



# Study of the Prevalence of overweight and its Associations with diabetes in Miyandoab city in Iran

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## ABSTRACT

The increasing prevalence of overweight & obesity and its related disorders with diabetes was the aim of present study in Miyandoab city / West Azerbaijan province / north-west of Iran which has been chosen because of the lack of available documents about the prevalence of overweight, obesity and diabetes in this city. A cross-sectional study that was done emphasizing on overweight to determine its association with diabetes. The sample of the study included 84 patients referring to nutrition ward of Fatimah Hospital, who were matched in BMI, gender, age group and educational status. The data included demographic and anthropometric parts. Its validity and reliability was confirmed. The data was analyzed by SPSS20 chi-square test, and  $p < 0.05$  was considered the significant level. Eighty four patients, females ( $n=58$ ; 69% of samples) and males ( $n=26$ ; 31% of samples) entered in this study. The date of the study was from September 2011 up to April 2012.

**Key Words:** Overweight, Diabetes, Iran, Prevalence.

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## INTRODUCTION

In recent years, there has been a marked change in life-style of Iranian population caused by urbanization, affluence, and dietary westernization. Few studies on the prevalence of overweight and its association with diabetes considering Iranian population have been reported. Since diabetes in overweight people is more prevalent than normal people, in this study, it was decided to investigate this association. Diabetes is on the rise. Nowadays, diabetes is not a disease of just predominantly developed countries anymore, it has been steadily increased everywhere, especially in the world's middle-income nations.

Globally, it has been estimated that there were 422 million adults suffering from diabetes in 2014, which were 108 million in 1980. Unluckily, in most of the regions, the prevention and treatment of diabetes, especially for the people of modest means, have not been done appropriately

because of the lack of effective policies to provide supportive environments for healthy lifestyles and also the lack of access to suitable health care.

1.5 million deaths in 2012 were caused by Diabetes. An additional 2.2 million deaths were the result of higher-than-optimal blood glucose, by enhancing the risks of cardiovascular and other diseases. Forty-three percent of these 3.7 million deaths occurred before the age of 70 years. In low- and middle-income countries, the prevalence of deaths caused by high blood glucose or diabetes occurring before the age of 70 s has been higher than in high-income countries. Not controlling diabetes leads to tremendous consequences for health and well-being. [1]

### Expression:

Since 1980, the prevalence of diabetes has almost doubled, increasing from 4.7% to 8.5% in the adult population. This phenomenon indicates that associated risk factors like being overweight or obese have been increased. During the

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past decade, diabetes has been getting more prevalent in low- and middle-income countries with a faster speed compared to the high-income countries. [2] Statistics released by the International Federation of Diabetes have suggested that more than 418 million adults worldwide are affected by diabetes, and by the next 25 years, this figure will reach over 600 million. Estimates suggested a doubling in the number of people with diabetes in the Middle East and North Africa, from 35 million and 400,000, to 72 million and 100,000. In Iran, over 12% of adults have diabetes, which has become a health and social problem. Basically, the main goal in treating diabetes is to place diabetic in a condition that can have uninterrupted, active, healthy and long life. [3] Overweight and obesity raise the risk for type 2 diabetes, heart disease and stroke. They can also increase the risk of high blood pressure, unhealthy cholesterol and high blood glucose (sugar). If a person is obese, losing weight may help him (her) prevent and manage these conditions. He (or she) doesn't have to lose a lot of weight to improve his (her) health—even losing 10-15 pounds can make a big difference. [4] Additionally, diabetes and its complications can tremendously affect the financial status of individuals and their families, and consequently the economy of the countries. Diabetes patients who require insulin as a life-saving medicine, would have to spend a lot of money when its price is not affordable. Globally, millions of people live with diabetes or have someone close living with diabetes. There has not been found any cure for all types of diabetes, yet. However, this disease can be treated in spite of being frightened, annoyed, and frustrated, and people with diabetes can have long, healthy, and happy lives. [5] A diabetic person can easily prevent complications of diabetes by participating in diabetes classes as well as consistently controlling their blood glucose and having HbA1c hemoglobin at normal or near normal levels.

