

Prevalence of cardiovascular disease and osteoarthritis in obese population of Hail region, Saudi Arabia

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Abstract. – OBJECTIVE: The aim of the study was to analyze if there was a link between chronic diseases, like cardiovascular disease (CVD) and osteoarthritis (OA), and obesity in the population of Saudi Arabia's Hail region.

MATERIALS AND METHODS: The study was conducted over 12 months using an observational cross-sectional survey on 172 patients from five clinics in Hail, Saudi Arabia. A total of 172 individuals with obesity (BMI \geq 30) finally participated in this research. The study evaluated sociodemographic variables *via* an electronic questionnaire with voluntary participation.

RESULTS: The study found a 76% prevalence of joint pain and 77.9% prevalence of cardiovascular abnormalities. Patients with CVD were older (58 \pm 23 vs. 56 \pm 12 years) than those with OA. CVD cases were found in 42 (31.3%) males and 92 (68.7%) females, whereas OA cases were recognized in 24 (18.5%) males and 106 (81.5%) females. The occurrence of various CVDs among our participants was 43 (32%) for high cholesterol, 64 (48%) for hypertension, and 27 for both high cholesterol and hypertension (20%). Definite osteophytes were found in 28 of 24 male knees (14 right and 14 left knees) and 175 of 106 female knees (88 right knees and 87 left knees).

CONCLUSIONS: The prevalence of obesity in the Hail region has continued to be a risk factor for CVD and OA in 2019 and 2020. The Saudi population has shown a higher prevalence of radiographic evidence of OA of the knee and associated symptoms than western civilizations, and preventive interventions are desperately needed in order to minimize overweight and obesity.

Key Words:

Cardiovascular disease, Hypertension, Obesity, Overweight, Pain, Knee.

Introduction

Obesity is on the upswing worldwide, with the Kingdom of Saudi Arabia (KSA) displaying a higher rate than most other countries¹. Obesity in Saudis is based on social attitudes, sedentary lifestyles, and a caloric-rich diet². According to WHO statistics³, the total incidence of overweight in KSA was projected to be 35.6% in 2016 when compared to the neighboring United Arab Emirates, Iraq, and Oman, respectively; a rise from 27.8% in 2007. Females are much fatter than males, at 44% vs. 26.4%.

Obesity has been a risk factor (RF) for developing diabetes mellitus, CVD, OA, and some malignancies, and they are predicted to rise in the KSA, especially among women⁴. CVD is now becoming a serious health problem in Gulf countries, such as KSA, where CVD is responsible for over 45% of all fatalities. Due to the rapid population, the Gulf nations' lifestyles have altered drastically, with a rise in lousy food and the embracing of a sedentary lifestyle. As a result, the Gulf population has high CVD RFs and chronic non-communicable illnesses⁵.

Obesity increases the risk of OA by increasing the mechanical stress on weight-bearing joints.

Even though overweight and obesity are deemed controllable, they remain the most predictive in many studies evaluating the RFs for OA. According to a recent meta-analysis⁶, a 5-unit rise in BMI was linked to a 35% higher risk of OA [relative risk (RR): 1.35; 95% confidence interval (CI): 1.21-1.51].

Another study showed an association between weight gain and increased risk of OA⁶. Many emerging nations have seen an epidemiological transition defined by a change in the leading causes of morbidity and mortality from infectious diseases to non-communicable diseases due to adopting a western lifestyle^{7,8}. Despite the evidence that obesity is an RF for CVD and OA, there is little research on the relationship between obesity intensity and better clinical outcomes. Also, there are no comprehensive data conducted to assess the frequency of joint pain and OA in the community of Saudi Arabia. The focus of this research was to see if there was a link between the incidence of CVD and OA of Saudi Arabia's obese population and a variety of chronic diseases, demographics, and lifestyle variables.

