

## Anthropometric Risk Predictors of Cardiometabolic Disorders among Farmers

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### ABSTRACT

Change in the form of doing the task in some occupations such as farming has led to overweight and obesity as a threatening factor for farmer's health. This study aimed to compare the anthropometric indices of obesity and fatness as the predictors of cardiometabolic disorders among rural farmers in the northern part of Iran. This cross-sectional study was carried out in 2012 on subjects whose first or second jobs were farming, aged over 18 yrs and lived in Babol City, northern Iran. The anthropometric indices in this study included Body Mass Index (BMI), Waist Circumference (WC), Waist-to-Hip Ratio (WHR) and Conicity Index (CI). Among 300 studied farmers, 66.7% suffered from overweight and obesity, in which female farmers were more frequent than male farmers ( $P < 0.05$ ). Farmers aged over 55 yrs had the highest frequency of overweight (46.5%), and those between 45-55 yrs had the highest frequency of obesity (26.7%). According to WC, WHR, and CI, 78.3%, 84.3%, and 84.6% of the studied farmers were at risk of cardiometabolic disorders, and their adverse effects, respectively and these problems were more probable in females. Chi-square test illustrated a significant relationship between age, WC, and CI. The educational level had not a significant relationship with any of the anthropometric indices. Although obesity is a risk factor for cardiometabolic disorders in both sexes, the issue mentioned in females and old age needs much more attention. Therefore, further investigations and interventional measures are necessary in order to prevent overweight and obesity among farmers.

**KEYWORDS:** *Obesity, Overweight, Farmer, BMI, Conicity index, Cardiometabolic disorders, Predictor, Occupational health*

### INTRODUCTION

During the recent decades, world-spread overweight and obesity have obviously increased. Globally, during the past 30 years, overweight in men and women has increased from 22.8% to 31.7%, and 25.7% to 34.9%, respectively [1]. Weight-gain and obesity are seriously prevalent and are the main reasons for the high rate of cardio-

metabolic disorders in the society, in Iran. In individuals aged more than 30 yrs in urban districts, rural areas of Tehran and in other villages not yet civilized, the observed rate of obesity and overweight were up to 82%, 72%, and 44%, respectively [2-3].

In the recent years, the worldwide prevalence of obesity engaged with industrialization and mechanical life has passed the pandemic criteria [4] and has become the most

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prevalent health problem in most countries [5]. Obesity and overweight cause mortality as well as staggering costs to medication systems, people and the society [6-7]. According to the current significant progress in the treatment of diseases and consequently increase in life expectancy, obesity is introduced to be the first reason for life expectancy reduction in the next 100 years [8].

Over the past 40 years until now, rural obesity has changed due to a shift in lifestyle and the neglect of traditional lifestyle. Taking into account the adverse health-related outcomes of obesity, the survey of rural obesity has an undoubted importance [9-11]. Obesity and overweight in farmers (as a numerous rural occupational group) have the same statements discussed in community studies. In Africa, implementation of a screening program on 845 rural people, including 305 farmers aged above 18 years, showed that the prevalence of obesity and overweight, as predictor indices for diabetes and blood pressure, was 32.4% [12-13]. The prevalence of obesity and overweight in Mazandaran Province (north of Iran), has been more than other provinces. In addition, prevention of its growth is of regional and national priorities [14].

Anthropometric indices engaged with obesity status, which predicts the cardiometabolic diseases like cardiovascular disease and metabolic syndrome include Body Mass Index (BMI), Waist Circumference (WC), Waist-to-Hip Ratio (WHR) and Conicity Index (CI) [13]. Each of them has an impact on the determination of the type of obesity and fat distribution, and consequently on their adverse outcomes.

According to multiple health-related problems caused by obesity and fatness in the workforce including increasing rate of cardiovascular diseases, musculoskeletal disorders, occupational asthma, some illnesses due to neurotoxic agents [15]. Along with the lack of actual information about the prevalence of this health-related problem among different occupational groups involving farmers (the most popular job in this region), the present study aimed to evaluate the prevalence of overweight and obesity via the most important anthropometric indices that predict the cardiometabolic disorders among rural farmers located in Babol City, Iran.