Complications of diabetes:

1. Early complications
  - 1.1 Ketoacidosis or diabetic coma is a metabolic disorder
  - 1.2 hyper-osmolar cancers
  - 1.3 Blood glucose lower than 60 mg per day threatens the risk of human hypoglycemia
  - 1.4 When blood glucose increases, there is no proper relationship between the need and the presence of insulin in the body. Cases that may lead to hyperglycemia include low physical activity, forgetfulness about insulin injections or taking medications, illnesses and gastritis
2. Late complications
  - 2.1 Eye disorders
  - 2.2 Nephropathy (Kidney Disease)
  - 2.3 Neuropathies
  - 2.4 Cardiovascular disease. [6]

## The importance of the subject

Overall Numbers, Diabetes and Prediabetes

Prevalence: In 2015, 30.3 million Americans, or 9.4% of the population, had diabetes.

Approximately 1.25 million American children and adults have type I diabetes.

Undiagnosed: Of the 30.3 million adults with diabetes, 23.1 million were diagnosed, and 7.2 million were undiagnosed.

Prevalence in seniors: The percentage of Americans age 65 and older remains high, at 25.2%, or 12.0 million seniors (diagnosed and undiagnosed).

New Cases: In the US, 1.5 million people are diagnosed with diabetes annually.

Pre-diabetes: In 2015, 84.1 million Americans more than 18 years old, had prediabetes.

Deaths: In 2015, Diabetes was found to be the 7th leading cause of death in the United States, and it was identified as the underlying cause of 79,535 deaths, and in a total of 252,806 death, diabetes was recognized as the underlying or contributing cause of death.

Diabetes in Youth

In the US, almost 193,000 Americans under the age of 20 consisting almost 0.24% of the population have been estimated to be diagnosed as having diabetes.

In 2011—2012, the yearly occurrence of diagnosed diabetes in youth was found to be 17,900 with type 1 diabetes, and 5,300 suffering from type 2 diabetes.

Diabetes by Race/Ethnicity

The rates of diagnosed diabetes in adults considering the race/ethnicity:

7.4% of non-Hispanic whites

8.0% of Asian Americans

12.1% of Hispanics

12.7% of non-Hispanic blacks

15.1% of American Indians/Alaskan Natives

The breakdown among Asian Americans:

4.3% for Chinese

8.9% for Filipinos

11.2% for Asian Indians

8.5% for other Asian Americans.

The breakdown among Hispanic adults:

8.5% for Central and South Americans

9.0% for Cubans

13.8% for Mexican Americans

12.0% for Puerto Ricans.

Deaths:

In 2015, Diabetes was found to be the seventh major cause of death in the United States considering the 79,535 deaths in which diabetes was reported as the underlying cause. In 2015, in the total number of 252,806 death, diabetes was found as causing death.

The death causing effect of diabetes may have been underreported. Studies have indicated that just about 35%

to 40% of people with diabetes who died had been reported to have diabetes anywhere, and only in approximately 10% to 15%, it was reported as the underlying cause of death.

Cost of Diabetes (Updated March 22, 2018)

\$327 billion: Total costs of diagnosed diabetes in the United States in 2017

\$237 billion for direct medical costs

\$90 billion in reduced productivity

After adjusting for population age and sex differences, average medical expenditures among people with diagnosed diabetes were 2.3 times higher than what expenditures would be in the absence of diabetes. [6]

