

# An insight into the prevalence rates of obesity and its related risk factors among the Saudi community in the Hai'l Region

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**Abstract. – OBJECTIVE:** Obesity/overweight is a major preventable cause of morbidity responsible for various health disorders. Thus, the present investigation aimed to estimate the prevalence rates of obesity and its related risk factors among the Saudi community in the Hai'l Region.

**PATIENTS AND METHODS:** In this study, 2,438 participants were randomly recruited in the Hai'l region during a cross-sectional survey. Participants were included based on their body mass index (BMI). Only those with BMI >25 weight (kg)/height (m)<sup>2</sup> were included.

**RESULTS:** The overall prevalence rates of overweight and obesity were 61% and 39%. The prevalence rates of males' overweight, obesity, and morbid obesity were 69%, 19%, and 12%, respectively. The prevalence rates of overweight, obesity and morbid obesity among females were 50%, 28%, and 22%, respectively.

**CONCLUSIONS:** Overweight, obesity, and morbid obesity are prevalent in Hai'l region, Northern Saudi Arabia. Overweight/obesity is more prevalent among women, rural inhabitants, less educated people, and adults aged 26-40 years. Hypertension, type 2 diabetes mellitus (T2DM), and deep vein thrombosis (DVT) are significantly obesity-associated risk factors in Saudi Arabia.

*Key Words:*

Obesity, Overweight, Hypertension, Diabetes, Saudi Arabia

30 [weight (kg)/height (m)<sup>2</sup>], whereas obesity is considered when the BMI is over 30 [weight (kg)/height (m)<sup>2</sup>]<sup>1,2</sup>. Overweight/obesity is a complicated multifactorial condition associated with amassed fats, leading to several health consequences. Higher BMI is strongly associated with many diseases, including cardiovascular diseases, T2DM, musculoskeletal illnesses, etc., leading to a remarkable decline in life quality and a decrease in life expectancy<sup>3</sup>.

Obesity is continuing to worry the health system in Saudi Arabia, as it is regarded as a major modifiable risk for several non-communicable diseases in the country. A recent study has reported<sup>4</sup> a prevalence of 68% among the general population, including 38.9% obese and 29.3% overweight. Obesity was more prevalent among Saudi females than males (45.3% vs. 31.2%,  $p < 0.01$ ). Although the prevalence of overweight/obesity is keeping in constant increase in Saudi Arabia<sup>5</sup>, there is still a knowledge gap between overweight/obesity and its related risk factors associated comorbidities. Accordingly, the present investigation aimed at estimating the prevalence rates of obesity and its related risk factors among the Saudi community in the Hai'l Region.

## Patients and Methods

In this study, 2,438 participants were randomly recruited in the Hai'l region during a cross-sectional survey, from October 2020 to October 2021. Participants were included based on their BMI.

### *Inclusion and Exclusion Criteria*

Only those with BMI >25 weight (kg)/height (m)<sup>2</sup> were included, regardless of age or gender. Those with BMI <25 Kg/m<sup>2</sup> were excluded. BMI was calculated by measuring height and weight, then calculated and categorized into 1) 25-<30

## Introduction

Today the World Health Organization (WHO) describes the dramatic increases in the epidemiology of obesity in all age groups as a global epidemic. About 650 million adults and 340 million children and adolescents suffer from obesity worldwide. Obesity is more prevalent among women and older persons than among men and young population<sup>1</sup>. Overweight is considered when the BMI is over 25 and less than

**Table I.** Distribution of the study population by obesity status and demographical characteristics.

Variable	Overweight (n=1436)	Obese (n=489)	Morbid (n=426)	Total (n=2351)
<i>Residence</i>				
Urban	519	221	138	878
Rural	917	268	288	1473
<i>gender</i>				
Males	741	210	130	1081
Females	695	379	296	1370
<i>Age</i>				
≤25 years	264	49	53	366
26-40	387	185	119	691
41-55	379	191	149	719
56-70	286	117	73	476
≥71	120	47	32	199
<i>Education</i>				
Illiterate	527	232	163	922
Primary	585	244	170	999
University	316	90	68	474

Kg/m<sup>2</sup>: overweight; 2) 30-<35 Kg/m<sup>2</sup>: obese; 3) >35 Kg/m<sup>2</sup>: morbid obesity.