## MATERIALS AND METHODS

This cross-sectional study was conducted on farmers of Babol, in central south part of Caspian Sea coast, Iran. The sample size was taken to be 256 based on 95% confidence level, and the maximum standard error of estimation of 5%, and prediction of prevalence obesity for 20% among studied farmers, which according to the chance of missing, was later increased to 300. Studied subjects were selected through the multistage

sampling technique including cluster, stratified and simple random methods. In the first stage, we considered 12 health care centers (HCCs) as clusters in the four cardinal directions of the Babol City according to rural population density and geographical distribution of HCCs. In each cluster, we recruited 25 individuals randomly, stratified by 17 men to 8 women in each cluster, based on sex distribution of farmers in this region.

Inclusion criteria were individuals aged less than 18 years whose first or second job was farming, having owned and leased a farm, or worked in land partnership. After filling agreement form, the information related to farming, physical activities, and anthropometric measurements was collected from all the subjects by a trained medical student and recorded on special forms. Weighing with minimal clothing was done via the Japanese Omron weighing scale with the accuracy of 0.1 kg and height measurement was taken while standing in heel-together, and without wearing shoes and hat using German Seca stadiometer with 0.1cm accuracy. Farmers who had not any chronic disorders like as hypertension, diabetes and hyperlipidemia were considered as healthy subjects.

Waist measurement was taken with minimal clothing from the superior iliac to the base of rib 12 around the navel via flexible tape measure. Hip measurement was taken with minimal clothing from the anterior-superior iliac spine (ASIS) from the widest part [16]. Obesity-and-fat-accumulation-related anthropometric indexes in the body are as follows: A: BMI (BMI is obtained as the body mass in kg divided by the square of the body height in meter and its ranges are underweight: under 18.5 kg/m<sup>2</sup>, normal weight: 18.5 to 24.9 kg/m<sup>2</sup>, overweight: 25 to 29.5 kg/m<sup>2</sup>, obese: over 30 kg/m<sup>2</sup>) [17]. B: WC (with cut-off points of 90 and 80 centimeter for women and men, respectively in order to meet the WHO guidelines for the risk of catching cardiometabolic diseases) [18], C: WHR (with cut-off points of 0.85 and 0.76 for men and women, respectively as risk threshold for catching cardiovascular diseases) [19] and the CI ( $CI = \frac{\text{abdominal circumference (m)}}{0.109 \cdot \sqrt{\frac{\text{weight (kg)}}{\text{height (m)}}}}$ )

for cardiovascular diseases with threshold risks of 1.25 and 1.18 for men and women, respectively).

Data were coded, entered into the data sheet and then analyzed by descriptive and analytical statistical test such as Chi-square test using SPSS ver. 18 (Chicago, IL, USA). Significant levels in all the tests were considered less than 0.05.

## RESULTS

All selected individual participated (response rate 100%). Of 300 studied individuals including 205 male and 95 female farmers, median,

the lowest and the highest ages were 51, 18 and 80 yrs, respectively. Farmer's demographic information has been presented in Table 1.

**Table 1.** Age and educational level distributions of farmers of Babol rural distinct in 2014

Demographic information		Men	Women
		Frequency (%)	Frequency (%)
Age groups (yr)	<45	64 (32.1)	32 (33.7)
	45-55	57 (27.8)	33 (34.7)
	>55	84 (41.0)	30 (31.6)
Educational level	Illiterate or elementary school	137 (66.8)	78 (82.1)
	Secondary school or high school	39 (19.0)	13 (13.7)
	Higher than diploma	29 (14.1)	4 (4.2)

27.66% of farmers had leisure-time physical activities. Total and gender-based obesity according to BMI has been illustrated in Table 2. Most of the

farmers (66.7%) had overweight and obesity problems which were more prevalent in women than in men ( $P=0.001$ ).

**Table 2.** Babol Farmer's obesity status based on BMI and age in 2014

Obesity status (BMI)	Men	Women	Total
	Frequency (%)	Frequency (%)	Frequency (%)
Underweight	4 (2.0)	0	4 (1.3)
Normal	78 (38.0)	18 (19)	96 (32.0)
Overweight	85 (41.5)	46 (48.4)	131 (43.7)
Obese	38 (18.5)	31 (32.6)	69 (23.0)
Total	205 (100)	95 (100)	300 (100)

According to age distribution, the highest frequency of overweight belonged to farmers aged over 55 yr (46.5%) and the highest frequency of obesity was observed in 45-55 yr (26.7%) while 34.4% of the under-45-year-old surveyed people were in normal weight. Based on anthropometric indices including WC, WHR, and CI, which predict the cardiometabolic diseases, most of the studied farmers (78.3%, 84.3% and 84.7%, respectively) were at "high risk" level of these indices for cardiometabolic disorders, and totally, women had

higher risk than men (Table 3). Based on WC and WHR, 45-55-year-old and less than 45-yr-old farmers were in the highest and the lowest risks of cardiovascular diseases, respectively. Whereas the CI showed that 55-yr-old farmers were more likely at risk for cardiovascular diseases than 45 to 55-year-old subjects (Table 3). Apart from BMI and WHR indices, and based on CI and WC, the risk of metabolic diseases was increased by aging. Nevertheless, the educational level had a significant relationship with none of these predictive indexes.

