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Assessment of Cardiometabolic Risk Factors in a Group of Office Employees

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Abstract

Background: Cardiovascular diseases (CVDs) are the leading cause of death representing 30% of all global deaths. The rising trend of morbidity and mortality are due to increased burden of cardiometabolic risk factors.

Aim of work: This study was performed to determine the prevalence of various behavioral and biological cardiovascular risk factors in a group of office workers whose sedentary work had influenced their health risk behavior leading to increased burden of obesity, hypertension and dyslipidemia.

Materials and Methods: A cross sectional study was performed in a private trade company in Egypt. All current employees aged 30-66 years participated in the study with no exclusion criteria. Detailed self-administered questionnaire was performed including sociodemographic characteristics, smoking habits, physical activity, fruit/vegetable consumption in addition to clinical examination and analysis of random blood sugar and lipid profile.

Results: Smoking, insufficient fruit/vegetable consumption, physical inactivity were reported by 27.9%, 42.6%, 52.9% of the workers respectively. Results showed that 32.4% of employees were hypertensive whereas 30.9% were in the pre-hypertensive state. Overweight and obesity was observed in 76.5% of the group. Participants with atherogenic dyslipidemia represented 86.8% with positive correlation with body mass index. Most of the participants (89.7%) had ≥ 3 cardiovascular risk factors.

Conclusion: High prevalence of cardiometabolic risk factors among office workers indicate serious lack of awareness about healthy life style and the urgent need to establish health promotion campaigns and public awareness programs locally at workplace and at the national levels.

Keywords: Cardiovascular; Behavioral; Biological; Risk factors; Atherogenic dyslipidemia; Lifestyle changes

Introduction

The burden of cardiovascular diseases (CVDs) is assuming an alarming proportion in many developing countries and had emerged as a major cause of morbidity and premature mortality. However, it did not assume a priority for control and prevention in many of these countries [1]. Worldwide, over 17 million deaths are now attributed annually to cardiovascular diseases [2]; 80% are estimated to occur in low and middle income countries[3-6]. Egypt was categorized according to WHO as a low-middle-income country [7]. The Egyptian National Survey conducted in 2017 [8] showed higher prevalence of various cardiovascular risk factors than the global and regional figures especially hypertension, obesity and physical inactivity with low fruits and vegetables consumption and that 46% of CVD mortality occurred in 2014 [9].

Recent observations suggested that 16.7% of Egyptians between 18-25 years old were already at an increased risk of developing fatal cardiovascular disease within the next 10 years due to high prevalence of overweight and obesity in all socioeconomic strata [10].

Most of the non-communicable diseases (NCDs) such as diabetes mellitus, hypertension, stroke, cardiovascular disease share common and preventable risk factors such as tobacco smoking, physical inactivity, unhealthy diet and consumption of high-cholesterol containing foods, overweight and obesity, raised blood pressure and blood glucose in addition to psychological stress [11,12]. The burden of NCDs can be reduced through effective preventive measures - up to 30% for cancer and 75% for cardiovascular diseases [13]. Over the past few decades, CV mortality had declined markedly in many developed countries due to better control of modifiable risk factors and improved management [2]. However, in Egypt the number of deaths due to CVDs continued to rise fueled by life style changes associated with urbanization and industrialization [14]. So effective management of associated risk factors is essential for limiting adverse outcomes. Sedentary behavior refers to behaviors that involves an energy expenditure of less than 1.5 metabolic equivalent units (METs) [15,16]. This include sitting on a desk for a long period of time, using a computer or lying such as watching television.

Certain occupations predispose individuals to sedentary lifestyle which is recognized as an occupational health risk factor [17]. Accordingly, office workers are considered as high-risk group, their job necessitated prolonged sitting in front of the computer screen. They are exposed to various hazards at the work place, unhealthy working conditions and various job stresses that unfavorably affect cardiovascular health [18]. In addition, this type of lifestyle affects people's levels of physical activity, had led to altered health behavior, increased intake of junk food with little or even no nutritional value.

