

ORIGINAL ARTICLE

# Comparison of Blood Glucose Levels, Physical Activity and Blood Pressure between Medical Sciences University Employees and General Population

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## ABSTRACT

**Background:** Diabetes is the 5<sup>th</sup> cause of mortality among women and the 16<sup>th</sup> cause of mortality among men. Therefore, the present study aimed to investigate and comparison of blood glucose levels, physical activity and blood pressure between medical sciences university employees and general population.

**Methods:** In across-sectional study using clustered sampling method, 238 subjects were enrolled, while 150 were Shiraz University of Medical Sciences employees and 88 were general population. A detailed standardized form was completed for all participants including demographic data, anthropometric measurements, systolic and diastolic blood pressure, fasting blood glucose, diabetes and hypertension history and medication, physical activity, dietary habits, and nutrition.

**Results:** The employees' abdominal circumference was 90.68±9.52 centimeter and that of general population was 78.18±26.9 centimeter (P<0.001). The systolic blood pressure of employees and general population were respectively 11.75±1.72 mmHg and 12.73±1.87 mm Hg and their diastolic blood pressure were 7.43±1.1 mmHg and 8.39±1.22 mmHg, respectively (P<0.001). Diabetes frequency in employees and general population was 9.9% and 41.8%, respectively (P<0.001).

**Conclusion:** The frequency of diabetes in medical personnel was less than general population which may reflect the impact of various factors on the physical activity; personal and social differences in different societies could explain the differences in the prevalence of physical inactivity and also proper control of blood glucose as well as appropriate and regular monitoring of blood glucose by medical staff.

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## Introduction

Diabetes is the 5<sup>th</sup> cause of mortality among women and the 16<sup>th</sup> cause of mortality among men (1).

Diabetes is associated with micro- and macro-vascular complications and long-term morbidity (2). This disease accounts for 2-15% of total direct

health expenditure. Hypertension is responsible for 9% of mortality (1) and has been well recognized as a major independent risk factor for cardiovascular disease and stroke (3). Uncontrolled hypertension leads to cardiovascular diseases, chronic renal failure, retinopathy, and nephropathy (1). WHO has suggested that insufficient physical activity is one of the ten causes of mortality. Insufficient physical activity was shown to be responsible for annually two million mortality (4) and 20% cardiovascular and cancer mortality (5). Physical inactivity is accepted as one of the key chronic disease risk factors (6).

The prevalence of diabetes is expected to increase worldwide from 4.0% to 5.4% from 1995 to 2025, with a 35% rise over 30 years (7). India, China and the US are the three countries with the largest numbers of people with diabetes (8). In Iran, 1.5 million people were estimated to be diabetic cases (9), while the prevalence of diabetes was reported 3% in rural areas and 7-8% in urban regions (10). In United States, approximately 75% of patients with diabetes have concomitant hypertension (11). In Taiwan, more than 50% of the elderly people are hypertensive. In 2009 to 2010, the prevalence of hypertension was 30.5% among men and 28.5% among women (3). In Iran, the prevalence of hypertension has been estimated 23.3% (12).

WHO reports indicate that more than 60% of adults perform insufficient physical activity (13). South Africa is estimated to be the third most physically inactive country in Africa, with more than half of the population being physically inactive (51.1%) (6). In Iran, approximately 70-80% of population are physically inactive (13) and the prevalence of physical inactivity is 58.8% in rural areas, 76.3% in urban regions, being totally 67.5% (14). Adults are recommended to undertake a minimum of 150 minutes of at least moderate-intensity physical activity per week (15). Aerobic exercise training decreases resting blood pressure 5 to 7 mmHg, while resistance exercise training declines blood pressure 2 to 3 mmHg among people with hypertension (16). Undergoing a physically active lifestyle reduces the risk of all-cause mortality, cardiovascular disease, type 2 diabetes, and some cancers (15).

Due to the high prevalence of diabetes (3% in rural areas and 7-8% in urban regions) (10), hypertension (23.3%) (12) and physical inactivity (70-80%) (13), investigating health status of the community seems to be of paramount importance. Personnel of university of medical sciences play an important role in community health promotion. Education and graduation in health and medical fields results in more concern about their health behaviors and status,

but due to their stationary work, they seem to be physically inactive. No study has investigated the health status among personnel of Shiraz University of Medical Sciences (SUMS) yet. So this study was conducted to investigate and compare the prevalence of hypertension, diabetes and level of physical activity in the personnel of Shiraz University of Medical Sciences and Shiraz population.

## Materials and Methods

The present cross-sectional study was conducted to investigate and compare the prevalence of diabetes and hypertension and level of physical activity among administrative personnel of SUMS and residents of Shiraz. The study population was a representative sample of general population of Shiraz and personnel of SUMS. Using clustered sampling method, 238 subjects were investigated, while 150 were personnel of SUMS and 88 were the residents of Shiraz population. After obtaining informed written consent, medical interviews and physical examinations of all participants were conducted.

