High prevalence of undetected metabolic risk factors among Saudi male office workers in a selected institution in Makkah city, Saudi Arabia

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Abstract: Background: The prevalence of diabetes is increasing, as a consequence of increasing incidence due to demographic changes such as ageing, and as a result of risk factors such as obesity and sedentary life becoming more common. Hyperlipidemia is reaching higher prevalence rates in Saudi Arabia. Our study is designed to clarify undetected metabolic risk factors including diabetes, newly developed Pre-diabetes and dyslipidemia which are contributing to cardiovascular complications among Saudi male office workers in a major institution in makkah city. **Methods:** This is a cross sectional study among Saudi male office workers in the administration of general education of makkah city, which is one of the biggest office buildings in makkah city. 141 male was selected and their age is over 20. They were included to obtain fasting blood glucose (FBG), 2 hours postprandial glucose, Triglycerides (TG), Cholesterol (Chol.), HDL-cholesterol, and LDL-cholesterol**. Results:** The Pre-diabetic individuals entirely (IFG and IGT) constitute (32.7%) 46 out of the total participants. 32 out of total individuals accidently were found diabetic (22.7%). Up to 37% (n = 48) of individuals developed hypercholesterolemia which were underdiagnosed. **Conclusion:** This study has found that diabetes and pre-diabetes is common among Saudi office workers and still some people unaware of their illness. The dyslipidemic changes among those pre-diabetic office workers are similar of that in the diabetic individuals which are liable for arthrogenic risk. Also there is increasing of undetected dyslipidemic changes.

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1. Introduction

Cardiovascular disease (CVD) is a disease of blood vessels and vascular disease of heart and brain.[1] Cardiovascular complications and mortality related can be reduced by decreasing modified risk factors including dyslipidemia, diabetes mellitus and obesity.[2,3] Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[4] In Saudi Arabia, the overall prevalence of DM in adults is 23.7 %.[5] The prevalence of diabetes is increasing, as a consequence of increasing incidence due to demographic changes such as ageing, and as a result of risk factors such as obesity and sedentary life becoming more common.[6] Population growth, ageing of populations and urbanization with associated lifestyle change is likely to lead to a 50.7% increase in worldwide numbers with diabetes by 2030.[6] In 2011 another study was conducted in KSA and revealed that the prevalence of diabetes mellitus type 2 in Saudi Arabia has increased by a whopping 10.0% in just a decade.[7] Studies were done outside Saudi Arabia revealed that at least 50% of diabetes were undiagnosed,[8] that is because asymptomatic behave of the early stages of type 2 DM. There is a remarkable variation in percentages of undiagnosed diabetes among some areas of Saudi Arabia. In eastern province of Saudi Arabia, a study noticed that nearly one-tenth of the participants (10.9%) were undiagnosed diabetes among those with no previous diagnosis of diabetes.[9] This percentage were lowered than that reported by other studies in Saudi Arabia.[5,10] According to The American Diabetes Association, the criteria for diabetes in diagnostic 2-hour postprandial glucose is value of 200 mg/dl (11.1 mmol/l) or above, and in the fasting blood glucose diagnostic cut point is 126 mg/dl (7.0 mmol/l) or above.[4] Pre-diabetes is a group of individuals whose glucose levels do not meet the criteria of diabetes but they are higher than those considered normal. These people either have impaired fasting glucose (IFG) or impaired glucose tolerance (IGT).[4] Pre-diabetes increases the risk of diabetes.[4] Pre-diabetes is not only a significant risk factor for progression to type 2 diabetes but is also considered a risk factor for macrovascular disease and for retinopathy[11] Moreover, the microvascular disease typically associated with diabetes is also observed in individuals with impaired glucose tolerance.[12] The study which was done in eastern region of Saudi Arabia revealed that undetected impaired glucose tolerance remain significantly high.[9] According to The American Diabetes Association, the criterion for impaired fasting glucose is fasting plasma glucose