Thus, young and middle-aged people spending most of their adult working lives in this situation are at increased risk of developing CVDs and its related complications with major implications on work productivity and overall community health, if they don't consciously

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try to manage most of the preventable factors and involve themselves in physical or sporting activities outside working hours.

Aim of the work

The aim of this study is to determine the prevalence of various behavioral and biological cardiovascular risk factors among a group of apparently healthy office workers, aiming to raise the level of awareness about preventable CV risk factors among a group of well-educated employees. Also, to determine the correlation between BMI and various CV risk factors and incidence in both sexes.

Materials & Methods

The study was performed on a sample of office workers with sedentary type of job in one of the private trade companies in Egypt. The study was conducted on the context of screening cardiometabolic risk factors among a group of apparently healthy workers. All current employees aged 30-66 years were invited to participate in the study. Before doing the work and after explaining the purpose of the study; nearly all employees (about 100 subjects) registered to perform the interview but on the day of appointment, a total of 68 employees only participated. Non-attendants, some of them claimed to be fear of the results of the investigations and others thought they feel healthy with no specific complaints so no need to be examined. So the study was performed to screen the workers who attended and approved the aim of the study. All workers were graduated from high universities with no difference regarding educational levels. All study participants signed the informed consent form with no exclusion criteria. The employees were interviewed, did the clinical examination, the anthropometric measurements and the required investigations.

Sociodemographic characteristics including age, gender, occupation, special habits, physical activity, dietary patterns and frequency of fruits and vegetables consumption; in addition, past and family histories were obtained with a detailed self-administered questionnaire. Data regarding cigarette smoking was obtained. Each participant was classified as current smoker, ex-smoker or non-smoker.

Physical exercise and consumption of fruits and vegetables was determined by answering questions: (Do you practice any type of physical activity? Give details about frequency, time spent, type of activity? Frequency of daily fruits and vegetables consumption?).

Most of the participants (workers and managers) were working on computer for 8 hours minimum with half an hour or without break.

Blood pressure was measured using a manual sphygmomanometer (in millimeters of mercury-mmHg) on the upper arm in a sitting position after 5 minutes rest.

Body weight was measured using a digital scale with the subject barefooted. The height was measured with a tape while standing on a wall. Body mass index (BMI) was calculated as weight in kg divided by height in meters squared (kg/m^2).

Blood samples of 5 cm were withdrawn in the laboratory in the morning- after fasting for 11-12 hours - from the antecubital vein to measure total cholesterol (mg/dl), HDL-cholesterol (HDL, mg/dl), LDL-cholesterol (LDL, mg/dl) and triglycerides (mg/dl).

Random blood glucose level was measured at the time of examination using Accu-Chek apparatus.

Definitions of risk factors

- Smoking status: a smoker was anyone who reported currently smoking cigarettes, shisha or both. Ex-smoker was exposed to side smokers and non-smokers were not smokers at all or stopped smoking for more than 5 years [19].
- Diabetes was diagnosed according to history or RBG ≥ 200 and prediabetes was diagnosed if RBG ≥ 140 [19].
- Low fruit/vegetable consumption: <5 per portions of fresh and/or cooked fruits/vegetables a day [19].
- Regarding physical activity, participants were required to report the level of activity they used to do using detailed questionnaire. They were categorized accordingly: no activity at all, mild physical activity: <150 minutes of moderate intensity, or 75 minutes of vigorous intensity exercise per week or equivalent combination of both, or <10 minutes of any type of physical activities per day, including activities at work, travel, leisure time and at home [19]. Moderate physical activity including walking for more than one hour at least 5 days/week or cycling at least 5 days/week. Vigorous intensity physical exercise includes running, swimming, playing (tennis, football, lifting heavy objects) for one hour/day for at least 5 days/week [19].
- Hypercholesterolemia: total serum cholesterol of ≥ 200 mg% and/or worker was receiving lipid lowering treatment; Hypertriglyceridemia (≥ 150 mg%), decreased HDL in males (<40 mg%), in females (<50 mg%) and increased LDL>100.
- According to WHO, BMI= 18.5-24.9 is considered normal, overweight from 25- 29.9 and obese ≥ 30 kg/m^2 [19].