Hypertension and diabetes conditions were considered based on information provided by the candidate to be in a current treatment usage due to a previous well-confirmed diagnosis of hypertension or diabetes. Additionally, the blood pressure was measured, and a blood sample was taken to estimate random blood glucose. Cardiovascular conditions were considered according to well documented medical history provided by the contributor.

All measures were taken in primary health centers in Hai'l region. The assessment was performed by a team including a family physician, a nurse, and medical students throughout the study.

Personal details, such as residence, gender, age, and education, were collected from participants during the interview.

### Statistical Analysis

All obtained data were arranged and entered into SPSS software (v.23, IBM Corp., Armonk, NY, USA) and analyzed to obtain frequencies, cross-tabulations, relative risk (RR), and Pearson Chi-square test for statistical significance (*p*-value). Statistically significant was considered with a *p*-value <0.05, considering a 95% confidence interval (CI).

## Results

This study investigated 2,351 participants aged 14-100 years old, with a mean age of 44 years. Of

the 2,351 participants, 1,081 (46%) were males, and 1,370 (54%) were females. About 878 (37%) participants lived in urban areas and 1,473 (63%) in rural areas. Most participants were in the age group 41-55 years (719, 30.6%), followed by 26-40 (691, 29.4%) and 56-70 years (476, 20.2%). Most contributors had primary education (999, 42.5%), followed by illiterates (922, 39.2%), as indicated in Table I and Figure 1.

The overall prevalence rates of overweight and obesity were 1,436 (61%) and 915 (39%).

The prevalence rates of overweight, obesity and morbid obesity among the urban population were 519/878 (59%), 221 (25%), and 138 (16%), respectively. The prevalence rates of overweight, obesity, and morbid obesity among the rural population were 917/1,473 (62%), 268 (18%), and 288 (20%), correspondingly.

The prevalence rates of overweight, obesity and morbid obesity among males were 741/1,081 (69%), 210 (19%), and 130 (12%), respectively. The prevalence rates of overweight, obesity and morbid obesity among females were 695/1,370 (50%), 379 (28%), and 296 (22%), in this order.

The age group 41-55 years had the highest prevalence rate of obesity/overweight (719, 30.6%), followed by 26-40 years (619, 29.4%).

The prevalence rates of obesity/overweight among illiterates, primary education, and university education were 39.2%, 42.5%, and 20.2%, correspondingly, as indicated in Table I and Figure 1.

Table II, Figure 2 summarizes the distribution of the study population by obesity status and car-