#### Literature Review about overweight and Diabetes

Damian et al., (2017) stated that the prevalence of overweight and obesity among type 2 diabetic patients attending diabetic clinics was 85.0% (n = 193). Of them, 44.9% were overweight and 40.1% were obese. [7] The results of the study done by Chen et al., (2018) indicated that weight loss but not weight gain increased all-cause mortality and CVD mortality in overweight or obese adults with diabetes. [8] Salehidoost et al., (2018) represented a U-shaped association between BMI and all-cause mortality in patients with type 2 diabetes with the lowest risk observed among the obesity patients. [9] Maksymets et al., (2018) remarked that the modification of lifestyle and individual approach to pharmacologic correction of dyslipidaemia in overweight and obese patients helped to avoid the development of insulin resistance, which is a predictor of type 2 diabetes mellitus. [10] Again, Chen et al. (2016) declared that the prevalence of non-alcoholic fatty liver disease in overweight and obese patients with Type 2 diabetes in South China was high, and multiple metabolic disorders were significant. [11] Damian et al. (2017) stated that lifestyle-based weight loss intervention trials in type 2 diabetes led to average and modest reductions in weight and HbA1c levels, but the results were heavily influenced by one trial. [7] The efficiency of lifestyle-based interventions in treating type 2 diabetes can be confirmed by evidence-based approaches, and future investigations are needed to identify their maintenance and cost effectiveness (Terranova et al. 2015). [12] Pinhas-Hamiel et al., (2014) represented the more prevalence of overweight rather than obesity among women with T1DM. And also, metabolic syndrome and its components were found to be more prevalent among overweight and obese individuals with T1DM comparing to the normal weight individuals. [13] Zhu et al, (2013) reported the low prevalence of type 2 diabetes among school-aged children in Tianjin, China. However, Type 2 diabetes-related

factors were very common, especially overweight and obesity. [14] All of these researchers confirmed that there is a correlation between obesity and type 2 diabetes.

The high rate of overweight and obesity (31.8%) emphasized the need for developing further strategies to prevent and treat excess fat accumulation in T1D. [15]

Saunders et al., (2000) contended that a research is valid if only it actually studies what it is set out to study. [16]

There are three methods for establishing validity. Saunders et al. (2000) explained that construct validity entails establishing accurate operational measurements for the core concept of the research. [16] This was accomplished by establishing a chain of evidence throughout the data collection process; by confirming the key information by using multiple sources of information; and presenting the information with a draft of the study for review. Fortunately, the data of this study collected from the patients referred to the nutrition ward directly, and the data were recorded in paper as well as in computer, and they were accessible any time. And also, the validity of the research was tested several times.

#### ANALYSIS:

The BMI (Body Mass Index) was calculated based on the weight and height. Obesity and overweight were defined based on BMI score using CDC chart. SPSS (VER 20) was used for the statistical data analysis. Chi-square test was used for the analysis. The value under 5% was considered significant. The findings indicated that the mean of body index (BMI) in overweight samples were  $27.8 \pm 1.3$  in females, and  $27.2 \pm 1.1$  in male samples, namely BMI in females samples was greater than males. The mean of body index BMI in obese samples were  $34.1 \pm 2.5$  and  $32.9 \pm 1.8$  in females and males, respectively. 4 samples had BMI more than  $40 \text{ kg/m}^2$ , in this study, all of them were females, the mean BMI of extremely obese people was  $43.0 \pm 1.3$ . The mean BMI of normal weight samples was  $21.9 \pm 1.6$ , and the BMI of the under-weight samples was  $17.3 \pm 0.7$ . The details have been shown in table 1. In this study, underweight was defined by BMI of less than or equal 18.5, and normal weight was defined by BMI of 18.5 .0 to 24.9.

