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Hematological and Biochemical Parameters Among Obese Students at the PSAU, Alkharj, KSA

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***Abstract*---**Management of obesity represents a global problem that challenges the provision of healthcare services in most countries. Saudi Arabia ranked number 29 on a 2007 list of countries with 6% of its population being overweight (BMI > 25).In a university setting, we studied hematological parameters (including whole blood counts, haemoglobin and platelets), the presence of basophilia, iron levels and lipid profiles in obese students, and also in non-obese student controls. We found a significant increase in whole blood count in obese compared to healthy individuals, and also found a high level of basophilia compared to healthy controls. We also report that the obese student group suffered from low iron levels, and also a reduced total iron binding capacity, as compared to healthy controls. Levels of cholesterol and triglycerides was significantly higher in obese students compared to healthy controls. This study can be interpreted that universities across the Kingdom, and beyond, should consider targeting obesity management in their students to try to reduce the prevalence of obesity and associated disorders, and to support such healthcare programs by offering a variety of environmental, physical exercise and nutritional interventions.

***Keywords*---**BMI, hematological parameters, obesity, university's students.

Introduction

Obesity represents a major medical challenge that affects populations and healthcare services in the majority of countries around the world. Affecting around half a billion people worldwide, obesity results from an imbalance between food intake and energy expenditure which leads to excessive accumulation of adipose tissue) Weiss J et al. 2007).

Whilst obesity is widely regarded as a disease of the elderly, its prevalence in the young is also extremely concerning (WHO report 2000). Obesity often leads to ill health and its extent and progression is measured by the body mass index (BMI

kg/m2) which provides practical classification system for identifying and monitoring the level of obesity in an individual (Bray G 1998). BMI is calculated by dividing body mass (kg) by squared height (m2). Adults with a BMI ≥30kg/m2 are considered obese. A BMI of 25–29.9 is classified as overweight. A BMI between 18.5–24.9 is considered normal. A BMI <18.5 is classified as underweight.

Established links have been described between obesity and several risk factors such as smoking, cardiovascular disease (CVD), cancer, osteoarthritis and sleep apnoea (Bray G 1985 & Dandona P et al 2004). Saudi Arabia is among the fastest growing economies of the world, and this has led to substantial changes in the lifestyles of people in the Kingdom, including eating habits and physical activity. The purpose of the current study was to assess the hematological, lipid and iron-related parameters of obesity at the PSAU.

Materials and Methods

Characteristics of study population

Data were collected as a questionnaire, which included demographic information and relevance to chronic diseases. The survey that included 500 Saudi students studying at the PSAU, Alkharj region, Saudi Arabia, during the period from Sept 2018 to December 2021. The sample size was calculated to obtain confidence level of 95% and confidence interval of 1.4.

Selection of obese students for this study

Only 171 of 500 students were found to be obese and thereby included in the current study. BMI was calculated from measured height and weight and classified as overweight (25–30 kg/m2); and obese (30–35 kg/m2), morbid obesity (>36 kg/m2).

Measurement of chemistry profile

The sera were separated from thirty obese students and thirty healthy controls (aged and sex matched). The sera was used to assess cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), iron levels and total iron-binding capacity (TIBC) (using an autoanalyzer Clinical Chemistry [Dimension, Dade Behring, USA]). A standard Complete Blood Count (CBC) was also carried out in each case, a blood film run using Coulter.

Statistical analysis

Statistical analysis was performed using the SPSS Version 2.0 (IBM, USA). Correlation coefficients were used to test the relationships between variables measured, and a p-value of less than 0.05 was considered statistically significant.

Results

Investigating hematological parameters in obese students

Table 1, and 2 show the hematological findings both in obese students, and in non-obese student controls. There was a significant increase in WBC count in obese compared to healthy individuals, while other parameters are comparable to those of healthy controls there was huge basophilia compared to controls. Other cells were similar to the normal values seen in the control group.