Materials and Methods

Study Design

The study was conducted over 12 months, from January 2020 to January 2021, using an observational cross-sectional survey on 200 patients from five clinics in Hail, Saudi Arabia, comprising both genders and ages ranging from 18 to 65 years old and more than BMI of 30. A total of 172 individuals with obesity (BMI \geq 30) finally met the inclusion and exclusion criteria for final participation in the research. The study contained questionnaires regarding sociodemographic variables such as age, gender, weight, height, nationality, residential region, occupational status, and social standing. It was done using an electronic questionnaire with voluntary participation *via* online (social media platforms, emails, etc.). This questionnaire also included personal history, family history, physical activity, smoking, nutrition, and other RFs for CVDs and OA.

Study Population

Inclusion

Females and Males \geq 18 years of age and BMI \geq 30 were included in the study.

Exclusion criteria

People less than 18 years old, those who could not communicate, those who did not give consent to participate, and participants with medical diagnoses were excluded from the study.

Statistical Analysis

The data were gathered using questionnaires and was analyzed with SPSS 25 (Armonk, NY, USA). The items and the study/variables were described using descriptive statistics such as frequencies and percentages. The descriptive measurements were expressed as mean \pm standard deviation. For comparison, the measurements are expressed as absolute values and respective percentage. The study considered conducting ANOVA for effective statistical analysis. The level of significance was considered to be $\alpha=0.05$.

Ethical Aspects and Consent Details

The study process was clearly explained to each patient. The signed consent was obtained from each patient before their participation. The study was approved by the Research Ethics Committee (REC) at the University of Hail with number H-2021-195.

Results

200 obese patients visiting Primary Health Care were invited to the study, and a total of 172 patients were finally selected. The population under investigation was 57 years old on average. The mean body mass index was 48. Out of 172 patients, 130 (76%) patients reported pain in one or more joints (106 were females and 24 were males), which is a significant finding ($p<0.05$), and 134 (77.9%) patients were found to have cardiovascular abnormalities, which is also a significant finding ($p<0.05$). Out of 134 patients, 92 were females and 42 were males. A total of 260 X-rays were taken (130 on left knees and 130 on right knees). Patients with CVD were older (58 ± 23 vs. 56 ± 12 years) than those with OA. CVD cases were found in 42 (31.3%) men and 92 (68.7%) females, whereas OA cases were recognized in 24 (18.5%) males and 106 (81.5%) females. When the prevalence of CVDs and OA was compared by gender in various age groups, females had a greater prevalence of both (31.3% vs. 68.7%) and OA (18.5% vs. 81.5%) than men in the same age range (Table I). When comparing males and females of similar ages, the prevalence was more significant in females over 50 (Table I). The prev-

Table I. Sociodemographic characteristics of patients with CVDs and/or OA.

Variables	Demographic Characteristics of patients with cardiovascular disease (Mean±SEM) N=134	Demographic Characteristics of OA Patients (Mean±SEM) N=130	p-value
Age (years)	58±23	56±12	p>0.05
Height (m)	1.64±0.04	1.65±0.08	p>0.05
Weight (kg)	127.6±11.65	126.5±26.95	p>0.05
BMI	49±8.4	48±6.9	p>0.05
Gender*			
Male (%)	42 (31.3)	24 (18.5)	p>0.05
Female (%)	92 (68.7)	106 (81.5)	p>0.05

*Expressed as number (percentage).

Prevalence of BMI was 49±8.4% in CVD patients and 48±6.9% in OA patients.

Table II depicts that majority of the overweight participants are observed in the age group of 26-40 years. They were followed by 41-45 years, then 56-70 years. Obese people can be predominantly seen in the 41-45 years age group, while morbid obesity is seen in the age of 41-45 years majorly.

It can be noted that when compared to the frequency of high cholesterol, hypertension was more common, accompanied by the significant RFs of experiencing both hypertension and high cholesterol. The family history of diseases like hypertension (39%), cardiac disease (27%), high cholesterol (22%), heart attack (7%), and vascular diseases (5%) accounted for non-modifiable risk factors (Figure 1).