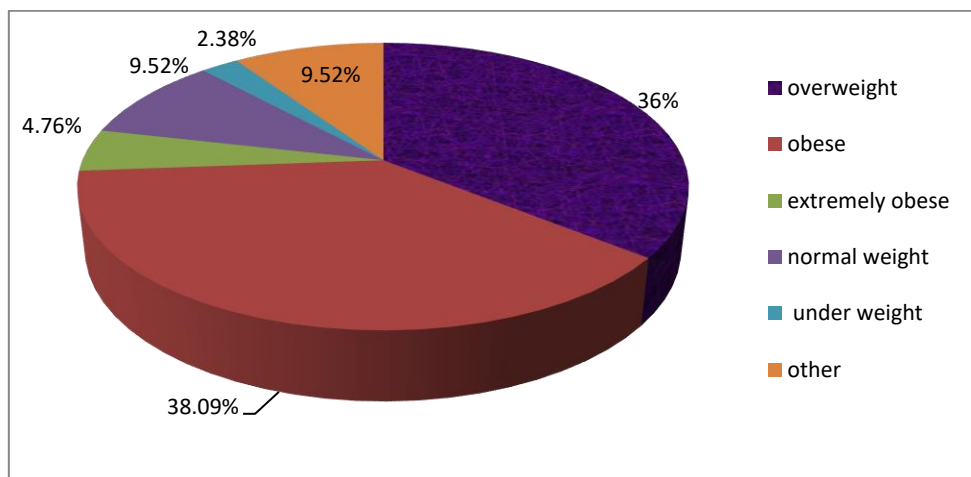
#### Overweight: namely BMI of 25.0 to 29.9

Obese: according to WHO criteria is BMI of 30.0 to 39.9  
Extremely obese: the BMI of greater than 40 or equal has been defined as extremely obese. The mentioned definitions have been accepted by many health organizations such as: WHO, FAO, etc.

**Table 1: Prevalence of overweight and obesity by mean BMI and sex. Data are mean ±SE and P<0.05**

Case	BMI	Frequency	Percent	Cumulative Percent	Mean BMI	
					F	M
Over weight	25≤BMI≤29.9	30	35.7142	35.7142	27.8±1.3	27.2±1.1
Obese	30<BMI≤39.9	32	38.0952	73.8094	34.1±2.5	32.9±1.8
Extremely obese	BMI≥40	4	4.7619	78.5713	43.0±1.3	0
Normal weight	18.5BMI≤24.9	8	9.5238	88.0951	21.9±1.6	22.3±1.8
Under weight	BMI<18.5	2	2.3809	90.476	17.3±0.7	0
Other	This group is not included the BMI definition	8	9.5238	100	15.2±2	15.0±0.8
Total	-	84	100	-	-	-

\* Data was analyzed by SPSS20 by chi-square test, and p<0.05 was considered significant.



**Fig. 1. Percentage distribution of Samples referred nutrition ward by BMI Status**

As can be seen in figure1, according to the findings, about 36% of the subjects were overweight, and 38.09% of subjects were obese, and 4.76% of the subjects were extremely obese. Meanwhile, only 9.52% of the samples had normal weight, and 2.38% of patients had underweight, and 36% of the samples had overweight (including 30 people).

As table 2 shows, only 2 male patients, namely 2.38% of the samples were under the age of 18.

At the age range between 18-30, one male patient namely 1.19% was overweight.

At the age range between 30- 60, there were 19 people, namely 22.61% of the samples, therefore, for the age greater than 60, there were 5 females (5.595%), and 3 males (3.571%).

The most recent international data on overweight in many countries have shown terrible statistics on overweight and obesity, this study in spite of being done in small population, was in agreement with national and international studies. Actually, overweight is worrisome; and governments should take practical actions immediately, otherwise, they would have to spend more for cure in the coming years. It is important to note the report of W.H.O about overweight, the report is the following:

More than 40 million children under the age of five were overweight in 2010.

In 2008, more than 1.4 billion adults, 20 and older, were overweight. Of these, over 200 million men and nearly 300 million women were obese.

Overweight and obese are the major risk factors for non-communicable diseases such as: Cardiovascular diseases (mainly heart disease and stroke), which were the leading cause of death in 2008; Diabetes; Musculoskeletal disorders (especially osteoarthritis - a highly disabling degenerative disease of the joints); Some cancers (endometrial, breast, and colon).