(FPG) levels from 100 mg/dl (5.6 mmol/l) to 125 mg/dl (6.9 mmol/l). And the criterion for impaired glucose tolerance is 2-h postprandial values in the oral glucose tolerance test (OGTT) of 140 mg/dl (7.8 mmol/l) to 199 mg/dl (11.0 mmol/l).[4] Blood lipids contribute to the formation of atherosclerotic plaque and subsequent vascular complications.[13,14] Although aggressive lowering of low-density lipoprotein cholesterol (LDL-C) has shown decrease in cardiovascular events, high-density lipoprotein cholesterol (HDL-C) is independent factors of cardiovascular disease and regression of the disease was correlated with increase in HDL-C.[15] Hyperlipidemia is reaching higher prevalence rates in Saudi Arabia. A Study was conducted in this country showing the prevalence of hypercholesterolemia is 54% among age of 30-70 with mean cholesterol level of 5.4 mmol/l and also showed the prevalence of Hypertriglyceridemia is 40.3% among same group with mean triglycerides level of 1.8 mmol/l.[16] Despite the increased awareness of the association between dyslipidemia and cardiovascular complications, lipid disorders is practically underdiagnosed.[17] According to American Heart Association, the optimal level of HDL-C is 60 mg/dl or above and of LDL-C is less than 100 mg/dl. While it is considered a major risk factor if HDL-C below 40 mg/dl and of LDL-C 160 mg/dl or above. The prevalence of metabolic syndrome varies in the different categories of occupational activity.[18] During the day most adults spend 7–10 h/d in a sedentary behavior. Apparently, work sitting is often occupying much of this time.[19] To our knowledge, there has not been a study conducted in Saudi Arabia considering the rate of metabolic risk factors among those who is work sitting as office workers. Our study is designed to clarify undetected metabolic risk factors including diabetes, newly developed Pre-diabetes and dyslipidemia which are contributing to cardiovascular complications among Saudi male office workers in the administration of general education of makkah city, which is one of the biggest office buildings in makkah city.

2. Material and Methods

This is a cross sectional study among Saudi male office workers in a major institution in makkah city after taking a research approval from the head office. The study was conducted under the supervision of Biochemistry Department, Faculty of Medicine, Umm Al-Qura University and was approved by local ethical committee of Faculty of Medicine, Umm Al-Qura University. We analyzed 141 Saudi male office workers. Their age was over 20 years and the mean of work sitting hours was 8 hours. Individuals with diagnosed diabetes and dyslipidemia and history of cardiovascular complications were excluded in our study. Some has history of controlled uncomplicated medical diseases such as asthma and others have history of uncomplicated surgical procedures in the past. Informed consent was obtained from each individual before a day of sample drawn with full explanation of all methods at the next day. All individuals were informed to come fasting for at least 12 hours before the time of specimen collection. The next day, they fill the structured questionnaire of personal data, medical and family histories. Body mass index now has been adopted instead of using waist circumferens.[20,21] We measured body weight and height for each participant with light clothing dressing by (Detecto®) balance beam scale with height rod. Body mass index (BMI) was calculated as weight in Kg / (height in meter^2) according to classification of BMI employed by WHO experts committee 1995. First blood sample was collected from each individual when he was fasting then he was given 75g glucose solution. After exactly 2 hours of drinking glucose solution we collected a second blood sample to measure 2 hours postprandial glucose. Blood was collected with safety precaution, protective gloves worn with the collection and handling of blood specimen. Blood was drawn from vein at antecubital area of the arm or back of the hand. The collection site was cleaned with alcohol swab before gentle insertion of the needle into the vein. Blood drawn and collected in plain and EDTA (Dipotassium ethylene diamine tetracetic acid) tubes, and serum samples were collected in plain tubes; the tubes were properly labeled and sent directly to biochemistry research laboratory in collage of medicine.

Measurement of fasting blood glucose (FBG), Triglycerides (TG), Cholesterol (Chol.), HDL cholesterol, LDL cholesterol, and 2 hours postprandial blood glucose was done using the standard procedures and available commercial kits in a fully automated auto-analyzer system (COBAS integra 400, Roche Diagnostics GmbH, D-68298 Mannnheim).