Our study revealed that only 42 patients had no complaints of joint pain. The other 130 (76%) patients reported pain in one or more joints. 134 (78%) patients had

cardiovascular problems, among which 42 were males, and 92 were females. There were 92 patients who had both cardiovascular diseases and osteoarthritis. The most common pain site was the lumbar spine, followed by the knees. Of these 130 patients with pain, 98 (75.4%) had low back pain, 96 (73.8%) knee pain, 30 (23%) dorsal pain, 33 (25.4%) cervical pain, 63 (48.5%) hip pain, and 56(43%) reported pain in hands (Figure 2).

Only a few people sought treatment for joint problems in clinics. The study found that 130 participants had OA out of 172 participants. A total of 260 X-rays of the knees were taken and reported 130 each of left knees and right knees. Definite osteophytes were found in 28 of 24 male knees (14 right and 14 left knees) and 175 of 106 female knees (88 right knees and 87 left knees). Females under the age of 89 were more likely to have radiographic signs of OA. In 70.8% of men's knees and 79.2% of females' knees, OA was bilateral (Table II).

Table II. Distribution of changes observed in knee OA (K-OA).

Age (years)	Males (24)		Female (106)		p-value
	Bilateral	Unilateral OA	Bilateral	Unilateral OA	
20-29	1	0	8	3	>0.05
30-39	1	0	17	7	>0.05
40-49	3	1	28	6	>0.05
50-59	4	2	19	3	>0.05
60-69	6	3	8	3	>0.05
70-79	1	1	2	0	>0.05
80-89	1	0	2	0	>0.05
90+	0	0	0	0	>0.05
Total	17	7	84	22	<0.05
Group (%)	70.8	29.2	79.2	20.3	

OA = Osteoarthritis.

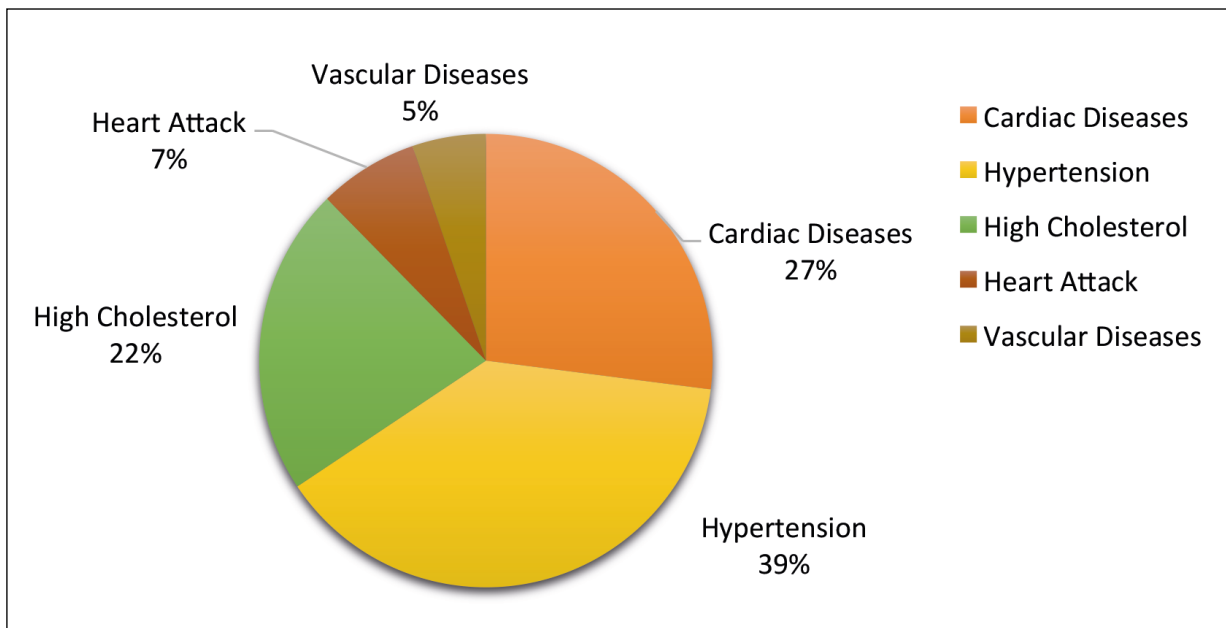


Figure 1. Percentage of participants, who had family history of different CVDs.