The cardiovascular risk factors were categorized as behavioral factors (smoking, low fruit and vegetable consumption, physical inactivity) and biological factors (BMI, hypertension, diabetes, hypercholesterolemia, hypertriglyceridemia, decreased HDL and increased LDL).

Statistical methods

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 25 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, minimum and maximum in quantitative data and using frequency (number) and relative frequency (percentage) for categorical data. For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5 [20]. Correlations between quantitative variables were done using Pearson correlation coefficient [21]. P-values less than 0.05 were considered as statistically significant.

Results

Baseline characteristics of the studied group were presented in Table 1, they included 33 males (48.5%) and 35 females (51.5%), the mean age of males was 47.8+6.90 and the females 50.4+9.00. Twenty-four of the subjects were managers (35.3%) and 44 were office workers (64.7%), working in front of computer screen for 8 hours or more/day for 5 days/week with no differences between both groups. Table 1 also describes the mean value of blood pressure (BP), random blood sugar (RBS), weight, height, body mass index (BMI) and lipid profile.

Table 2 describes different behavioral and biological cardiometabolic risk factors. Smoking was significantly higher among

			Male		Female	
	No.	**%**	**No.**	**%**	**No.**	**%**
Total	68	100	33	48.5	35	51.5
Occupation	Office worker		25	75.8	19	54.3
	Manager		8	24.2	16	45.7
	Mean + SD		**Mean+ SD**		**Mean+ SD**	
Age	49.16+8.10		47.82+6.90		50.43+ 9.00	
SBP	127.75+10.94		125.36+9.78		130.00+11.63	
DBP	82.68+8.11		82.79+8.64		82.57+7.71	
Height	168.04+8.19		172.61+7.15		163.74+6.68	
Weight	82.49+14.28		88.67+12.59		76.66+13.43	
BMI	29.11+4.60		29.62+3.88		28.63+5.20	
RBS	100.06+36.56		112.33+48.07		88.49+13.24	
T. Cholesterol	216.79+43.42		221.09+44.61		212.74+42.51	
HDL	52.75+13.32		47.06+8.67		58.11+14.76	
LDL	136.62+38.29		139.64+39.58		133.77+37.39	
TG.	137.94+59.67		166.70+44.61		110.83+55.82	

Table 1: Baseline characteristics of workers.

No. = number of workers, SD = standard deviation, SBP = systolic blood pressure, DBP = diastolic blood pressure, BMI= body mass index, RBS= random blood sugar, HDL= high density lipoproteins, LDL= low density lipoproteins, TG = triglycerides

Behavioral Risk Factors		**Total**		**Sex**				**P value**
				Male		**Female**		
		No.	**%**	**No.**	**%**	**No.**	**%**	
Smoking	Smoker	19	27.9	16	48.5	3	8.6	<0.001
	Ex-smoker	2	2.9	1	3	1	2.9	
	Non-smoker	47	69.1	16	48.5	31	88.6	
Physical activity	Inactive	36	52.9	19	57.6	17	48.6	0.456
	Mild activity	27	39.7	13	39.4	14	40	
	Moderate activity	5	7.4	1	3	4	11.4	
Fruit intake	<5	29	42.6	15	45.5	14	40	0.649
	>5	39	57.4	18	54.5	21	60	
Vegetable intake	<5	26	38.2	15	45.5	11	31.4	0.234
	>5	42	61.8	18	54.5	24	68.6	
Biological Risk Factors								
HTN	Hypertension (newly discovered)	22	32.4	8	24.2	14	40	0.359
	Pre-hypertension	21	30.9	12	36.4	9	25.7	
	Normal or controlled	25	36.8	13	39.4	12	34.3	
DM	Diabetes (newly discovered)	2	2.9	2	6.1	0	0	0.023
	Prediabetes	3	4.4	3	9.1	0	0	
	Not diabetic or controlled	63	92.6	28	84.8	35	100	
BMI	Healthy	16	23.5	5	15.2	11	31.4	0.212
	Overweight	23	33.8	11	33.3	12	34.3	
	Obese	29	42.6	17	51.5	12	34.3	
Hypercholesterolemia	Yes	40	58.8	20	60.6	20	57.1	0.772
	Non-smoker	28	41.2	13	39.4	15	42.9	
Hypertriglyceridemia	Yes	24	35.3	19	57.6	5	14.3	<0.001
	Non-smoker	44	64.7	14	42.4	30	85.7	
HDL	Low	18	26.5	7	21.2	11	31.4	0.34
	Normal	50	73.5	26	78.8	24	68.6	
LDL	High	55	80.9	26	78.8	29	82.9	0.67
	Normal	13	19.1	7	21.2	6	17.1	