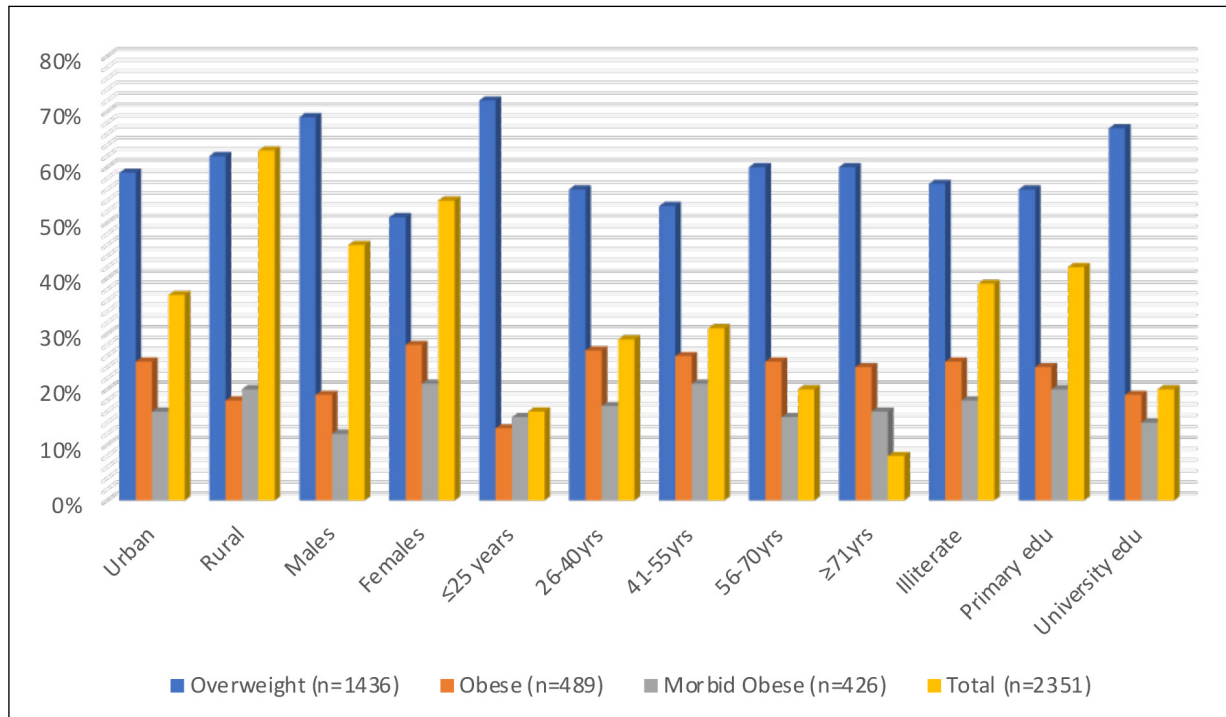


Figure 1. Description of the study participants by obesity prevalence rates and demographical characteristics.

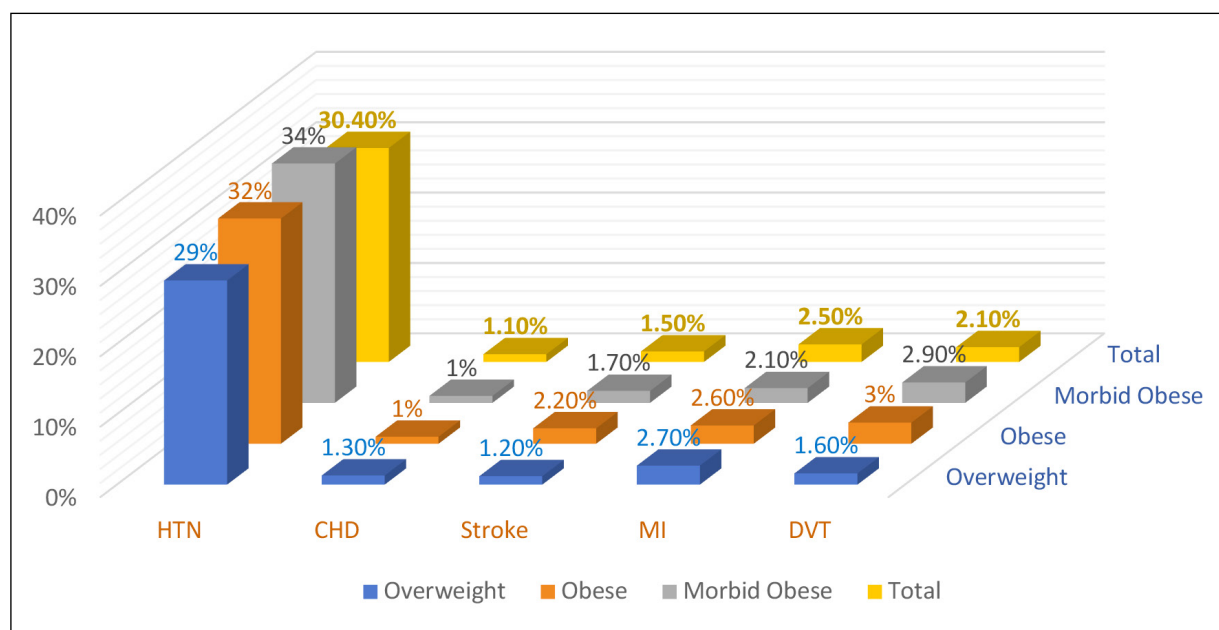
diovascular risk factors. The prevalence of hypertension was 740/2,433 (30.4%). The prevalence rates of overweight, obesity and morbid obesity among hypertensive individuals were 412/740 (55.7%), 185 (25%), and 143 (19.3%), respectively. The risk of hypertension (HTN) with increas-

ing body weight, and the relative risk (RR) and 95% confidence interval (95%CI); RR (95%CI) = 1.1084(1.0033-1.2246),  $p = 0.0428$ .