Descriptive statistics, t-tests were used to compare the measured parameters in the studied groups. Crosstab is used as well. P value of < 0.05 was considered as statistically significant. All statistical methods were performed using SPSS for windows, version 19, SPSS Inc., IL, Chicago. USA.

3. Results

A total of 141 individuals were checked for metabolic risk factors for CVD. The most striking result to emerge from the data is that Pre-diabetic individuals entirely (IFG and IGT) constitute (32.7%)

46 out of the total participants. 32 out of total individuals accidently were found diabetic (22.7%) (Table 1).

Table 1. Distribution of individuals depends on the state of blood sugars

Blood sugar status	Frequencies (Percentages%)
Healthy	63 (44.7%)
IFG	17 (12.1%)
IGT	29 (20.6%)
Diabetes	32 (22.7%)

The current study revealed that up to 37% (n = 48) of individuals developed hypercholesterolemia which were underdiagnosed. Meanwhile, up to 20.6% of individuals carried a potential risk of high Low density lipoproteins (LDL-C). About 10% of those individuals had marked decrease in HDL-C which put them in high risk of cardiovascular complications as they relatively got low protection against bad cholesterol (LDL-C) (Figure 1).

The proportion of newly diagnosed DM individuals was increased with age (*P* value = .000) and started doubling in the third decade of life. Same results showed the age was significant with pre-diabetes as well (*P* value = .000). The percentage of subjects with undetected pre-diabetes increased twice in overweight. Actually, the majority of them were located in obese groups (*P* value = .027). Although undiagnosed diabetes was observed significantly in overweight individuals, there was no significant increase regarding obesity (*P* value = .094). That may belong to the fact that diabetic patients undergo negative nitrogenous balance which obviously seen in uncontrolled diabetes (Table 2).

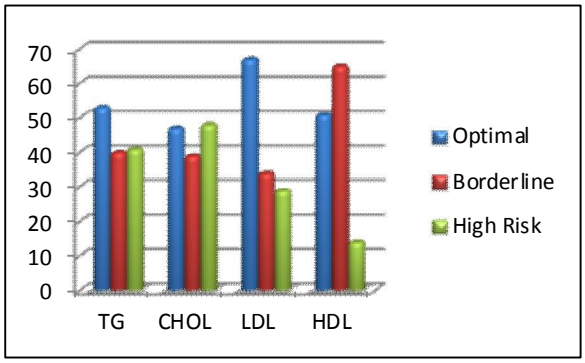

Figure 1. Frequency of individuals at risk of CVD according to their lipid profiles

Table 2. Characteristics between Normal individuals, Pre-diabetes and Newly Diagnosed DM

Characteristics	Normal Individuals	Pre-diabetes	Undiagnosed DM
Age groups:			
21-30	28 (46.7%)	9 (20.5%)	3 (9.4%)
31-40	15 (25%)	10 (22.7%)	8 (25%)
41-50	14 (23.3%)	14 (31.8%)	7 (21.9%)
> 50	3 (5%)	11 (25%)	14 (43.8%)
Total	60 (100%)	44 (100%)	32 (100%)
BMI groups:			
Normal	12 (25.5%)	5 (14.3%)	0 (0%)
Overweight	17 (36.2%)	9 (25.7%)	8 (57.1%)
Obese	18 (38.3%)	21 (60%)	6 (42.9%)
Total	47 (100%)	35 (100%)	14 (100%)

The characteristics of subjects with newly diagnosed DM compare to those with normal glucose are described in table 3. Subjects with newly diagnosed DM have higher concentration of total cholesterol, triglyceride and LDL-C than those with normal glucose, while HDL-C showed no significantly difference between undiagnosed diabetes and those of normal (Table 3).

Table 3. Characteristics between Normal Individuals and Newly Diagnosed DM

Characteristics	Normal Individuals	Undiagnosed DM	*P* value
CHOL (mg/dl)	207.3	260	.001
TG (mg/dl)	161.6	208.7	.019
LDL-C (mg/dl)	113.2	161.1	.000
HDL-C (mg/dl)	61.2	59.3	.802

4. Discussions

Our research included 141 Saudi males office workers aged over 20 years who were randomly selected and those of previously diagnosed as a diabetic were excluded. They were divided into 4 groups according to their fasting blood glucose and 2 hours postprandial glucose tolerance test based on the definitions of the American Diabetes Association.