Table 2: Behavioral and biological cardiovascular risk factors of the studied group. (HTN: hypertension; DM: diabetes mellitus)

males (48.5%) versus females (8.6%). Regarding physical activity 57.6% of males did not perform any scheduled physical activity versus 48.6% of females; while 39.4% of males and 40.0% of females were practicing mild activities with no significant differences between them. Regarding daily consumption of fruits and vegetables, although no significant differences were observed between males and females but the majority of the studied group recorded low fruits and vegetables consumption 42.6% and 38.2% respectively.

About biological risk factors, hypertension was discovered in 8 males (24.2%) and 14 females (40.0%) whereas 12 males (36.4%) and 9 females (25.7%) were in the pre-hypertensive state. Nearly 40% of males and 34.3% of females were normotensive or hypertensive with good control. Diabetes was discovered in 2 males (6.1%) and 3 (9.1%) were in the pre-diabetic glycemic levels with no similar cases detected in females making significant differences between the 2 groups. Hypercholesterolemia was recorded in 60.6% of males versus 57.1% of females with no significant differences between them. Triglyceride levels were elevated in 57.6% of males and 14.3% of females with significant difference between them. Levels of high-and low-density lipoproteins, did not significantly vary by gender, 21.2% of males and 31.4% of females had low HDL and 78.8% of males and 82.9% of females had high levels of LDL. Participants who presented with atherogenic dyslipidemia were 86.8% (Figure 1). DLP was comparable across gender except for high triglyceride levels which predominate in males.

Using the WHO classification for obesity, 16 workers (23.5%) were classified as healthy, 23 (33.8%) were overweight and 29 (42.6%) were obese indicating high prevalence of overweight and obesity in the examined population with no significant difference between both sexes; 84.8% of males and 68.6% of females had BMI ≥ 25.

Comparison between males and females regarding different behavioral and biological risk factors was illustrated in (Figure 2).

Table 3 describes disease incidence in the examined group and its relation to family history, results showed that all workers with diabetes mellitus (DM), hypertension (HTN) and ischemic heart disease (IHD) had positive family history confirming genetic susceptibility, while only 2 workers with dyslipidemia (DLP) had family history meaning that nutrition transition played the most important role in high prevalence of DLP among the examined group, with good adherence to treatment in all diseases.

Analysis of risk factors was illustrated in Table 4 carrying a very bad figure, it showed that 81.8% of males and 68.6% of females had more than 3 risk factors. A finding which necessitates rapid and urgent intervention.

Table 5 describes the prevalence of various behavioral and biological risk factors according to the BMI. Behavioral risk factors

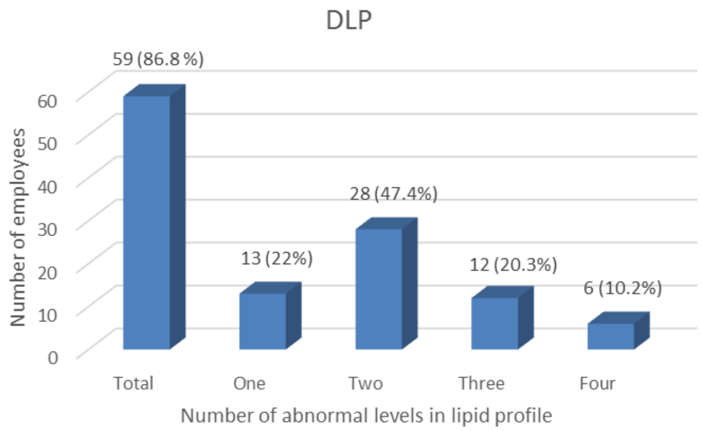

Figure 1: Incidence of DLP among the studied group.