For all study subjects, a detailed standardized form was completed, including demographic data, anthropometric measurements, systolic and diastolic blood pressure, fasting blood glucose, diabetes and hypertension history and medication, physical activity, dietary habits, and nutrition. Demographic data were evaluated on the basis of an interview with the study subjects. Measurements of systolic and diastolic blood pressure, fasting blood glucose and anthropometric parameters were carried out using calibrated instruments. Both fasting blood sugar (FBS) and 2-h plasma glucose level (2hPG) (17) were determined in all eligible subjects, except for patients with known diabetes, in whom only FBS was recorded.

Known diabetes mellitus (KDM) was defined as diabetes previously diagnosed by a physician and/or the use of anti-diabetic drugs, while newly diagnosed diabetes mellitus (NDM) was defined as diabetes detected for the first time during the study. Diabetes was defined as FBS  $\geq 126$  mg/dL ( $\geq 7$  mmol/L) or 2hPG  $\geq 220$  mg/dL ( $\geq 12.2$  mmol/L), or both. Pre-diabetes was diagnosed as the presence of isolated impaired fasting glucose (IFG), defined as FBS  $\geq 110$  mg/dL ( $\geq 6.1$  mmol/L) and  $< 126$  mg/dL ( $< 7$  mmol/L), and 2hPG  $< 160$  mg/dL ( $< 8.8$  mmol/L) or isolated impaired glucose tolerance (IGT), defined as 2hPG  $\geq 160$  mg/dL ( $\geq 8.8$  mmol/L) and  $< 220$  mg/dL ( $< 12.2$  mmol/L) and FBS  $< 110$  mg/dL ( $< 6.1$  mmol/L), or both IFG and IGT (as defined above), according to WHO criteria (8).

Resting blood pressure was measured by an

experienced staff using a mercury random-zero sphygmomanometer (cuff size 14-54 cm; Hawksley) in the right arm in sitting position after 5 min of rest. Subjects were considered hypertensive, if systolic blood pressure was >140 mmHg or diastolic blood pressure was >90 mmHg or currently taking medication for hypertension control (16, 18, 19). Physical activity was assessed by a physical activity questionnaire (20). Three levels of self-declared weekly leisure-time physical activities were defined as level 1: with only light physical activity (sometimes walking), level 2: with moderate physical activity for at least 30 min three or more times a week (driving bicycle, at least 30 minutes walking, 3 times a week, carrying low weight, swimming, etc.) and level 3: with intense physical activity for at least 30 min, three or more times a week (professional sports).

Regular physical activity is defined as at least 30 minutes moderate physical activity at least 3 times a week. A range of anthropometric measurements was determined. BMI was evaluated as weight (kg) divided by height square (m<sup>2</sup>) (21). Height was measured twice with a standard stadiometer to the nearest centimeter (cm), and weight by a digital weighing machine to the nearest 0.1 kg. The participants were invited to have repeat laboratory measurements, physical examinations and interviews, using the same protocol as the baseline survey.

## Results

The study participants' characteristics were shown in Table 1. Of the 238 subjects in the investigation, 150 were personnel vs. 88 general population; while 121(48.8%) were men vs. 127 (51.2%) women. Their mean age was 45.35±13.6 years; the body mass index (BMI), 25.56 kg/m<sup>2</sup>; abdominal circumference (AC), 84.43 cm; hip circumference (HC), 97.14 cm; systolic blood pressure (SBP), 12.24 mmHg; diastolic blood pressure (DBP), 7.91 mmHg; fasting blood sugar (FBS) 116.37 mg/dl; level of physical activity was light in 50.6%, moderate in 45.9% and heavy in 3.4%. 93.6% of the subjects had physical activity (59.7% in personnel vs. 40.3% general population). Table 2 shows physical activity of 2 groups.

## Discussion

This study compared the physical activity, and the prevalence of diabetes and hypertension between general population and the employees in SUMS showing that the low, moderate and heavy physical activity were 52.5%, 41.7% and 5.8% among the employees, respectively. Also, in general population, the prevalence of low physical activity was 47.9% and moderate physical activity was 5.8%, while none of the individuals in general population had a history of heavy physical activity.

**Table 1:** The participants' general characteristics in the two groups (personnel and general population).

Participants' general characteristics		Personnel N(%) or mean±SD	General population N(%) or mean±SD	P value
Sex	Male	85 (57%)	36 (36.4%)	0.047
	Female	64 (43%)	63 (63.6%)	
Education	Diploma	49 (33.6%)	74 (83.1%)	0.036
	BSc	72 (49.3%)	14 (15.8%)	
	MSc	21 (14.4%)	1 (1.1%)	
	PhD	4 (2.7%)	0 (0%)	
Age: Year		41.11±9.001	51.78±16.67	0.043
Body mass index (BMI): kg/m <sup>2</sup>		25.1±3.39	26.03±3.52	0.121
Abdominal circumference (AC): cm		90.68±9.52	78.18±26.9	<0.001
Hip circumference (HC): cm		99.59±7.16	94.7±17.6	0.143
Systolic blood pressure (SBP): mmHg		11.75±1.72	12.73±1.87	<0.001
Diastolic blood pressure (DBP): mmHg		7.43±1.1	8.39±1.22	<0.001
FBS*: mg/dl		107.65±23.54	125.1±27.5	<0.001
Type 2 diabetes no. (%)		8 (9.9%)	38 (41.8%)	<0.001