The results of this study showed that there is remarkable numbers individuals have developed pre-diabetes which are reliable to progress to diabetes by few years. Unfortunately, some of them are accidentally diagnosed diabetic. There was high prevalence of undetected dyslipidemia among the individuals characterized by hypercholesterolemia and high LDL-C and triglyceride and low HDL-C. A study was done by Miguel-Angle showed that the prevalence of metabolic syndrome among male managers and administrators occupied the second highest number among other occupations related metabolic syndrome in the study.[18]

LDL-cholesterol was increased significantly among both those diabetics and pre-diabetic groups, while the changes in HDL cholesterol were non-significant. These findings are supported by the results reported by Magge, Prasad et al.; they concluded that obese pre-diabetic adolescents have a significantly more atherogenic lipoprotein profile compared with obese normglycemic peers.[22] Another study reported that the diabetic patients with poor glycemic control exhibited a significant increase in cholesterol and TG and decrease in HDL.[23]

In regards to body mass index (BMI), we found that there is significant increase in BMI of IGT group ($P < 0.01$). The findings of the current study are consistent with other study which concluded that Physical inactivity and body mass index (BMI) are established independent risk factors in the development of type 2 diabetes; Dowse et al (1991) indicated that BMI, abdominally distributed fat, and physical inactivity are important independent risk factors for both IGT and NIDDM in diverse ethnic groups.[24,25]

Age of diabetic and pre-diabetic groups were significantly increased in comparison with the normal healthy group ($P<0.001$). A similar result was obtained by Li, Saito et al. (2013).[26]

The prevalence of normal weight, overweight, and obesity classes I, II, and III among our study group was 17.7%, 35.4%, 24%, 14.6% and 8.3% respectively. Habib (2013) assessed the BMI prevalence in Saudi population by same classification of normal weight, overweight, and obesity classes I, II, and III and revealed that 30.2%, 33.6%, 17.7%, 8.7% and 7.4%, respectively, with an overall obesity prevalence of 33.8%.[27] So, obesity is more common among Saudi office workers than general population.

This study has found that diabetes and pre-diabetes is common among Saudi office workers and still some people unaware of their illness. The dyslipidemic changes among those pre-diabetic office workers are similar of that in the diabetic individuals which are liable for arthrogenic risk.

Vigorous screening and interventions is required to unmask diabetes in our society especially in those of third decades of life. Adult office workers are in need of intentional weight control to avoid the development of pre-diabetes. We recommend also that pre-diabetic individuals should assess their lipid profile to avoid the risk of developing cardiovascular complications.

Further work needs to be done in Saudi Arabia. Large randomized controlled trials could provide more definitive evidence show this epidemic illness among office workers and needs more statically analysis to reveal the relative risk.

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References

1. Lionel H Metabolic syndrome. Circulation 2007; 115:32-35.
2. Isomaa B, Almgren P, Tuomi T, Forsén B, Lahti K. Cardiovascular morbidity and mortality associated with the metabolic syndrome. Diabetes Care 2001; 24: 683-689. 6.
3. Hsin-Jen C, Chyi-Huey B, Wen-Ting Y, Hou-Chang C, Wen-Harn P. Influence of metabolic syndrome and general obesity on the risk of ischemic stroke. Stroke 32006; 7: 1060-1064.
4. American Diabetes Association (2013). "Diagnosis and classification of diabetes mellitus." Diabetes Care36 Suppl 1: S67-74.
5. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, et al. Diabetes mellitus in Saudi Arabia. Saudi Med J 2004; 25:1603-10.
6. Whiting, D. R., et al. (2011). "IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030." Diabetes Res Clin Pract94(3): 311-321.
7. Al-Daghri, N. M., et al. (2011). "Diabetes mellitus type 2 and other chronic non-

