

ORIGINAL ARTICLE

# Prevalence of Risk Factors Related to Non-Communicable Diseases among Health Center Staff of Karaj, Alborz, Iran

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## ABSTRACT

**Background:** Non-communicable diseases (NCDs) are the most common causes of mortality worldwide. The purpose of the current study was to determine the prevalence of risk factors related to NCDs among health center personnel who worked in this field.

**Methods:** Two hundreds and ten females and 73 males from health center staff in Karaj, Alborz, Iran with the mean age of  $40.55 \pm 0.48$  years were randomly recruited in this cross-sectional study. Socio-demographic, anthropometric, and biochemical variables related to NCDs were collected by an expert. The relationship between risk factors and NCDs was investigated too.

**Results:** The mean body mass index (BMI), and waist and neck circumferences were  $26.8 \pm 0.25$  kg/m<sup>2</sup>,  $88.01 \pm 0.65$ , and  $35.58 \pm 0.02$ , respectively. Totally, 65.2% of study population were overweight and obese, and about 40% had abdominal obesity. Approximately, 59.5% were inactive, and 1.8% and 7.3% had high systolic and diastolic blood pressure, respectively. About 15.8% and 29% of them had fasting blood sugar (FBS) and cholesterol above the normal level, respectively. BMI had a positive correlation with age, occupation and blood factors and a negative relationship with physical activity.

**Conclusion:** The prevalence of associated risk factors of NCDs especially the obesity, and physical inactivity was high among Karaj health center staff. Regarding the role of BMI in NCDs, the modification in BMI and an increase in physical activity can be effective to decrease NCDs.

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## Introduction

Non-communicable diseases (NCDs) are the most common causes of mortality worldwide in the 21<sup>st</sup> century (1). More than 36 million people die annually due to NCDs, that almost 80% of these deaths occur in developing countries (lower- and

middle-income countries) (2). Hence, the World Health Organization (WHO) in 2005 proposed a strategy for control and prevention of NCDs, which offers a new global goal to the health community to reduce mortality rates from all chronic diseases by 2% per year during the next 10 years (3).

NCDs are estimated to contribute to almost 60% of mortalities worldwide and 43% of the global burden of disease in 1999. With current trends by 2020, NCDs are predicted to account for 73% of deaths and 60% of the disease burden (4). NCDs are already of major importance in developed countries and are rapidly turning into a major public health threat in the developing countries too. Over a period of 30 years, the burden of NCDs for developing and newly industrialized countries is expected to rise by more than 60% by 2020, less than a rise of 10% in developed countries (5).

The underlying cause of this epidemic is the increase in lifestyle-related risk factors resulting from social and economic changes. Obesity and overweight, arterial hypertension, inadequate physical activity, hypercholesterolemia and addiction are the first leading five risk factors, causing 68% of risk factors burden and 11% of total burden of diseases, leading to 1.6 million disability adjusted life years (6). Prevalence of NCDs' risk factors has been determined for many provinces of Iran. A reliable report of NCDs' risk factors as the national surveillance program conducted in Iran enrolled type II diabetes, hypertension and mean body mass index (BMI), smoking, high cholesterol and obesity (7).

With the transition in global economy, the distribution of BMI is shifting upward in many populations leading to an increasing proportion of obese people. This situation is putting more and more people to the risk of NCDs and uprising of mortality rate. It is, therefore, become imperative to study the obesity-related health issues and also the linkages between obesity and the risk factors related to NCDs. In this study, we investigated the prevalence of major risk factors for NCDs among health center personnel.

## Materials and Methods

In this descriptive cross-sectional study in 2019, a total of 285 volunteers aged 18-65 years old (staff who have worked in a health center for at least one year) were enrolled. The prevalence of NCDs' risk factors was defined for health center personnel as FBS, blood pressure, BMI, smoking of cigarettes or hookah and a high cholesterol level. Obesity was also considered as NCDs and the relationship between risk factors and NCDs was investigated. Pregnant or breastfeeding women, those who have had at least one month of continuous leave in the last 6 months were excluded from the study.

The analyses performed in a central laboratory using blood samples collected in a fasting state. Standardized enzymatic methods were utilized to measure plasma glucose concentrations in fasting

state, total serum cholesterol, HDL cholesterol, and triglycerides. Readings were recorded twice with a semi-automatic sphygmomanometer (Omron Hem 742 Int), following the procedure recommended by the European Society of Hypertension and the European Society of Cardiology (8). Age, sex, and weight were recorded using digital scales to the nearest 100 grams with the subjects minimally clothed and without shoes. Height was measured without shoes, with a tape measure.