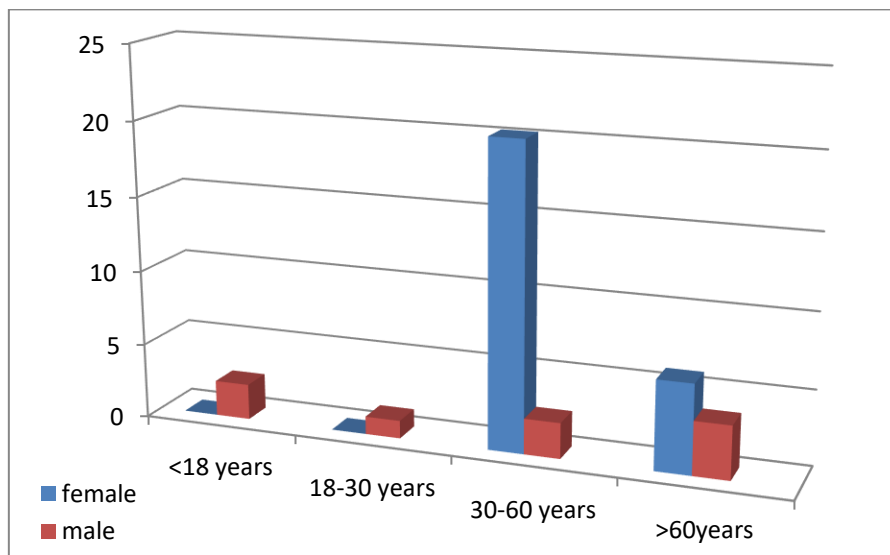
The risk for these non-communicable diseases increases with the increase of BMI.

Childhood obesity has been associated with a higher chance of obesity, premature death and disability in adulthood. But in addition to the increased future risks, obese children experience breathing difficulties, increased risk of fractures, hypertension, and early markers of cardiovascular diseases, insulin resistance, and psychological effects.

Table 2 and figure 2 show the overweight subjects by age and sex.

**Table 2: Age-Adjusted prevalence of overweight by sex**

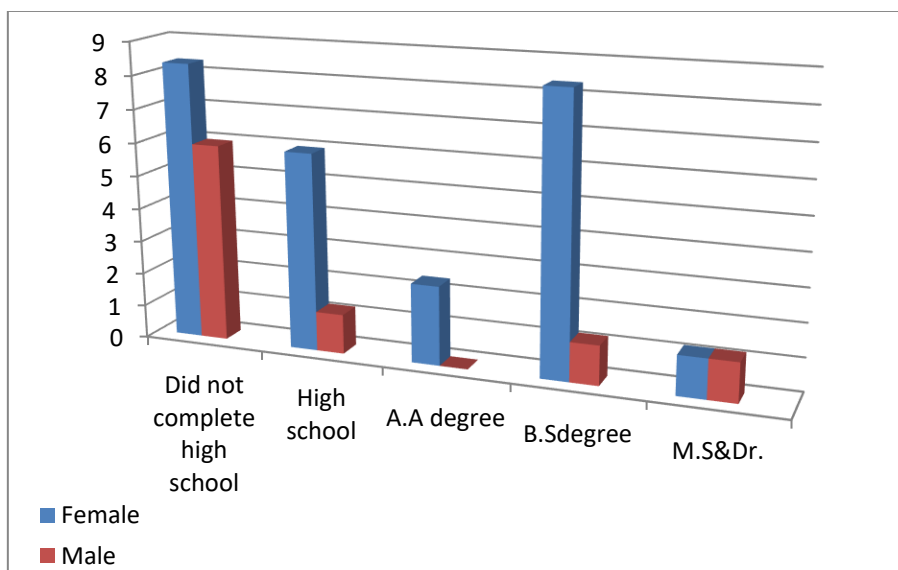
Age	Sex			
	F		M	
	Frequency	Percent	Frequency	Percent
<18years old	0	0	2	2.380
30-18years old	0	0	1	1.190
60-30years old	17	20.238	2	2.380
>60years old	5	5.952	3	3.571
Total	22	26.19	8	9.523



**Fig. 2: Chart of overweight subjects by age and sex**

**Table 3. Percentage distribution among overweight subjects by sex and education status**

case	Level of education	Sex			
		F		M	
		Frequency	Percent	Frequency	Percent
Over weight	Did not complete high school.d	7	8.333	5	5.952
	High school degree	5	5.952	1	1.190
	A.A degree	2	2.380	0	0
	B.S degree	7	8.333	1	1.190
	M.S& Dr. degree	1	1.190	1	1.190
Total		22	26.188	8	9.523



**Fig. 3. Chart of overweight among samples by educational status and sex**



The number of diabetic people was 14 people, that included 16.6% of the samples.