As indicated in Table III and Figure 3, the prevalence of Type 2 Diabetes mellitus (DM) was 782/2,438 (32%). The prevalence rates

Table II. Distribution of the study population by obesity status and cardiovascular risk factors.

Variable	Overweight	Obese	Morbid Obese	Total
<i>Hypertension (HTN)</i>				
Yes	412	185	143	740
No	1,016	397	280	1,693
Total	1,428	582	423	2,433
<i>Chronic Heart Disease (CHD)</i>				
Yes	18	5	4	27
No	1,412	576	416	2,404
Total	1,430	581	420	2,431
<i>Stroke</i>				
Yes	17	13	7	37
No	1,410	571	413	2,394
Total	1,427	584	420	2,431
<i>Heart attack (MI)</i>				
Yes	38	15	9	62
No	1,392	568	412	2,372
Total	1,430	583	421	2,434
<i>Deep Vein Thrombosis (DVT)</i>				
Yes	23	17	12	52
No	1,399	566	408	2,373
Total	1,422	583	420	2,425



**Figure 2.** Description of the study subjects by cardiovascular risk factors within entire obesity status.

of overweight, obesity and morbid obesity among diabetic patients were 428/782 (55%), 219 (28%), and 135 (17%), in that order. The RR (95%CI) = 1.1480 (1.0414-1.2656),  $p = 0.0055$ .

The prevalence of stage II, III, IV, and V Chronic Kidney Disease (CKD) were 665/2,438 (27.3%), 134 (5.5%), 11 (0.5%), and 7 (0.3%), respectively, as shown in Table III and Figure 3.

Of the 2,203 respondents to the smoking status question, 203/2,203 (9.2%) were current smokers, and 1343/2,203 (61%) were ex-smokers (Table III, Figure 3).

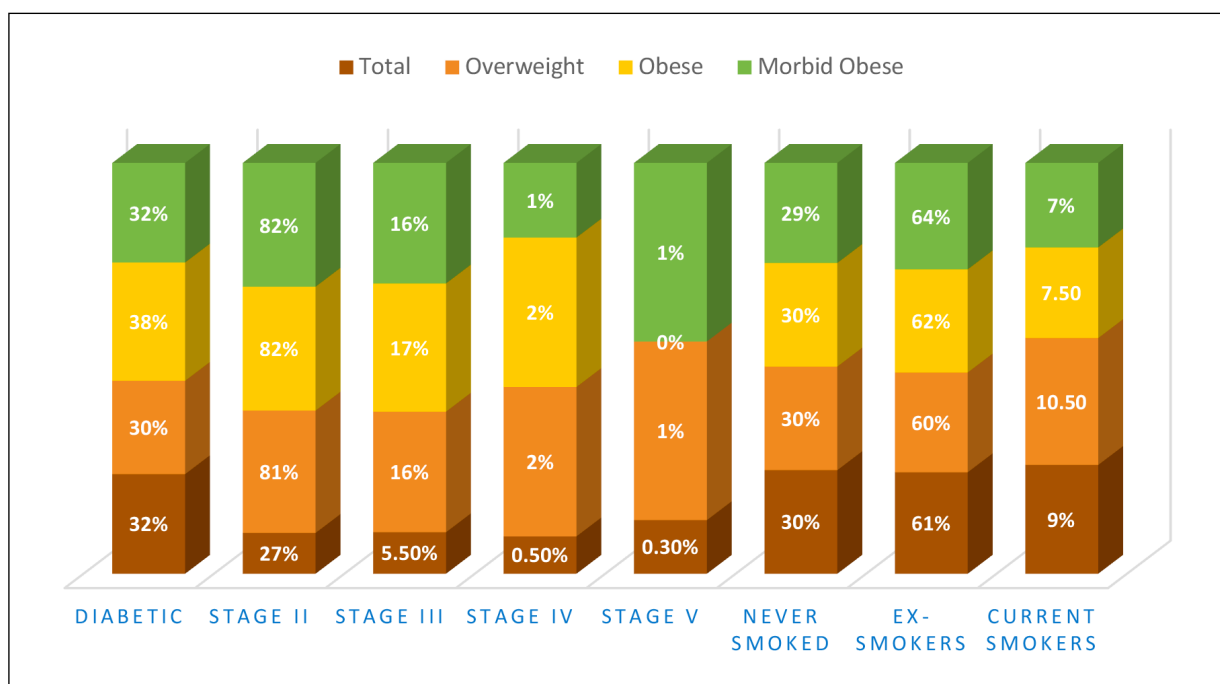
Chronic Heart Disease (CHD) prevalence was 27/2,431 (1.1%). The prevalence rates of overweight, obesity, and morbid obesity among CHD patients were 18/27 (67%), 5 (18%), 4 (15%), respectively. The RR (95%CI) = 0.8078 (0.4728-1.3801),  $p = 0.4347$ .