**Table 3.** The distribution of risk levels of cardio metabolic diseases based on waist circumference, waist-to-hip ratio, and Conicity Index in Babol farmers according to gender, age, and educational level

cardiometabolic risk levels	Demographic information												
	Risk level	Gender			Age groups					Educational level			P
		Men Frequency (%)	Women Frequency (%)	P	<45 Frequency (%)	45-55 Frequency (%)	>55 Frequency (%)	P	Illiterate or elementary school Frequency (%)	Middle school or high school Frequency (%)	Higher than diploma Frequency (%)		
Waist circumference	Normal	64 (31.2)	1 (1.1)	0.000	27 (28.1)	12 (13.3)	14 (22.8)	0.047	45 (20.9)	11 (21.2)	9 (27.3)	0.839	
	High	141 (68.8)	94 (98.9)		69 (71.9)	78 (86.7)	88 (77.2)		170 (79.1)	41 (78.8)	24 (72.7)		
Waist-to-hip ratio	Normal	46 (22.5)	0	0.000	17 (28.1)	15 (13.3)	74 (86.7)	0.499	36 (16.8)	6 (11.5)	4 (12.2)	0.740	
	High	158 (77.5)	95 (100.0)		79 (71.9)	74 (86.7)	100 (77.2)		178 (83.2)	46 (88.5)	49 (87.8)		
Conicity index	Normal	40 (19.5)	6 (6.3)	0.030	24 (25.0)	7 (7.8)	15 (13.2)	0.004	31 (14.4)	11 (21.2)	4 (12.2)	0.057	
	High	165 (80.5)	89 (93.7)		72 (75.0)	83 (92.2)	99 (86.8)		184 (85.6)	41 (78.8)	29 (87.8)		

As is seen in Table 3, 68.7% of farmers with leisure-time physical activity were faced with overweight and obesity; whereas the same status for farmers who did not exercise were 65.9% ( $P=0.515$ ). Among subjects with chronic diseases, 39.9% and 27.7% were overweight and obese, respectively; whereas these rates in healthy subjects were 47.4% and 18.4%, respectively ( $P=0.167$ ). Among subjects who had second jobs (apart from farming), 67.8% had excessive fat accumulation, while this problem was observed in 66% of subjects whose jobs were just farming ( $P=0.932$ ). In addition, according to the farmland area, the frequency of obese and overweight subjects non-significant differ (65.4% and 65.9%) by increasing in the farmland area (less than 5000m<sup>2</sup> compared with more than 10000 m<sup>2</sup>) ( $P=0.237$ ).

## DISCUSSION

The most of the farmers were at risk of cardiometabolic diseases, and this risk was higher among female subjects. WC and CI revealed that the higher risk gets more serious with age, and can be linked to the various cardiometabolic disorders including diabetes, hypertension, and hyperlipidemia as well as other metabolic disorders that may lead to some adverse effects on farmer's life and occupational performance.

Overall, 505 rural farmers in the southern part of Greece were examined and demonstrated that 42.9% and 43.2% of subjects were overweight and obese, respectively; which was due to the higher intake of daily calories along with lower physical inactivity [9] in line with the findings of this study. In an investigation on 340 farmers of northern parts Iran, 49.1% and 2.4% of farmers were overweight and obese, respectively. It was due to worldwide obesity and alignment of these results with changes in lifestyles among the population of developing countries such as Iran [14].

In China, among 100000 rural people, 4.5%-47% were overweight, and 0.1%-6.4% was obese, and this confirms our findings [20]. With the glance at farming as a seasonal activity and farmer's inactivity time after harvesting, farming is linked to overweight and obesity. In contrast, the survey of the prevalence of obesity among Saskatchewan rural people, the highest frequency of obesity was observed among people who were not farmers [21]. This difference can be due to the differences in climate, ethic, and diet, type of farming activities, lifestyle or the age spectrum.