The following findings can be observed in tables and figures 4 to 6:

Totally, 16.66% of the samples were diabetic, only 2 people (2.38%) of diabetic cases had normal weight.

6 people (7.14%) of diabetic person were overweight.

6 people (7.14%) of diabetic person were obese.

Totally, 85.71 percent of the diabetic cases were obese or overweight.

5 people (5.95%) of the diabetic cases were aged between 30 - 60 years.

9 people (10.71%) of the diabetic patients had age over 60 years.

Only 2 people (2.38%) of the diabetic people had high education (high school degree).

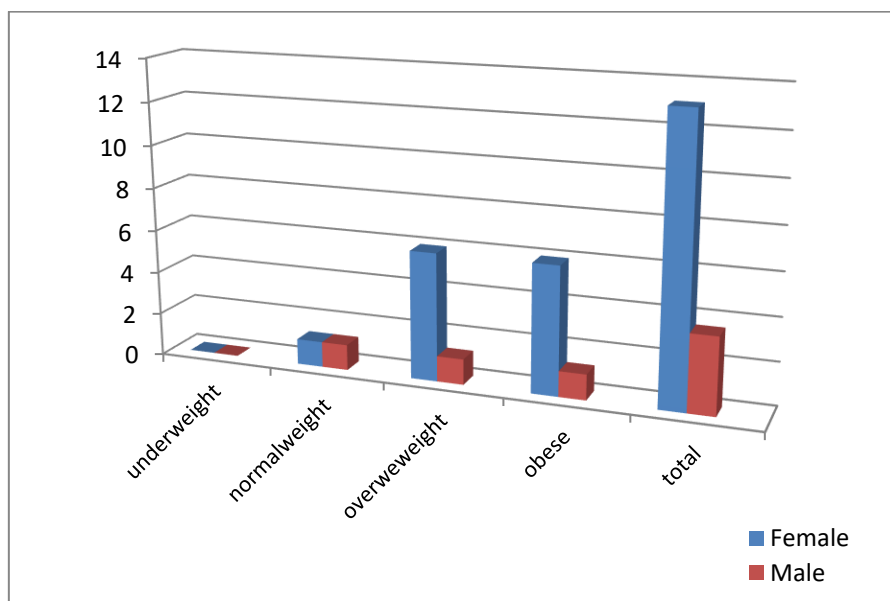
12 diabetic people (14.28%) did not complete high school degree, that means that 87.5% of diabetic people had low education.

Aging, obesity, low education, being female, and having low income are factors for suffering diabetes worldwide. The findings of this study agreed with the international reports, in which aging, obesity or overweight, female sex, and low education were factors for suffering diabetes.

The prevalence of obesity was higher among older women compared with the younger women.

**Table 4. percentage distribution among diabetic subjects by sex and BMI status**

Diabetic samples case	F		M	
	Frequency	Percent	Frequency	Percent
Underweight	0	0	0	0
Normal weight	1	1.19	1	1.19
Overweight	5	5.95	1	1.19
obese	5	5.95	1	1.19
Total	11	13.09	3	3.57



**Fig. 4. chart of diabetic subjects by sex and BMI status**

**Table 5. Age-Adjusted prevalence of diabetic samples by sex**

Diabetic samples Age	Sex			
	F		M	
	Frequency	percent	Frequency	percent
<18 year old	0	0%	0	%0
18-30 years old	0	%0	0	%0
30-60 years old	3	3.57	2	2.38
+60 years old	8	9.52	1	1.190
Total	11	13.09	3	3.57