The prevalence of stroke was 37/2,431 (1.5%). The prevalence rates of overweight, obesity and morbid obesity among stroke patients were 17/37 (46%), 13 (35%), and 7 (19%), respectively. The RR (95%CI) = 1.3151 (0.9734-1.7768),  $p = 0.0744$ .

The prevalence of heart attack (MI) was 62/2,434 (2.5%). The prevalence rates of over-

**Table III.** Distribution of the study population by obesity status and other obesity-related risk factors.

Variable	Overweight	Obese	Morbid Obese	Total
<i>Type2 Diabetes mellitus (DM)</i>				
Yes	428	219	135	782
No	1,003	365	288	1,656
<b>Total</b>	<b>1,431</b>	<b>584</b>	<b>423</b>	<b>2,438</b>
<i>Chronic Kidney Disease (CKD)</i>				
Stage II	396	156	113	665
Stage III	80	32	22	134
Stage IV	7	3	1	11
Stage V	5	0	2	7
Total	488	191	138	817
<i>Smoking status</i>				
Never smoked	395	157	105	657
Ex-smoker	784	323	236	1,343
Current smoker	138	39	26	203
Total	1,317	519	367	2,203



**Figure 3.** Description of the study subjects by obesity-related risk factors within the entire obesity status.

weight, obesity, and morbid obesity among MI patients were 38/62 (61.3%), 15 (24.2%), 9 (14.5%), respectively. The RR (95%CI) = 0.9369 (0.6825-1.2862),  $p = 0.6870$ .

The prevalence of DVT was 52/2,425 (2.1%). The prevalence rates of overweight, obesity and morbid obesity among DVT patients were 23/52 (44%), 17 (33%), and 12 (23%), respectively. The RR (95%CI) = 1.3587 (1.0616-1.7391),  $p = 0.0149$ .

## Discussion

In this series of overweight/obese individuals, the prevalence rate of overweight was 61%; hence, that of obesity was 39%. Several studies<sup>2,6,7</sup> have shown a global increase in the adults' BMI of >25 Kg/m<sup>2</sup>. In some countries, such as Kuwait, Libya, and Qatar, the prevalence of adult obesity exceeded 50%. Nonetheless, there is a shortage of literature showing the prevalence rates of overweight and obesity in Saudi Arabia.

A study<sup>8</sup> conducted in this context involving Australian adults has found that the prevalence rates of overweight were 34%, obesity at 26%, and combined overweight/obesity was 60%. A study from Kuwait<sup>9</sup> has revealed that the prevalence rate of overweight was 40.6%, obesity at

42.1%, and central obesity was 73.7%, which were in some parts have similarity to our findings in the current study.

The present study's findings showed that the prevalence of overweight was higher among men, but the prevalence of obesity was higher among women compared to men. Such results were previously reported from the Gulf Cooperation Countries, including Saudi Arabia<sup>10,11</sup>.

In the current study, the prevalence of overweight/obesity was higher among the rural population than the urban. Similar results were recently reported<sup>12,13</sup> indicating that the prevalence of obesity among adults living in rural areas is significantly higher than that among urban population.

The findings of this study suggest that the highest prevalence rates of overweight/obesity occur in the age range 26-55 years, and such findings were previously reported<sup>14</sup>.

Higher prevalence rates of overweight/obesity were noted among those with primary education, followed by illiterate. Several developed countries previously reported an inverse correlation between obesity and education level<sup>15</sup>.