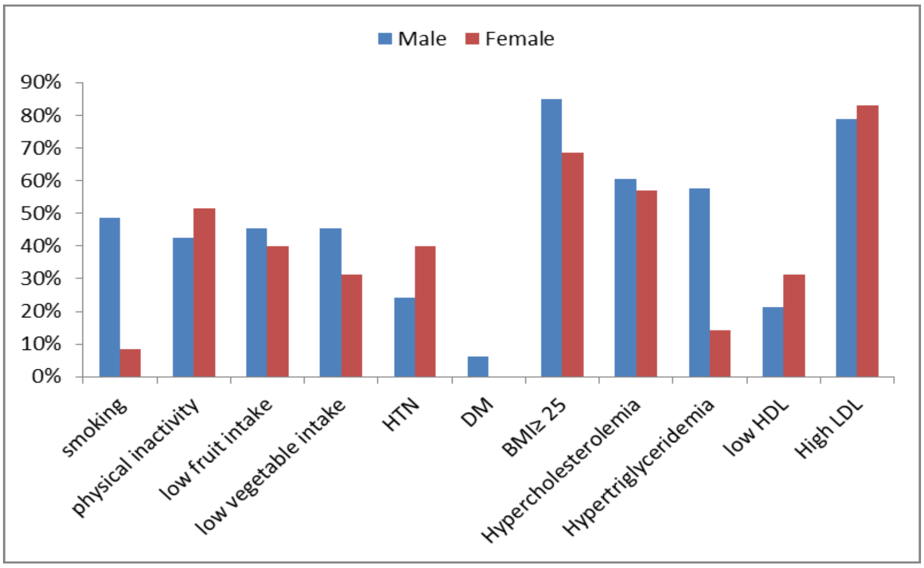

Figure 2: Comparison between males and females regarding behavioral and biological risk factors.

Disease	Past History		Family History		P value	Adherence to treatment	
	No.	%	No.	%		No.	%
DM	8	11.80%	21	30.90%	0.006	7	10.30%
HTN	18	26.50%	17	25%	0.844	18	26.50%
IHD	2	2.90%	7	10.30%	0.165	1	1.50%
DLP	23	33.80%	2	2.90%	<0.001	22	32.40%

Table 3: Disease incidence, relation to family history and adherence to treatment. (IHD: ischemic heart disease: DLP: dyslipidemia)

		Total		Sex				P value
				Male		Female		
		No.	%	No.	% within sex	No.	% within sex	
Number of risk factors	**One risk factor**	1	1.50%	1	3.00%	0	0.00%	0.352
	2 Risk factors	6	8.80%	2	6.10%	4	11.40%	
	3 Risk factors	10	14.70%	3	9.10%	7	20.00%	
	more than 3 risk factors	51	75%	27	81.80%	24	68.60%	

Table 4: Risk factors profile among the studied group.

