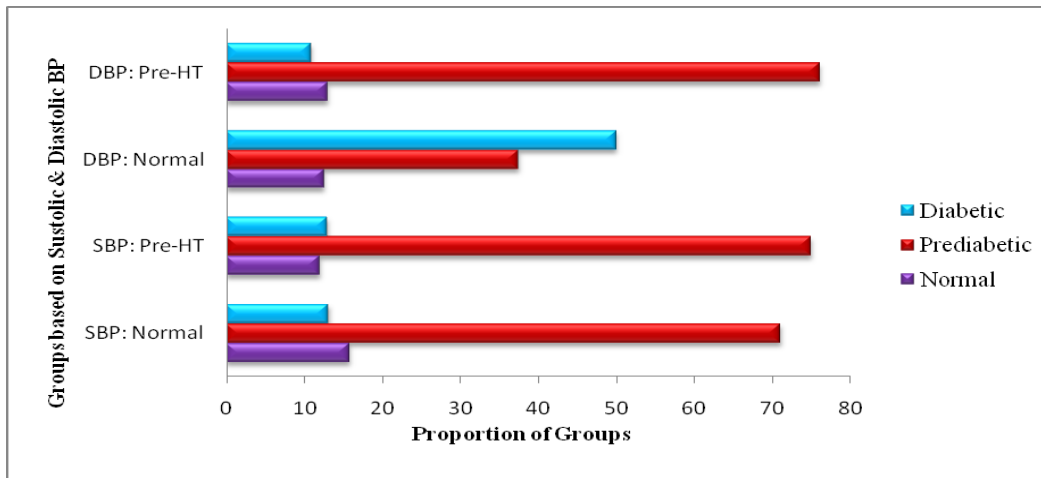


Figure 2: Proportion of Physiological Risk Factors among Male Office Workers

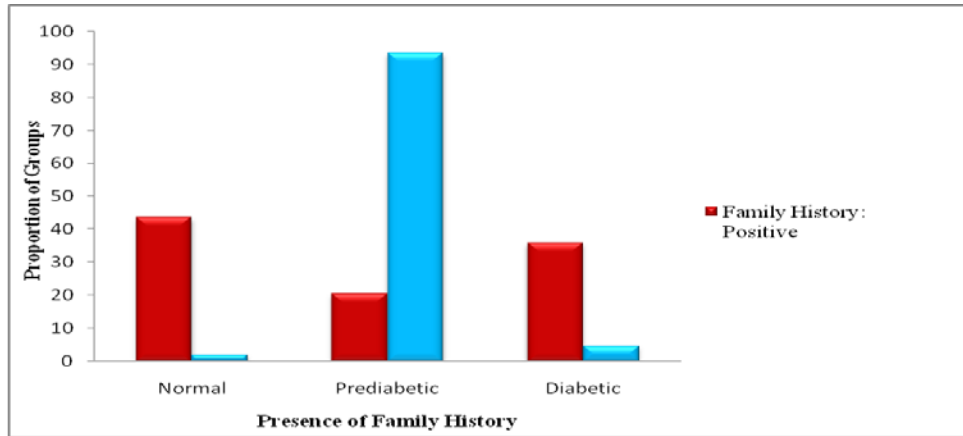


Figure 3: Proportion of Familial Risk Factors among Male Office Workers

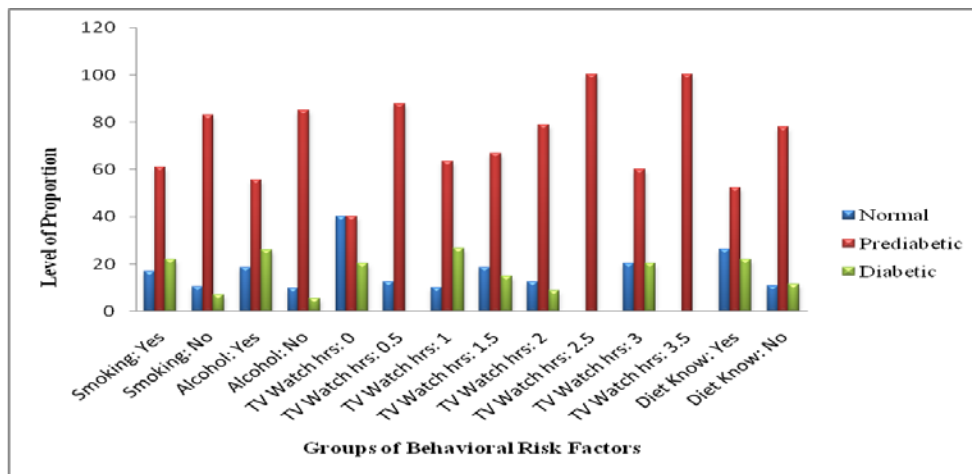


Figure 4 (a): Proportion of Behavioral Risk Factors among Male Office Workers

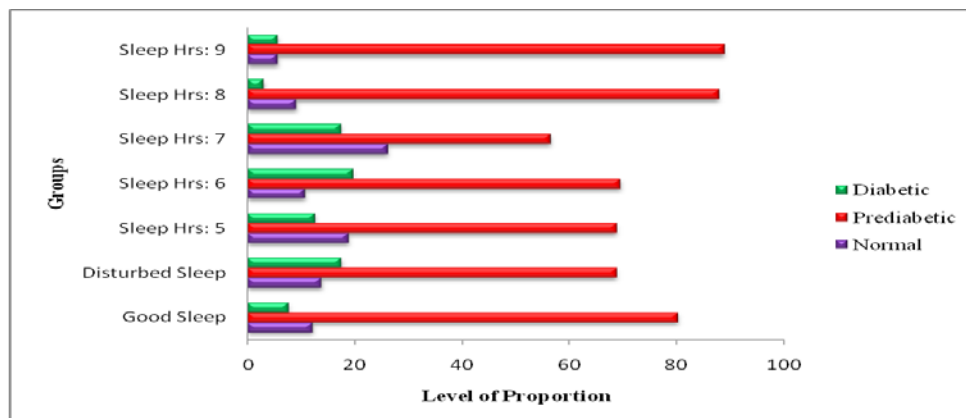


Figure 4 (b): Proportion of Behavioral Risk Factors among Male Office Workers