Obesity and fatness were more frequent in female farmers in the present study. In line with this study, a survey on 3600 residents of Mazandaran, aged between 20-70 years, showed the higher frequencies of overweight and obese women compared with men. In detail, the prevalence rates of overweight were almost the same in both sexes, but they indicated the almost 3-times more

frequency of obesity in women rather than in men [22]. The reasons were obtained as women's inactivity compared with men, early marriage, the number of childbirths and the role of female sex hormones.

In a study on 2102 residents of Tehran, they reported higher prevalence rates of obesity in women and overweight in men, respectively, that is consistent with this study and other related studies. Higher rates of obesity and overweight among female farmers can be caused by the long time they spend at home as housewives as well as the short time they spend on farmland for farming beside their husbands [23].

According to the WC and CI, there was a significant relationship between obesity and age in this study which was in line with investigation [22] and other related investigations carried out in Iran [23-24] as well as in Canada [25], Lebanon [26], Saudi Arabia [27] and Bahrain [28].

In this study, no significant correlation was observed between obesity, overweight and educational level; however, in a survey in Tehran and China, observed significant relationships between obesity, overweight and educational level [29-30] and they can be caused by having dietary knowledge or proper diet. Moreover, no association between educational level and BMI in this study was due to the limited sample size, etc. Also, the relationships between WC, age, and gender were significant so that in females and elderlies, it was more than in males and youngsters. In a study on 2428 urban and rural people in the northern part of Iran, according to the WC, 15.9% of men and 56.7% of women had abdominal obesity, which was because of their housewifery status [31]. Based on a study on people from 28 provinces of Iran aged over 15, there was a significant relationship between gender and abdominal obesity. In addition, 43.3% of females and 9.7% of males had abdominal obesities, both based on WC [32]. Based on WC, abdominal obesity was in the relationship between aging and gender [33-34]. Moreover, high rate of women's abdominal obesity in the present study, caused by early marriage, childbirth at early ages, the number of childbirths and their less participation in farming, is consistent with recent findings. According to WC, abdominal obesity status had not a significant relationship with educational level in this study. Illiterate men and women had 20% and 31% more abdominal obesities than people had educational experiences of 1-9 yrs, respectively; this was caused by low socioeconomic status as well as the lack of health-related education during study periods [31]. In a study on rural and urban populations of four provinces of China, aging over 60 showed that literate farmers have lower WC than sedentary illiterate workers. In addition, farming and educational level had indirect significant relationships with abdominal obesity [35].

Based on the WHR, women are significantly placed at a high-risk group than men (except age and educational points of view); in the study in the USA, the frequency of obesity among over 55-year-old women was insignificant relationship with aging, based on WHR [36-37].

In this study, based on CI, females and older farmers were at high risk of catching cardiometabolic diseases. There was a significant relationship between educational level and abdominal obesity according to the CI; however, no significant relationship was observed between age and gender [9]. In this study, no relationship was observed between fatness and obesity indexes with variables including type of farmland owned, use of agricultural machinery, the cultivated area per farmer, having chronic diseases, leisure-time physical activity and having a second job. It may be because of the insignificant roles of the mentioned variables, as well as the probable inadequate dimensions of the study. Among all variables, the prevalence of obesity by increasing physical activities was reported [33, 38]; and having exercise was reported in many studies [39]. Amount and location of fat accumulation diseases in surveyed farmers, as predictor indices for cardiometabolic disorders, were high. This problem was more serious among older people and females. Rural old women were at higher risks of catching cardiovascular diseases, diabetes, and hyperlipidemia, etc. Thus, considering the high prevalence of obesity in the surveyed region and especially among children [40] as well as its mental and physical adverse effects on older ages and future generations, women require more considerations and planning than men. Inaccessibility to samples during the daily working hours, lack of participation of requested farmers due to inattention and non-personal profit, no tension or truth in answering the required personal information including age, farmland ownership, diseases etc., were the limitations researchers faced while doing the survey.

## CONCLUSION

In this regard, planning and preparing healthy diets as well as having regular physical activities during less farming time are recommended. Additionally, further researches to collect detailed databases, identify rural at-risk groups and to do interventional studies for promoting the farmers' awareness and welfare can demonstrate solutions that are more efficient and conclusions.

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## CONFLICT OF INTERESTS

Non Declared

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