The data presented in Table III indicate that, as people become older, the prevalence of OA increases, ranging from 16.6% at age of 20-29 years to 90% at age of 60-69 years. Females were found to have a higher prevalence of K-OA than males. The medial compartment of the knee was the area of the knee that was most often affected (Table IV).

Discussion

Obesity has become a serious global public health issue. Obesity prevalence in the KSA is on the rise⁹⁻¹². This may be attributed to the changing lifestyle and the genetic makeup of the Arabs¹³. There is a scarcity of data on the lifestyle habits and demographic variables linked with over-

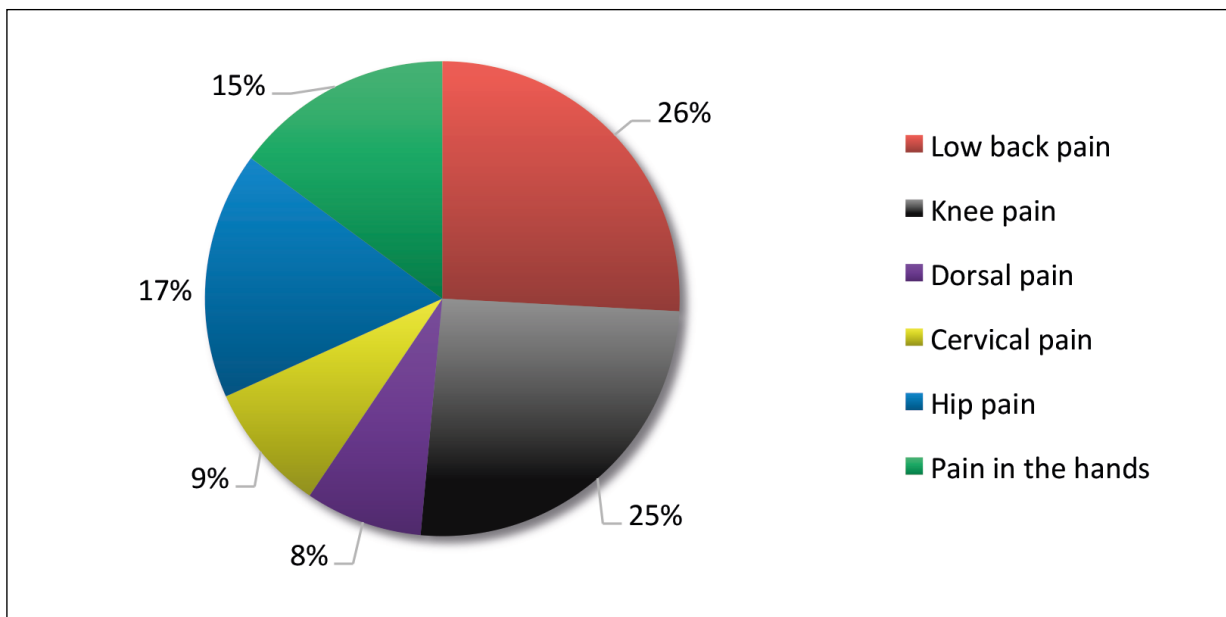


Figure 2. Site of pain distribution in the study population.

Table III. Relation of K-OA with age and sex.