Behavioral Risk Factors		Healthy(16)		Overweight(23)		Obese (29)		P value
		No.	%	No.	%	No.	%	
Smoking	smoker	4	25.00%	5	21.70%	10	34.50%	0.603
	ex-smoker	1	6.30%	1	4.30%	0	0.00%	
	non-smoker	11	68.80%	17	73.90%	19	65.50%	
Physical activity	Inactive	7	43.80%	10	43.50%	19	65.50%	0.442
	Mild activity	8	50.00%	11	47.80%	8	27.60%	
	Moderate activity	1	6.30%	2	8.70%	2	6.90%	
Fruit intake	< 5	6	37.50%	9	39.10%	14	48.30%	0.717
	> 5	10	62.50%	14	60.90%	15	51.70%	
Vegetable intake	< 5	6	37.50%	9	39.10%	11	37.90%	0.994
	> 5	10	62.50%	14	60.90%	18	62.10%	
Biological Risk Factors								
HTN	Hypertension	3	18.80%	4	17.40%	15	51.70%	0.024
	Pre-hypertension	5	31.30%	7	30.40%	9	31.00%	
	Normal or controlled	8	50.00%	12	52.20%	5	17.20%	
DM	Diabetes	1	6.30%	1	4.30%	0	0.00%	0.218
	Prediabetes	0	0.00%	0	0.00%	3	10.30%	
	Normal or controlled	15	93.80%	22	95.70%	26	89.70%	
Hypercholesterolemia	yes	5	31.30%	11	47.80%	24	82.80%	0.001
	non-smoker	11	68.80%	12	52.20%	5	17.20%	
Hypertriglyceridemia	yes	3	18.80%	6	26.10%	15	51.70%	0.045
	non-smoker	13	81.30%	17	73.90%	14	48.30%	
HDL	low	5	31.30%	7	30.40%	6	20.70%	0.641
	Normal	11	68.80%	16	69.60%	23	79.30%	
LDL	High	10	62.50%	18	78.30%	27	93.10%	0.035
	Normal	6	37.50%	5	21.70%	2	6.90%	
Age	<40	4	25.00%	1	4.30%	5	17.20%	0.187
	>40	12	75.00%	22	95.70%	24	82.80%	

Table 5: Risk factors according to the BMI.

showed no significant differences between the 3 groups. However, participants with BMI ≥ 30 are smokers, physically inactive, of low fruit and vegetable consumption than the others. Regarding biological risk factors it shows significant differences between the 3 groups regarding HTN, hypercholesterolemia, hypertriglyceridemia & high LDL levels which were more prevalent among obese.

Table 6 shows the correlation between different risk factors; positive correlation was evident regarding BMI and all factors including systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol, low-density lipoproteins (LDL) and triglycerides (TG) levels. Also,

		SBP	DBP	T. Chol	Low HDL	High LDL	TG.
SBP	r	1	0.629	0.111	0.014	0.142	-0.057-
	P value	-	<0.001*	0.367	0.912	0.247	0.642
DBP	r	0.629	1	0.071	-0.071-	0.063	0.024
	P value	<0.001*	-	0.566	0.565	0.612	0.846
BMI	r	0.298	0.399	0.336	-0.015-	0.27	0.245
	P value	0.014*	0.001*	0.005*	0.902	0.026*	0.044*
RBS	r	-0.229-	-0.251-	0.142	-0.297-	0.15	0.401
	P value	0.061	0.039*	0.247	0.014*	0.222	0.001*
T. Chol.	r	0.111	0.071	1	0.279	0.942	0.111
	P value	0.367	0.566	-	0.021*	<0.001*	0.367
TG.	r	-0.057-	0.024	0.111	-0.599-	0.009	1
	P value	0.642	0.846	0.367	<0.001*	0.94	-

Table 6: Correlation between all risk factors.

positive correlation between random blood sugar (RBS) and DBP, low levels of high - density lipoprotein (HDL) and high TG.

Discussion

This study was performed to investigate the association between sedentary nature of working environment and some behavioral and biological cardiovascular risk factors among a group of office workers in one of the trade companies in Egypt.

The main finding in this study revealed strong association between sedentary work and various cardiovascular risk factors.

Regarding workers' behavioral risk factors; findings indicated increased prevalence of smoking among the studied group (27.9%) which was higher than that recorded in Egypt steps survey done in 2017 [8] in addition, more than half of the participants (52.9%) were not engaged in any type of physical activity as recommended for health by WHO [22] due to lack of time, high-density traffic and pollution that discouraged people who had no club subscription or sport facilities. Also, fruits and vegetables intake were not of great concern in the studied group of workers (42.6% and 38.2% respectively). Low intake seemed to be common among Egyptians as evidenced from the nationally reported rates in 2017 which was 90.3% [8]. The cause is almost related to financial problems and economic overload on workers.