communicable diseases in the central region, Saudi Arabia (Riyadh cohort 2): a decade of an epidemic." BMC Med 9: 76.
8. 28 World Health Organization. Screening for Type 2 Diabetes. Report of World Health Organization and International Diabetes Federation meeting. Geneva: World Health Organization, 2003.
9. Al-Baghli N A, Al-Ghamdi A J, Al-Turki K A, Al Elq A H, El-Zubaier A G, Bahnassy A Prevalence of diabetes mellitus and impaired fasting glucose levels in the Eastern Province of Saudi Arabia. Singapore Med J 2010; 51(12) : 923.
10. Al-Nuaim AR. Prevalence of glucose intolerance in urban and rural communities in Saudi Arabia. Diabet Med 1997; 14:595-602.
11. Aroda, V. R. and R. Ratner (2008). "Approach to the patient with prediabetes." J Clin Endocrinol Metab 93(9): 3259-3265.
12. Garber, A. J. (2009). "Combined pharmacologic/nonpharmacologic intervention in individuals at high risk of developing type 2 diabetes: pro pharmacologic therapy." Diabetes Care 32 Suppl 2: S184-188.
13. Drew BG, Carey AL, Natoli AK, Formosa MF, Vizi D, Reddy-Luthmoodoo M, Weir JM, Barlow CK, van Hall G, Meikle PJ, Duffy SJ, Kingwell BA. Reconstituted high-density lipoprotein infusion modulates fatty acid metabolism in patients with type 2 diabetes mellitus. J Lipid Res. 2011;52:572-581.
14. Murphy RC, James PF, McAnoy AM, Krank J, Duchoslav E, Barkley RM. Detection of the abundance of diacylglycerol and triacylglycerol molecular species in cells using neutral loss mass spectrometry. Anal Biochem. 2007;366:59-70.
15. Nicholls SJ, Tuzcu EM, Sipahi I, Grasso AW, Schoenhagen P, Hu T, et al. Statins, high-density lipoprotein cholesterol, and regression of coronary atherosclerosis. JAMA 2007; 297: 499 – 508.
16. Al-Nozha MM, et al. Hyperlipidemia in Saudi Arabia. Saudi Med J. 2008 Feb;29(2):282-7
17. American Heart Association. 2002 Heart and Stroke Statistical Update. Dallas, Tex: American Heart Association; 2001: pp 4, 23.
18. Miguel-Angle, et al. Occupation-Related Differences in the Prevalence of Metabolic Syndrome. Diabetes Care 31:1884–1885, 2008.
19. Thorp AA, Owen N, Neuhaus M, Dunstan DW (2011) Sedentary behaviors and subsequent health outcomes in adults a systematic review of longitudinal studies, 1996–2011. American journal of preventive medicine 41: 207–215.
20. Ridker PM, Buring JE, Cokk NR, Rifai N (2003) C-reactive protein, the metabolic syndrome, and risk of incident cardiovascular events. Circulation 10, 391-7
21. Sattar N, et al. (2003) Metabolic syndrome with and without C-reactive protein as a predictor of coronary heart disease and diabetes in the west of Scotland coronary prevention study. Circulation 108, 414-9
22. Magge, S. N., et al. (2012). "Prediabetic obese adolescents have a more atherogenic lipoprotein profile compared with normoglycemic obese peers." J Pediatr 161(5): 881-886.
23. Khan, H. A., et al. (2007). "Association between glycaemic control and serum lipids profile in type 2 diabetic patients: HbA1c predicts dyslipidaemia." Clin Exp Med 7(1): 24-29.
24. Weinstein Ar, S. H. D. L. I. and et al. (2004). "RElationship of physical activity vs body mass index with type 2 diabetes in women." JAMA 292(10): 1188-1194.
25. Dowse, G. K., et al. (1991). "Abdominal obesity and physical inactivity as risk factors for NIDDM and impaired glucose tolerance in Indian, Creole, and Chinese Mauritians." Diabetes Care 14(4): 271-282.
26. Li, Y., et al. (2013). "Prediabetes and impaired lung function in asymptomatic adults." Diabetes Res ClinPract.
27. Habib, S. S. (2013). "Body mass index and body fat percentage in assessment of obesity prevalence in saudi adults." Biomed Environ Sci 26(2): 94-99.

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