Neck and waist circumferences were determined for each participant and recorded to the nearest millimeter using a standard flexible measuring tape (Rosscraft, UK) to provide an index of fat distribution (9). Waist circumference was assessed at the level midway between the lower rib margin and iliac crest (10). In order to minimize the error, all measurements were taken by the same person. Dietary intake evaluation was undertaken by a 24 hour dietary recall by trained nutritionists in a random day to obtain the 'usual intake'. For mixed dishes, food types were disaggregated before ingredients were categorized into appropriate food groups. Dietary diversity score (DDS) was measured through FAO questionnaire as a good indicator of the nutritional adequacy of diets (9).

Results were presented as means±standard errors (quantitative variables) or as frequencies (n) for qualitative variables. The general characteristics of the participants were analyzed with descriptive statistics. The independence hypothesis was tested with a  $\chi^2$  test. The 95% confidence intervals were estimated for each of the components and a significance level of 0.05 was used by applying SPSS software (version 19, SPSS Inc., Chicago, IL, USA) for statistical analysis.

## Results

A total of 283 staff with a mean age of 40.55 years and the mean weight of 71.60±0.78 kg were enrolled. The mean BMI was 26.80±0.25 kg/m<sup>2</sup>. The mean (±SE) waist circumference was 88.01±0.65 cm. Out of 283 participants, 102 (39.3%) had a waist circumference >90 cm (Table 1). They were classified into several groups based on their BMI; 17.9% of individuals were found in the upper (obese1-3) group having a BMI more than 30 kg/m<sup>2</sup>, while about 34.8% were in the normal weight category and the rest of participants (47.3%) were overweight. Central obesity was measured by waist circumference revealing 39.3% among participants (Table 2).

The number of participants diagnosed with hypertension was almost two times greater than those with high fasting plasma glucose (28.5% and 15.8%, respectively). It also appears that dyslipidemia was common among participants; while the total serum

**Table 1:** General and anthropometric characteristic of staff in Karaj Health Center, Karaj, Alborz, Iran (N=283).

Variable	Mean±SE	Range
Age (y)	40.55±0.48	25-64
Sex (F/M)	210/64(76.6/23.4) <sup>a</sup>	-
Weight (kg)	71.60±0.78	46-140
Height (cm)	163.12±0.48	145-187
BMI (kg/m <sup>2</sup> )	26.80±0.25	17.04-42.68
Underweight	3 (1.1) <sup>a</sup>	-
Normal weight (18.5-25)	92 (33.7) <sup>a</sup>	-
Overweight (25-30)	129 (47.3) <sup>a</sup>	-
Obesity (≥30)	49 (17.9) <sup>a</sup>	-
WC (cm)	88.01±0.65	65-130
NC(cm)	35.58±0.20	31-51

<sup>a</sup>n (%). BMI: Body mass index; WC: Waist circumference; NC: Neck circumference.

**Table 2:** Biochemical constituents of NCDs and blood pressure among staff in Karaj Health Center, Karaj, Alborz, Iran (N=283).

Variable	Mean±SE	Range	N (%) Abnormal
FBS (mg/dL)	91.18±0.98	65-203	35 (15.8)
TG (mg/dL)	129.53±5.61	32-831	63 (28.6)
TC (mg/dL)	181.3±2.45	100-323	64 (29)
LDL-C (mg/dL)	104.19±0.25	30-193	76 (44.6)
HDL-C (mg/dL)	51.89±0.76	26-99	133 (60.2)
SBP (mmHg)	108.59±0.79	80-170	75 (28.5)
DBP (mmHg)	72.43±0.61	40-100	96 (36.7)

FBS: Fasting blood sugar; TG: Triglycerides; TC: Total cholesterol; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; NCDs: Non-Communicable diseases.

cholesterol and triglyceride above the clinically significant cut off value (200 mg/dL and 150mg/dL) were found in 29% and 28.6% of participants. Almost half of participants (44.6%) had the serum low density lipoprotein cholesterol (LDL-C) lower than the protective level (100 mg/dL), while three quarters of participants (71.7%) had the serum high density lipoprotein cholesterol (HDL-C) lower than the protective level (40 mg/dL for women and 50 mg/dl for men) (Table 3).

Table 4 displays the mean and correlation of NCDs criteria in BMI group as an important risk factor of NCDs. Prevalence of hypertension, low physical activity, cholesterol, low-density lipoprotein (LDL), triglycerides (TG) and fasting plasma glucose increased steadily with increasing BMI. However, serum high-density lipoprotein (HDL) decreased steadily with increasing BMI. Regarding NCDs' risk factors, the odds ratio by using BMI-adjusted binary (normal and high BMI) logistic regression analysis (Table 4) for the prevalence of the obesity, no significant difference was found. BMI was correlated with all variables (number of children, age group and area of education). It is important to mention that the positive gradient was associated with older age and increased number of children and BMI ( $p<0.05$ ). On the other hand, prevalence of an elevated BMI as a

component of the NCDs was correlated with the area of education ( $p<0.05$ ) (Table 5).