Regarding biological risk factors, the results revealed high prevalence of hypertension among the examined population, it was undiagnosed in 32.4% of workers while 30.9% were in the pre-hypertensive state and 36.8% were either controlled cases or normal (Table 2). Of particular concern in this study is the high incidence rates of prehypertension in addition to undiagnosed cases which accounts for more than 60% observed among apparently healthy employees who are unaware of their health condition. Similarly in India, two studies were conducted among bank employees with sedentary type of work; Singh and colleagues in 2015 found that nearly half of the subjects had hypertension and another one-third were pre-hypertensive [23]. Also, Undhad and colleagues in 2011 [24] reported high prevalence of hypertension (25%) which were positively correlated to obesity/overweight known as major risk factors for hypertension [25]. Positive correlation between BMI and systolic and diastolic blood pressure was also recorded in our participants (Table 6) similar to the INTERSALT study which showed strong association between BMI and blood pressure [26].

The reported figure in this study is much higher than the national rate reported in Egypt health issues survey (EHIS) in 2015 which was (17.2%) and that of the rate reported from a screening survey in urban Cairo (16.5%) [27,28]. However, it was comparable with the population based survey done by Gadallah and his colleagues in 2018 among urban slum dwellers in Egypt who reported hypertension in 31.2% of the studied population denoting rising incidence with serious lack of awareness among Egyptian population of different educational levels about CV risk factors [29] and the importance of regular follow up of blood pressure measurements. Positive family history was noticed in hypertensive workers (Table 3) indicating the importance of establishing awareness about other risk factors sharing disease development and associated serious health consequences; also early intervention and management are of great importance in prevention of cardiovascular disease burden.

The prevalence of overweight and obesity in our participants was 33.8% and 42.6% respectively [30-32].

This finding was also reported by Peltzer and his research team in 2014 who studied the prevalence of overweight and obesity in 22 countries and found it higher in Egypt and Tunisia [33]. Moreover, studies indicated that overweight and obesity are prevalent in all socioeconomic strata in Egypt [8,34].

The cause could be related to different life stresses with increased consumption of fast foods, frequent snacking and skipping breakfast, sedentary lifestyles both in and outside the workplace, the lack of time due to work commitments, the long working hours with lack of healthy dietary options in the workplace and large availability and accessibility of food delivery services throughout Cairo; factors that escalate the risk of being overweight or obese. In addition to increased economic burden making it difficult for people to be involved in any kind of physical activity.

Similarly, high prevalence of obesity and overweight was recorded by Singh and colleagues in 2015 in a group of bank employees with sedentary job and various job stresses [23]. Authors attributed this to be caused by changes in the metabolism of these employees as they continually sit for long hours [35,36]. Also, a cross sectional study in Ghana in 2015 [37] denoted high prevalence of overweight and obesity among financial institutional workers with sedentary nature of job and strong association with physical inactivity similar to our results where 52.9% of workers were inactive and 39.7% reported mild physical activity and only 7.4% were engaged in moderate activity (Table 2).

Amugsi and colleagues in 2017 performed a large study that investigated the prevalence and time trends in overweight and obesity between 1991 and 2014 in 24 African countries. Results revealed that levels of overweight reached 36% in Egypt in the 1990s surveys. In all other countries, overweight was under 20% and obesity was under 10%. In 2010, Egypt recorded the highest prevalence of overweight (44%) and obesity (39%) followed by Ghana with an overweight prevalence of 30% and obesity of 22%. Follow up revealed that obesity increased by 12% in Egypt in 2014 [38]. Other authors stated that the results of Egypt are not surprising as the country was previously ranked among the countries in the world with the most obese people [39].

Statistical data points to worsening phenomenon of obesity among the Egyptian population in the past few years. A finding that necessitate rapid intervention to decrease this astonishing rate and its expected health implications as evidence proved that the risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increased steadily with increasing body mass index (BMI) [40,41], also that overweight and obesity were linked to 13 different types of cancer [42].