Our findings revealed that the risk of hypertension is significantly increased with an increase in BMI,  $p = 0.0428$ . Such association was well-established in numerous investigations<sup>16,17</sup>. It was reported that obesity is strongly associated

with hypertension ( $R^2=0.811$ ). A 10 Kg increase in body weight is associated with a 3.0 mm Hg higher systolic and 2.3 mm higher diastolic increase in blood pressure, which is associated with a 12% risk of coronary heart disease and 24% of stroke<sup>18</sup>.

There is no significant association between cardiovascular diseases (CHD & heart attack, myocardial infarction and stroke) and obesity. However, stroke showed a relatively high correlation ( $p=0.0744$ ). Previous studies indicated a low correlation between obesity and heart attack ( $R^2=0.067$ ); a moderate correlation with stroke ( $R^2=0.462$ ), which is similar to our findings in the present study<sup>18,19</sup>.

A statically significant association between increased BMI and DVT was demonstrated in the current study. Previous studies<sup>20</sup> have shown a relatively moderate association between obesity and DVT. Yet obesity can interact with environmental or genetic factors leading to a high risk of DVT. Chronic inflammatory processes and impaired fibrinolysis derived from obesity represent fundamental effector mechanisms of obesity-associated thrombosis. The proinflammatory and impaired fibrinolytic consequences influenced by obesity can be worsened by dysregulated expression and secretion of adipokines and microRNAs<sup>21</sup>.

There is a statistically significant association between increased BMI and T2DM in the present study. Obesity represents the comments modifiable risk for the development of T2DM. It was found that a weight loss  $\geq 5\%$  of the bodyweight resulted in glycemic control, decreased diabetic medications use, and enhanced the quality of life<sup>22</sup>. However, a recent study<sup>23</sup> that assessed the prevalence of overweight/obesity and DM in low-income and middle-income countries has reported that the correlation between BMI and DM risk is subject to considerable regional variations. DM risk is higher at lower BMI and at younger ages than reflected in the BMI limits used for considering DM risk. Such concepts suggest an insight to instruct perspective-specific DM screening guidelines.

The current study has exhibited no clear association between obesity and CKD, though many overweight/obese individuals were found with impaired glomerular infiltration rate (GFR). Increased BMI may influence the kidney through the development of systemic arterial hypertension or DM or directly by the ectopic accumulation of fats in the kidney<sup>24</sup>.

Approximately 70% of the participants in the present study were smokers or ex-smokers. Obesity and smoking are potent risk factors for subsequent disability<sup>25</sup>. There is a widespread attitude that smoking safeguards against weight gain. This influences the initiation and continuance of smoking, particularly among the younger generation. Concepts that smoking protects from weight gain may be oversimplified. However, quitting smoking may be coupled with weight gain<sup>26</sup>. Moreover, smoking is correlated with central obesity<sup>27</sup>.

### **Limitations**

Though the present study has provided valuable data, which are currently missing in Saudi Arabia, it has some limitations, including its setting as including overweight/obese only in addition to the absence of economic status of participants.

### **Conclusions**

Overweight, obesity and morbid obesity are prevalent in Hai'l region, in Northern Saudi Arabia. Overweight/obesity is more prevalent among women, rural inhabitants, less educated, and adults aged 26-40 years. Obesity significantly contributes to the development of cardiovascular risk factors, including dyslipidemia, hypertension, and type 2 diabetes. Obesity is associated with increased prevalence rates of CKD and smoking.

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### **Ethics Approval**

The proposal of this study, including its informed ethical consent, was approved by the ethical committee Research board at the College of Medicine, University of Hai'l, Hai'l, Saudi Arabia. (No. HREC 00105/CM-UOH.04/20).

### **Informed Consent**

Each participant has consented before being included in the study.

### **Availability of Data and Material**

The data presented in this study are available on request to the corresponding author.

### Conflict of Interests

The authors declare no conflict of interest.

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### Authors' Contributions

Alreshidi FF: Conception, manuscript drafting, revision, and approval of the final version.

Alreshidi FS: Conception, data collection, approval of the final version.

Ahmed HG: Conception, data analysis, manuscript drafting, and approval of the final version.

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