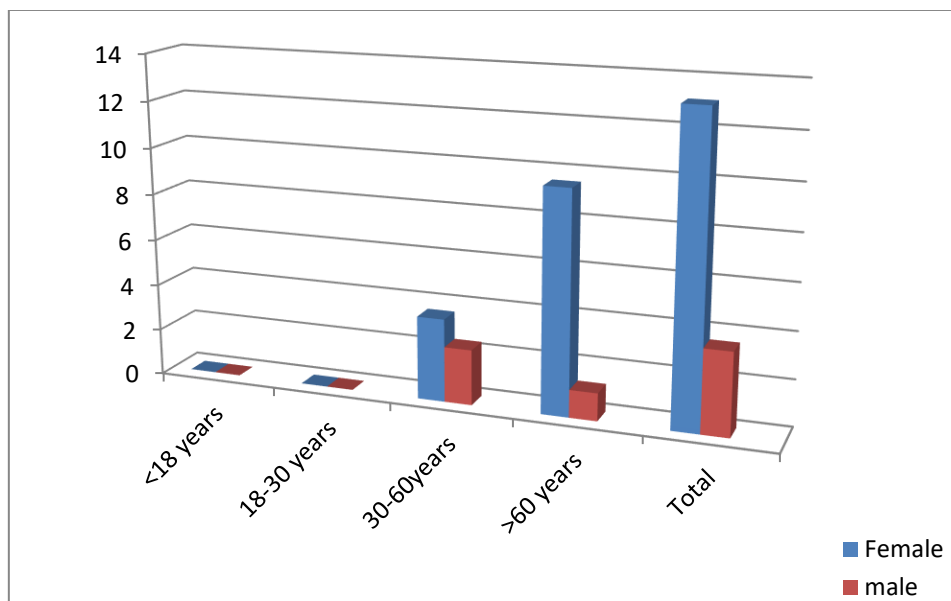


Fig. 5. chart of diabetic samples by age and sex.

Table 6. percentage distribution among diabetic subjects by sex and education status

Case	Education	Sex			
		Female		Male	
		Frequency	Percent	Frequency	Percent
Diabetic persons	Did not complete high school	9	10.71	3	3.57
	High school degree	0	0	1	1.190
	A.A degree	1	1.190	0	0
	B.S degree	0	0	0	0
	M.S &Dr	0	0	0	0
Total		10	11.9	4	4.76