Age (years)	Males (24)			Female (106)		
	No. of Subjects Studied	No cases of OA knee	OA (%)	No. of Subjects Studied	No instances of OA knee	OA (%)
20-29	6	1 (2 knees)	16.6	24	11 (19 knees)	45.8
30-39	4	1 (2 knees)	25	29	24 (41 knees)	82.8
40-49	6	4 (7 knees)	66.7	36	34 (62 knees)	94.4
50-59	7	6 (10 knees)	85.7	22	22 (41 knees)	100
60-69	10	9 (15 knees)	90	11	11 (19 knees)	100
70-79	5	2 (3 knees)	40	2	2 (4 knees)	100
80-89	5	1 (2 knees)	20	3	2 (4 knees)	66.6
90+	2	-	-	-	-	-
Total	45	24 (41 knees)		127	106 (190 knees)	

OA = Osteoarthritis.

weight and obesity among the adult population in different parts of Saudi Arabia. Furthermore, there is little research on the influence of obesity and overweight on our people's general health¹. As a result, the current study was done among Saudi Arabian adult population to explore the relationship between some chronic diseases, demographic and lifestyle variables, and the prevalence of CVD and OA in Saudi Arabian obese population.

Obesity was prevalent in both men and women at around 35.6%. This was comparable to earlier surveys from 1985 to 2011 and more significant than the most recent national survey for KSA in 2013, showing that obesity prevention initiatives in the Kingdom's western area have had little impact¹. Obesity and overweight prevalence rose with age, according to literature concerning the KSA and other nations. Indeed, extensive population studies³ show that mean body weight and BMI rise steadily throughout adulthood, peaking in both men and women between 50 and 60 and then falling after that. It is conceivable that hunger and food consumption decrease at this age or that BMI does not accurately represent adiposity.

As per the GBD (Global Burden of Disease) comparison website, cardiovascular illnesses were the top cause of mortality in KSA due to obesity. Obesity was formerly considered the leading cardiovascular RF in Germany, but it now accounts for 15.3% of the population in Nepal¹⁴⁻¹⁶. Genetic factors, ethnicity, gender, and age are non-modifiable RFs for CVD, but body weight, blood pressure, cholesterol and lipoprotein levels, and smoking status are modifiable RFs¹⁷. Obesity ranks first among modifiable RFs in the Hail region population. A positive family history of cardiovascular illness, such as hypertension, heart

disease, high cholesterol, heart attack, and vascular disease, reveals a relatively high prevalence. Obesity, on the other hand, has been linked to an increased risk of dyslipidemia and hypertension¹⁸.

Hypertension was found in 39% of the participants in this research, similar to other Saudi Arabian cities, such as Al Qassim¹⁹ (11.8%), among women exclusively. Another research²⁰ in Hail found that hypertension was prevalent in 44.3 % of males and 27.2% of women. In Jeddah, 72% of patients of both sexes were found to have high blood pressure, notably at King Abdul-Aziz University Hospital. In the United Arab Emirates, the prevalence of hypertension was found in Stage 1 (26%) in both males and females and Stage 2 (8.2%) in both males and females, with males having a higher incidence than females (9.3% vs. 7.1%). Hypertension was prevalent in 34.6% of Nepalese adults, with males accounting for 41.8% of the total, compared to females accounting for 29.6%²¹⁻²³.

Table IV. Region of the knee joint where space narrowing was observed.

Compartment	Males		Females	
	LK	RK	LK	RK
Med.	25	23	36	34
Lat.	2	2	2	2
PF	5	6	1	1
Med+PF	10	13	11	8
Lat+Med	2	3	4	3
Lat+Med+PF	13	10	2	1
Total	57	57	56	49

LK: left knee, RK: right knee; Med: medical compartment of the knee joint; PF: patellofemoral joint; Lat.: lateral compartment of knee joint.