Table 1
Hematological parameters in obese students and controls

	Platlets	RBC	WBC	Hgb
Controls	252± 19.7	4.7± 1.9	5.5± 1.3	14± 1.7
Obese Subjects	245± 17.1	5.9± 1.2	13.9± 1	9.8± 1.1
P - value	P=0.1	P=0.3	P=0.05	P=0.03

Table 2
Comparison of leukocyte levels between obese students and controls

	Neutrophils	Basophils	Eosinophils	Lymphocytes	Monocytes
Healthy Controls	44± **2**.7	**1**± **0**.7	**4**± 1.**1**	26± **3**.**1**	**9**± 1.**8**
Obese Subjects	56± **1**.7	**11**± **0**.**3**	3± 1.**2**	37± **2**.7	7± 1.**1**
P value	P=0.9	P=0.**006**	P=0.2	P=0.2	P=0.1

Iron levels

Samples taken from the thirty obese students and thirty healthy controls (aged and sex matched) were used to assess the concentrations of iron-related parameters. Table-3, also shows that obese student group suffered from low iron and TIBC in the obese student group compared to healthy controls.

Table 3
Iron-related parameters compared between obese students and controls.

	Iron	TIBC
Healthy Controls	16.8± 4.7	76± 5.5
Obese Subjects	10.2± 3.1	45± 4.2
P value	p=0.03	p=0.005

Lipid profile

Table 4 shows the lipid profiles both in obese and healthy individuals.These students, whether obese or not, were not receiving treatment and/or on diet.The level of Cholesterol and Triglycerides was significantly higher in obese students compared to healthy controls.

Table 4
Comparison of Lipid profile between obese students and controls

	Trigycerides	Cholesterol	LDL	HDL
Healthy Controls	1.1± 1.4	3.1± 1.1	290± 8.1	0.88± 0.7
Obese Subjects	2.6± 1.2	4.7± 1.3	277± 6.7	1.1± 0.3
P -value	P=0.001	P=0.05	P=0.8	P=0.9

Discussion

According to Forbes, Saudi Arabia ranked number 29 on a 2007 list of countries with a population that has 6% of its citizens being defined as overweight (BMI > 25) (Streib L, Forbes report 2007). There are many local published studies showed the prevalence of obesity in the KSA. First, it was shown 21.8% of college students in the Kingdom were obese (ElMouzan, et al 2010& Al-Malki et al 2003& Al-Rethaiaa et al 2010). Second, it was reported in 2004 that over 82% of the population was either overweight or obese (Al-Qahtani et al 2005). Third, a 2009–2011 study demonstrated that the prevalence of obesity amngst military personnel in KSA was 29%, with 40.9 overweight (Horaib H et al 2013). Fourth, a study on the prevalence rates of obesity in the Hail region (in Baqaa, Ash Shinan and Ghazala were, 64%, 70%, 69%, and 55%, respectively)(Hussain Ahmed et al 2014).

Our results are in agreement with those reports, and also with seven papers which also indicated that WBC cells counts were elevated in obese individuals compared to healthy controls. Our obese group was also anemic. (Fernandes R et al 2013 &Barazzoni R et al 2014 & Aladily T et al 2019& Herishanu Y et al 2006 & Furuncuoglu Y et al 2016& Lampalo M et al 2019 & Sait S et al 2016).

Additionally, our results are also in agreement with three papers which showed that people with a high BMI had low iron and low TIBC (Khan K et al 2016& Sofiantin N et al 2021 &Abo Zeid A et al 2013). There are a few factors explaining this negative relationship, including an increased plasma volume in obese people, consumption of energy-dense foods, poor nutrients, and chronic inflammation in response to obesity. In the current study we found a negative relationship between iron deficiency and obesity. It is well known that iron is a key component in many blood cells, proteins, enzymes, hormones, and therefore any defect with it will disturb the whole body metabolism. Our results are in agreement with several groups who have shown a possible association between high BMI and anemia, as well as an increased risk of low iron levels. These studies showed that a high BMI is a risk factor for low iron levels (Memish Z et al 2014 & Emam E et al 2018 & Datz C et al 2013). However, it is well known that eating a diet rich in haem iron (e.g., meat) is associated with very high serum ferritin levels, and this is because red meat is a rich source of haem iron. In contrast, a Colombian group and others have found no association between anemia and obesity Eckhardt CL et al 2008& Kordas K 2012). In conclusion, the administration of the PSAU university is in a position to target obesity management and try to reduce the prevalence of obesity and associated disorders, supported by environmental, physical and nutritional interventions.

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