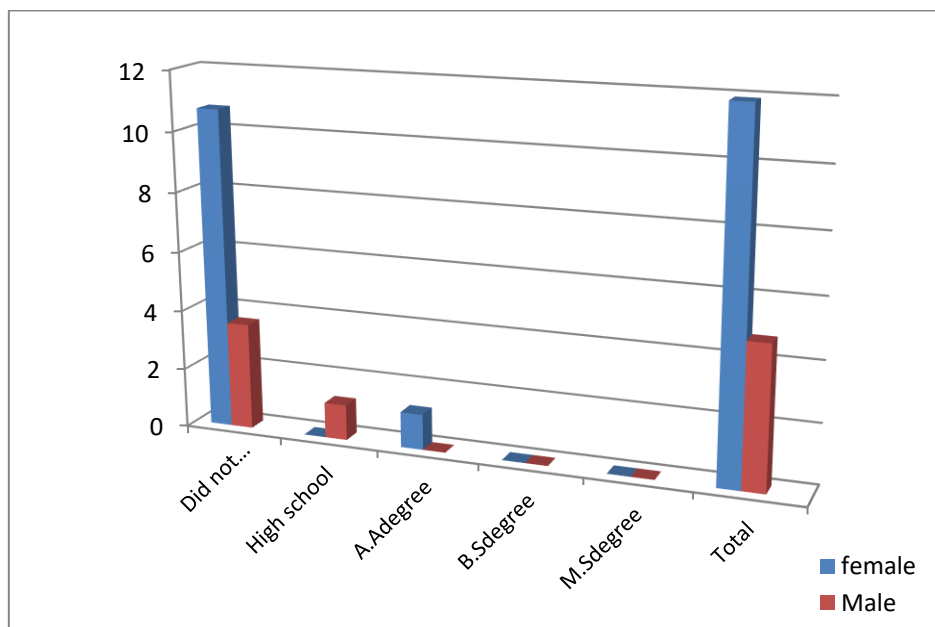


Fig. 6. chart of diabetic samples by educational status and sex

## RESULTS

The data analysis determined statistically significant associations between overweight and obesity and the prevalence of type II diabetes and relatively high prevalence of overweight, obesity and diabetes in this city. 35.70% of the samples of this study had overweight, 38.09% of the samples were obese. 4.76% of the samples were extremely obese; altogether 42.85% of the samples were obese, 9.5% of subjects had normal weight and 2.38% of subjects were underweight. 16.66% of the samples were diabetic. The main point was that 71.42% present of the diabetic people were overweight or obese. Meanwhile, 78.57% of the diabetic people were female, and 85.71% of them did not complete high school. The mean BMI of the female overweight subjects was  $27.8 \pm 1.3$ , and the mean BMI of male overweight samples was  $27.2 \pm 1.1$ .

## CONCLUSION

Both, overweight and obesity have been associated with the incidence of multiple comorbidities including type II diabetes. Low education, female sex, increasing age, and increasing BMI have been the risk factors for overweight, obesity and diabetes. The maintenance of a healthy weight and healthy diet could be important in the prevention of the large disease burden in the future.

The prevalence of overweight in subjects was a little higher than the other studies that were done before in this community. Hypo activity and intake of high calorie foods have also been the main risk factor for overweight and obesity

Totally, the rate of overweight and obesity growth is increasing in Iran, while the overweight rate is higher in females than in males. The rate of obesity prevalence is directly related to increasing age. To identify risk factors related to overweight and obesity in different parts of Iran, a comprehensive screening study with a unique instruction and diagnostic method, considering different races is required.

Generally, overweight and obesity rate has a decreasing and increasing trend in urban and rural areas, respectively. The associated factors leading to this change are needed to be considered in the future studies, and national actions are needed to reduce overweight and obesity.

This study also showed significant positive correlation between bodies mass indexes with the prevalence of diabetes, so that 71.42% present of diabetic patients were overweight or obese. Meanwhile increasing age, females married, less educated people are more like to suffer from overweight and obesity, and diabetes.

This study showed that the prevalence of diabetes, overweight and obesity is relatively high in this city, and it remains as a major health problem especially in women, at

the national level which should be taken into consideration. The alarming rate of overweight and diabetes in this city agreed with the prevalence of overweight and diabetes in Iran, however the prevalence was found to be somehow higher. Therefore, national action is needed to reduce the overweight and diabetes.

The prevalence of overweight and obesity has not been restricted to the developed countries, but also the underdeveloped and developing countries have the problem of increasing overweight and obesity. Based on WHO's report, in 2005, 1.6 billion of adults over 15 years were overweight, and at least 400 million were obese. WHO's report showed that one of the ten was afflicted with obesity.

Although the prevalence of diabetes is relatively high in this city, fortunately it is low compared with countries like Kuwait (34.1%).

The prevalence of overweight was reported in Iranian men and women to be 54% and 70% respectively in the year of 2005 by W.H.O.

The prevalence of obesity increased to 2.3 billion by 2015, which was equivalent to the population of china, U.S.A, EU.

NHANESIII [17] reported the followings in U.S.A:

- overweight over than 58 million.
- Obesity over than 40 million.
- More than 3 million were extremely obese. Based on the mentioned report, the prevalence of obesity in adults from %15 in 1980 increased to 23% in 1994 and increased to 27% in 1999.

Both overweight and obesity have been associated with type II diabetes, cancer, cardiovascular diseases, and some chronic disease. The maintenance of a healthy weight could be important in the prevention of the large disease burden in the future.

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