Other research conducted at Abdul-Aziz University Hospital in Jeddah has shown that 71.6% of patients had much higher serum cholesterol levels when compared to our research finding where the level of cholesterol was 22%. Hence, they had to follow a strict diet plan as prescribed by the healthcare expert²². Dyslipidemia was 87.4% prevalent in United Arab Emirates (UAE), among both genders. In UAE, 90.7% of the males and 84.1% of the females are having dyslipidemia. Further, 16.8% of the total participants from Shaqra city (KSA) showed a history of high levels of cholesterol and triglyceride. Another research study²³ on the Saudi population has shown that 32.1% had significantly higher total cholesterol. In the Chinese population, a prevalence of higher cholesterol levels (31%) was observed, attributed to 31.2% of males and 30.6% of females²⁴. People with high cholesterol and hypertension described their lack of awareness about the dangers of eating unhealthy foods. Our findings are most likely explained by the predicted absence of physical exercise in higher or executive roles at work^{25,26}.

The two primary RFs for OA development are ageing and fat. According to the findings of this study, there is a clear link between age, obesity, and OA. Based on the radiographic diagnosis, the prevalence of OA increased with age in the current research, ranging from 16.6% at age 20-29 to 90% at age 60-69. According to our findings, the prevalence of radiographic OA (R-OA) rises with age. In those under the age of 20, however, no cases of R-OA were found. This might explain why Al-Shammari et al²⁷ reported instances of OA diagnosed clinically in people aged 30 and under.

K-OA is presently thought to be significantly linked to obesity's high metabolic and inflammatory settings. Adiponectin, resistin, and leptin, adipokines linked with fatty tissue, may influence OA by direct articular degradation or increasing local inflammatory processes. Moreover, mechanoreceptors on the exterior of chondrocytes sense the increased load in obese joints, activating internal signaling cascades of cytokines, growth factors, and matrix metalloproteinases²⁸. According to growing data, estrogen appears to have an essential role in articular tissue homeostasis. The high frequency of OA in women after menopause, linked to estrogen receptors in articular tissues, implies a connection between OA and ovarian function decline. Even though the effects of estrogen on articular carti-

lage receive a lot of attention, estrogen deprivation also impacts various joint tissues implicated in OA, such as the subchondral bone, synovium, muscle, ligament, and capsule²⁹.

Our study discovered that females have a higher prevalence of OA than males and that the R-OA considerably increases with age. The highest reported rate of R-OA in the western world has been in The Netherlands. The estimated prevalence of OA in the USA is considerably lower than what recorded in our study. Studies³⁰ also reported that joint pain is the most commonly reported symptom of R-OA.

The findings from our study showed an increased patella association in OA, which is consistent with other studies^{31,32} carried out in Saudi Arabia's eastern region. This patellofemoral joint involvement is reflected in the high complaints of knee unease while performing actions known to stress this region. The increased frequency of K-OA in our study might be influenced by our technique of analyzing individuals who attended their doctors' clinics. A general population radiographic investigation of K-OA would eliminate this referral bias; however, logistical and financial constraints would make such an endeavor extremely difficult to carry out^{33,34}.

Limitations

The study had limited number of patients as this was a single-center study. As the questionnaire was directly provided to the patients, there were recall bias and response bias. The authors suggest conducting these similar studies with larger number of patients and the similar studies should also be conducted in other regions of Saudi Arabia.

Conclusions

Our research shows that the prevalence of obesity among Hail Population will continue as a risk factor for CVD and OA in 2019 and 2020, at least as high as previously recorded in prior surveys¹. The Saudi population has a higher prevalence of radiographic evidence of OA of the knee and associated symptoms than western civilizations, with a preference for the patellofemoral compartment. In Saudi Arabia, preventive interventions are desperately needed to minimize overweight and obesity. Evidence-based treatments are urged to be implemented and evaluated.

Conflict of Interest

The authors declare that there is no potential conflict of interest between them.

Funding

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Ethics Approval

The study was approved by the Research Ethics Committee (REC) at the University of Hail with number H-2021-195.

Informed Consent

The study process was clearly explained to each patient. The signed consent was obtained from each patient before their participation.

Authors' Contributions

We declare that this work was done by the authors named in this article, and the authors will bear all liabilities claims relating to the content of this article.

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