## Discussion

In the present study, we conducted a population-based survey to assess the prevalence of NCDs' risk factors in Iran revealing the high frequency of risk factors in our population. The development of the concept of risk factors and their relationship to the incidence of NCDs evolved from prospective epidemiological studies in the United States and Europe. The identification of risk factors can lead to a decrease in NCDs' risk factors, through the reduction of modifiable risks, and better treatment decisions and via more accurate determination of overall risk status. Risk factors reduction is the primary clinical approach to prevent NCDs' morbidity and mortality. Epidemiological studies have clearly demonstrated that obesity, hypertension, use of tobacco and dyslipidemia are the major risk factors of NCDs which act in a synergistic manner. As the prevalence of risk factors for NCDs is increasing, and based on the clinical and cost burdens mounting, identifying the risks remains a national priority (11).

In this population-based survey among staff of Karaj Health Center, a high prevalence of obesity,

**Table 3:** Prevalence of NCD criteria among staff in Karaj Health Center, Karaj, Alborz, Iran.

Variable No. (%)			
BMI (kg/m <sup>2</sup> )			
Normal	Overweight	Obesity	
95 (34.8)	129 (47.3)	49 (17.9)	
WC (cm)			
<90	>90		
168 (60.7)	102 (39.3)		
SBP(mmHg)			
90-119	120-139	>140	
187 (71.4)	70 (26.7)	5 (1.8)	
DBP(mmHg)			
60-79	80-89	>90	
166 (63.4)	77 (29.4)	19 (7.3)	
Physical activity			
Low	Moderate	High	
163 (59.5)	79 (28.8)	20 (7.3)	
DDS			
DDS<3	DDS=5-6	DDS>6	
24 (9.2)	147 (53.3)	90 (34.5)	
FBS (mg/dL)			
FBS<100	100-126	FBS>126	
186 (84.2)	31 (14)	4 (1.8)	
TC (mg/dL)			
Chol<200	200-239	Chol>240	
157 (71)	51 (23.1)	13 (5.9)	
LDL(mg/dL)			
LDL<100	100-129	LDL>130	
107 (55.4)	74 (38.3)	12 (6.2)	
HDL(mg/dL)			
Female: 40>HDL	Male: 50>HDL	Female: 40>HDL	Male: 50<HDL
80 (45.7)	38 (82.6)	95 (54.3)	8 (17.4)
TG (mg/dL)			
TG<150	150-200	TG>200	
157 (71.4)	37 (16.8)	26 (11.8)	

BMI: Body mass index; WC: Waist circumference; DDS: Diet Diversity Score; FBS: Fasting blood sugar; TG: Triglyceride; TC: Total cholesterol; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; NCDs: Non-Communicable diseases.

**Table 4:** Correlation and binary logistic regression analyses of risk factor related NCDs by BMI, among staff in Karaj Health Center, Karaj, Alborz, Iran.

Variable	BMI			Pearson	p value <sup>#</sup>	OR (95% CI)	p value*
	Normal	Overweight	Obesity				
WC (cm)	78.79±0.56	89.41±0.67	101.71±1.33	0.76	0.001	1.48 (1.28-1.73)	0.00
MET	1193.39±219.3	819.67±110.22	692.48±149.47	-0.18	0.002	1.00 (1.00-1.00)	0.71
DDS	5.01±0.21	4.97±0.10	4.96±0.17	-0.05	0.43	1.08 (0.7-1.68)	0.71
FBS (mg/dL)	87.67±1.14	92.51±1.03	94.38±3.95	0.203	0.002	0.93 (0.89-0.99)	0.02
TG (mg/dL)	103.4±5.76	135.26±9.21	162.64±14.48	0.247	0.001	1.004 (0.99-1.01)	0.59
TC (mg/dL)	170.75±3.35	183.94±3.81	194.64±6.09	0.271	0.0001	1.02 (0.98-1.06)	0.27
LDL-C (mg/dL)	96.31±2.92	105.72±3.05	115.21±5.28	0.260	0.001	1.02 (0.96-1.04)	0.98
HDL-C (mg/dL)	54.31±1.40	51.62±1.07	47.98±1.55	0.174	0.01	0.98 (0.92-1.04)	0.65
SBP (mmHg)	105.33±1.33	107.83±1.08	116.47±1.68	0.304	0.001	0.97 (0.90-1.02)	0.23
DBP (mmHg)	69.36±1.09	72.40±0.79	78.16±1.38	0.30	0.001	1.04 (1.00-1.10)	0.02

#Correlation of NCD criteria by BMI group; \*Binary logistic regression analyses of risk factor related NCD; WC: Waist circumference; DDS: Diet Diversity Score; FBS: Fasting blood sugar; TG: Triglyceride; TC: Total cholesterol; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; NCDs: Non-Communicable diseases.