FBS: Fasting blood sugar

**Table 2:** The details of physical activity of 2 groups.

Physical activity	Personnel (%)	General population (%)
Light	52.5	47.9
Moderate	41.7	52.1
Heavy	5.8	0

According to the World Health Organization report, physical inactivity has a growing trend worldwide (22). Totally, public health focus is toward the importance of physical activity in situations such as sports activities in the leisure time, activities related to job and activities associated with the household chores. The review of physical activity in relation to business activities revealed absence of physical activity in leisure-time in 60% of men and 77% of women (23). Unfortunately, the findings of this study showed that a high percentage of the population in terms of physical activity were sedentary which is consistent with the results of several studies in America (24), Sweden (25) and Australia (26), while the prevalence of physical inactivity was 68, 40 and 67 percent, respectively.

In a study in Yazd (27), the prevalence of physical inactivity was 65.8 percent. In Marave Tappe city (28), 56.4% of the study population had regular physical activity. Also, in a study in Hamedan (29), 65.7% of surveyed subjects did not report a suitable physical activity. Due to the impact of various factors on physical activity, social and personal differences could explain the difference in prevalence of physical inactivity in various populations. Abdominal circumference in medical science employees was  $90.68 \pm 9.52$  cm and in general population,  $78.18 \pm 26.9$  cm. In Moker and colleagues' study (30), waist circumference in patients with high systolic blood pressure was  $97.36 \pm 9.8$  mmHg and in patients with diastolic blood pressure was  $97.56 \pm 10.0$  mmHg.

Obesity as one of the most important factor related to lifestyle habits happening as a result of imbalance between energy intake and expenditure. The level of physical activity is also an important part of weight control program (31). In our study, the systolic and diastolic blood pressure in medical science employees was  $11.75 \pm 1.72$  mmHg and  $7.43 \pm 1.1$  mmHg, respectively and in general population was  $12.73 \pm 1.87$  mmHg and  $8.39 \pm 1.22$  mmHg. The FBS level in medical science employees and the general population were  $107.65 \pm 23.54$  mg/dl and  $125.1 \pm 27.5$  mg/dl, respectively. The frequency of diabetes in medical personnel was 9.9% and in the general population was 41.8%.

In a study in Esfahan (32), 22.2% of people suffered from high blood pressure and 6.6 percent had diabetes. In Grillo et al.'s study (28), the mean systolic blood pressure was 12.57 mmHg and the mean diastolic blood pressure was  $8.24 \pm 71.32$  mmHg. Also, in the study in Tehran (33), the systolic blood pressure was  $16 \pm 116$  mmHg and diastolic blood pressure was  $10 \pm 77$  mmHg. Overall, the chance of developing cardiovascular disease increased with an increase in blood pressure (34). In a study in Semnan,

48.7 percent of men and 47.7 percent of women had hypertension (35), while hypertension in America was reported 41% in men and 23% in women (36). In Tehran, Iran, hypertension prevalence was reported 37% in men and 35% in women (37). This difference could be due to the participants' age range, and economic and cultural factors.

We showed the BMI in medical sciences employees to be  $25.1 \pm 3.39$  kg/m<sup>2</sup> and in the general population as  $26.03 \pm 3.52$ . However, in Hamedinia's study, the BMI was reported in the faculty of Tarbiat Moallem University of Sabzevar to be  $26.6 \pm 4.2$  kg/m<sup>2</sup> (38), and in Hojati's study, the BMI in the university staff was  $25.43$  kg/m<sup>2</sup>. Damirchi and colleagues reported (39) that in 24.5% of cases, the BMI was between 18.5 to 25 kg/m<sup>2</sup> and among 52 percent was between 25 to 30 kg/m<sup>2</sup>. In addition, in a study, 51% of BMI index was over 23 kg/m<sup>2</sup> and in 43%, the BMI was less than 23 kg/m<sup>2</sup>. Inlays et al. in 2006 (40) reported the prevalence of obesity and overweight in German men to be 89%. Admi and Kordera in 2003 reported that the prevalence of BMI was 28 kg/m<sup>2</sup> in 22% of employees and drivers of public transport in Italy (41). Overall, the prevalence of obesity was demonstrated to be associated with many environmental factors. Reduced mobility and tendency toward a sedentary life and job opportunities were the result of social pressures (42).

## Conclusion

Findings of this study revealed that a high percentage of the population is sedentary in terms of physical activity. The frequency of diabetes in medical personnel was less than general population which reflects the impact of various factors on the physical activity; personal and social differences in different societies could explain the differences in the prevalence of physical inactivity and also proper control of blood glucose as well as appropriate and regular monitoring of blood glucose by medical staff. We need to look for ways to promote physical activity and blood glucose control in our society.

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## Conflict of Interest

None declared.

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