As dyslipidemia is the most important factor in the pathogenesis of CVDs and is significantly associated with increased BMI [43,44], in addition to contribution to complications of hypertension [43]; analysis of the results of this study revealed that 86.8% of the workers suffered from one or more unhealthy levels of total cholesterol, triglycerides, low HDL or high LDL (Figure 1).

Similarly, several studies showed high prevalence of dyslipidemia among the examined groups with sedentary work [23,45]. Mihaylova and colleagues in 2012 proved positive correlation between the incidence of CVDs and levels of LDL concentration. The possible reasons for dyslipidemia included sedentary lifestyle, nutrition transition with high consumption of fat and high caloric foods and development of obesity [46].

Interestingly, some studies proved that disturbances in glucose and lipid metabolism are strongly linked to subsequent development of cardiovascular morbidity in a state of insulin resistance [47]. In this study, undiagnosed diabetes was discovered in 2 employees (2.9%) while 3 (4.4%) were in the pre-diabetic glycemic levels. The results are evidenced by the positive correlation between hyperglycemia and hypertriglyceridemia and low HDL levels observed in the studied group (Table 6). However, the likelihood that other undiagnosed cases might have been missed is an important issue as we depended on random blood glucose levels not fasting and postprandial levels, thereby potentially underestimating the true prevalence of diabetes in this study.

Coincidently, the study of Osei-Yeboah and colleagues in 2018 found increasing level of glycaemia with a corresponding increase in atherogenic lipid parameters [48]. The cause is not clearly understood, but postulated mechanisms had linked glycemic dysregulation and dyslipidemia. There is increased hepatic gluconeogenesis and glucose output, reduced suppression of lipolysis leading to a high free fatty acid influx, and increased hepatic very low density lipoproteins (VLDL) secretion resulting in hypertriglyceridemia and reduced plasma levels of HDL [49].

In conclusion, it was evident that one of the major challenges in reducing morbidity and mortality from CVDs is to control hypertension, overweight and obesity in addition to DLP. Studies showed that every 10% reduction in plasma total cholesterol, CVD mortality was reduced by 15% and total mortality risk by 11% [50]. Most of our participants are unaware of risk factors associated with disease incidence as 75% of the participants had more than 3 risk factors including behavioral and biological ones.

Accordingly, strategies should be implemented to address different modifiable risk factors which will be an important step towards curbing the surge of NCDs which is likely to surpass the toll of sickness and death from infectious diseases by 2030 [51]. A step that will contribute greatly to the potential of development of the community, reducing premature mortality from NCDs and promoting mental health and well-being by 2030 [52].

Strengths and Limitations

One of the limitations of this study is lack of data on other important variables as psychological factors which might add to the risk factors of obesity, health insurance status that may affect health of workers, periodic medical examination, risk factors assessment and access to medications. Also, we depended on BMI to define obesity, abdominal obesity was not considered.

Diagnosis of diabetes depended upon random blood glucose not fasting and postprandial tests as it was not possible to ask employees to go to the laboratory for 2 days, fasting for 8 hours to test blood sugar levels and then for 11 hours for assessment of DLP, which might lead to underestimation of disease incidence.

However, the study provided a good evidence about rising rates of most of the modifiable risk factors of NCDs which should be acted upon at the personal, institutional and community levels and that Egypt was facing NCDs health burden in the next coming years, so interventions should be appropriately formulated to tackle the extraordinarily high prevalence of overweight and obesity in a highly educated section of the community.

Conclusion and Recommendations

This study presents a pattern of high risk for CVDs. It revealed high prevalence of some behavioral and biological cardiovascular risk factors among a group of highly educated employees especially HTN, DLP and obesity indicating serious lack of awareness about healthy lifestyle and the urgent need to establish health promotion campaigns and public awareness programs at the local and national levels. These campaigns would highlight about importance of lifestyle modifications that would reduce the burden of CVDs, to emphasize the importance of routine and annual checkup for early detection and screening of CVDs; these policies should be incorporated in all companies allowing early intervention aiming at alleviating the growing burden of CVDs and associated morbidity and mortality. The interaction of social, occupational, behavioral and biological factors might lead to increase vulnerability to multiple risky behaviors that may contribute to CVDs.

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