**Table 5:** Frequency of demographic factors associated with BMI among staff in Karaj Health Center, Karaj, Alborz, Iran.

Variable							Spearman	p value
Area of education	Physician	Nutritionist	Health care	Diseases	Health	Others		
Frequency	27	9	47	74	34	70	0.138	0.02
BMI	25.74±0.94	22.87±0.83	26.92±1.39	27.62±0.53	26.28±0.54	27.11±0.36		
Age group	<35	35-45		45-55	>55		0.19	0.002
Frequency	72	109		82	10			
BMI	26.18±0.53	26.54±0.37		27.57±0.46	29.76±1.33			
Family size	2	3		4	>4		0.5	0.42
Frequency	81	83		76	25			
BMI	25.72±0.49	26.70±0.42		28.03±0.48	28.65±0.64			

BMI: Body mass index.

overweight, and low physical activity was observed (65.2% and 59.5%, respectively). Identically, the age-standardized prevalence was estimated 65.4% in Karaj city according to Sib System Report. A comparison between our study and that of Sib System Report indicated a similar prevalence of obesity and overweight. Obesity was particularly common, exceeding 17.9 % among participants. A high prevalence of obesity and overweight, as expected existed which was in line with age and family size of some more recent studies (12, 13).

Regarding the large size of female participants, pregnancy and lactation could be the causative factors. Among various risk factors responsible for the development of NCDs as this study reported, obesity has been considered as a major risk factor. Totally, 5% of NCDs have strongly been associated with obesity and overweight (14, 15). The prevalence of obesity and overweight was different according to the area of education, and the prevalence varied between groups. Nutritionist had the lowest BMI; although diseases committee showed the largest BMI. It is suggested that nutritional knowledge is decreasing and affecting BMI which is in line with recent studies for the importance of education (12, 16).

Hypertension was less common than obesity and overweight; although hypertension was higher than other previous studies (17, 18). Obesity and overweight changes were increasing and affecting hypertension in participants that was in line with recent studies (19, 20). Lack of physical activity was particularly common among participants showing that almost 60% of staff were inactive revealing to be higher than other studies in the past (17, 18, 21). Lack of physical activity was associated with overweight and obesity that was in line with several studies (22-25).

Our data illustrated no clear correlation between BMI and dietary diversity among staff of Karaj Health Center. Although a high dietary diversity

is widely recommended, our data did not show a significant association between dietary diversity score and BMI status that may be due to lack of balanced distribution among food diversity groups. In line with our study, several researchers reported no correlation between BMI and dietary diversity score (26-28). On the contrary, an inverse association between dietary diversity score and obesity/abdominal adiposity was reported among the female students of Isfahan University (29); and others (30), which may be due to use of different methods for assessing dietary intake and determination of dietary diversity score (29, 30).

Uncontrolled FBS was found among 4% of the staff which was lower than Health Center Statistics Report in public areas of Karaj (7%). Our data denoted to a significant association between FBS and BMI; which is similar to findings of other studies (31-34). Cardiovascular diseases (CVDs) were the leading cause of 30 % of mortality worldwide (35) and up to 50 % of deaths in Iran (36). The association between different lipid measures and cardiovascular diseases and mortality have been shown in other studies (37-39). Based on the results of this observational study, high prevalence of abnormality of lipid profile, HDL abnormality was much more common than other lipid profiles (more than 60%). The cholesterol contained within HDL was inversely associated with risk of coronary heart disease and was a key component of predicting cardiovascular risk (40).

We found a considerably high prevalence of lipid disorders that is consistent with the high prevalence of overweight in the studied population (37-40). So, a good way to reduce NCDs is through altering blood lipid levels, which is related to BMI and lifestyle. The main limitation of this study was inherence in the characteristics of the cross-sectional study, that is, the associations between BMI and the studied variables that cannot be interpreted as causal correlations. Also, the staff that controlled their diseases with

medication were ignored.

### Conclusion

There was a higher prevalence of NCDs' risk factors among the older participants, large families, those who were overweight based on BMI. The prevalence of overweight, obesity, and inactivity was reported high. After adjusting for age, the frequency of NCDs' risk factors was shown to be associated with BMI. So BMI and physical activity were important factors to be considered in interventions against NCDs. Implementing specific actions towards the improvement of the life style to reach or maintain a healthy nutritional status could contribute to the prevention of this problem in the population.

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### Conflict of Interest

None declared.

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