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Original Article

Association of Obese and Morbidly Obese Status with Hypoalbuminemia in Adults Without Liver and Kidney Disease

Muhammad Maqsood[1*], Husna Iram[2], Sundus Mariyam Haroon[1], Sadia Salman[1], Amanullah Bhalli[1] and Sadaf Iqbal[1]

[1]Department of Internal Medicine, Jinnah Allama Iqbal Institute of Diabetes and Endocrinology, Jinnah Hospital, Lahore, Pakistan
[2]Department of Medicine Children Hospital Lahore, Pakistan

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***Corresponding Author:**
Muhammad Maqsood
Department of Internal Medicine and Department of Jinnah Allama Iqbal Institute of Diabetes and Endocrinology, Jinnah Hospital, Lahore, Pakistan
drmmaqsood@gmail.com

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ABSTRACT

Obesity is an excessive accumulation of fat in the body and is measured in terms of increased body mass index. Its prevalence is increasing in all age groups and is now considered to be a global epidemic. Albumin is the most abundant plasma protein synthesized in the liver and is customarily utilised to detect malnourishment and severe starvation. It is one of the poor prognostic factors in medical, surgical, and critically ill patients. **Objective:** To identify the relationship between obesity and morbid obesity and hypoalbuminemia in adults in Pakistan with no signs of liver or kidney disease. **Methods:** Jinnah Allama Iqbal Institute of Diabetes and Endocrinology (JAIDE), Jinnah Hospital Lahore Pakistan, was chosen for the completion of this cross-sectional study with a time frame of October 2019 to April 2020. 90 patients, ranging between ages of 18 and 70 years, without liver and kidney diseases, were recruited and were divided into three categories, healthy control, obese, and morbidly obese on the basis of BMI. Venous blood samples for albumin were taken. **Results:** The percentage of hypoalbuminemia was 10.0% in healthy controls, 40.0% in the obese group, and 46.7% in morbidly obese. Hypoalbuminemia rate was significantly higher in obese and morbidly obese groups (p-value 0.005) as compared to healthy controls, independent of age, sex, and diabetes. **Conclusions:** Upon completion of this study, it was concluded that the morbid obesity and obesity are the independent forecasters of hypoalbuminemia.

INTRODUCTION

Obesity is defined as an abnormal deposition of body fat and is evaluated utilising the Body Mass Index (BMI) [1,2]. Obesity with BMI≥30kg/m^2 or overweight with BMI ranging between 25 to 29.9 kg/m^2) is linked to mortality and illness. This fact has been developed in the medical field for even more than two millennia [3-4]. Overweight is becoming increasingly prevalent in all age categories and is currently regarded a worldwide epidemic. Obesity was believed to affect 108 million children and 604 million adults in 2015. Its prevalence has increased among almost all regions of the world since 1980, nearly doubling in 70 countries [5].The complications of obesity are linked to a variety of chronic conditions, including metabolic syndrome, type 2 diabetes mellitus, coronary heart disease, obstructive sleep apnea, osteoarthritis, Non-Alcoholic Fatty Liver Disease (NAFLD), and breast, colon, and many other malignancies [6-7]. Key factors which are contributing to increase the obesity burden are changing trends of food, rapid industrialization, urbanization and sedentary lifestyle. This fact is known that various countries having the highest burden of obesity also have the highest burden of metabolic syndrome and diabetes mellitus [8]. Previously only developed countries were facing this major public health issue of obesity but now for the last 20 years, prevalence of obesity has

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increased to three times in all age groups both in developing and developed countries because of accelerated environmental and social transition. On the other hand, developing countries are already facing various issues of malnutrition, especially in children [9]. Albumin is a plasma protein that is the most abundant and synthesized in the liver. In the medical field, it is used as an indicator of chronic starvation and malnutrition. Hypoalbuminemia is defined as serum albumin less than 3.5 mg/dl and it is prevalent in people who have acute or chronic health issues. According to the literature, 20% of patient populations have hypoalbuminemia at the time of hospitalisation. Various conditions can cause hypoalbuminemia, the most common are acute and chronic inflammatory responses. According to The Academy of Nutrition and Dietetics albumin level should be interpreted with caution because of its negative correlation with kidney, liver, and other different inflammatory diseases [10]. The evaluative criteria for abnormal albumin threshold assessment in obese patients is not well characterised. According to the scientific evidence, "obesity is a chronic inflammatory condition in which adipocyte hypertrophy and hypoxia result in the formulation of pro-inflammatory cytokines, including tumour necrosis factor-alpha [11-12]. Yet another prospect could be that this chronic inflammatory condition causes modified serum albumin thresholds in obese people. In a study of the literature, researchers looked at the relationship among Body Mass Index (BMI) and albumin levels in adults with diabetes [13-14] or the relationship between body mass index and glycated albumin [15]. According to one research, serum albumin levels in obese non-diabetic youngsters are low [16]. Few researches have looked at obesity and morbid obesity as predictive factors of hypoalbuminemia in adults. One of these studies showed "obese subjects had significantly higher odds of hypoalbuminemia, with Odd Ratio (OR) of 4.10, 95% Confidence Interval (CI) ranging between 1.50 to 11.27 with P-value of 0.006, as did morbidly obese subjects having OR of 6.94, 95% CI ranging between 1.91 and 25.23 and P-value of 0.003" [17]. Further studies are required to make recommendations to interpret albumin in obese individuals. The purpose of this research was to identify the relationship between obesity and morbid obesity and hypoalbuminemia in adults in Pakistan with no signs of liver or kidney disease.

METHODS

Jinnah Allama Iqbal Institute of Diabetes and Endocrinology (JAIDE), Jinnah Hospital, Lahore Pakistan, was chosen for the completion of this cross-sectional study with a time frame of October 2019 to April 2020 after the synopsis approval from College's ethical review board. The study was carried out based on the importance of a better clinical practice, as demonstrated in the Declaration of Helsinki. 90 patients, ranging between ages of 18 and 70 years, without liver and kidney diseases, were recruited. Every participant was provided with written informed consent. The participants were divided into three categories, healthy control (BMI 18.5 to 24.9 kg/m2), obese (BMI 25 to 29.9 kg/m2) and morbidly obese (BMI >30 kg/m2). Patients with BMI <18.5 kg/m2, liver and kidney disease were eliminated from the research. The research included demographic data such as height, weight, and gender. Body mass index (BMI) was determined by dividing body weight in kg by body height squared in meters. Patients were asked regarding diabetes, any chronic illness, medications ever used, and the presence of other comorbidities. Venous blood samples for albumin were taken.

Calculation of sample size was achieved by the following formula:

$$n = \frac{(z_{1-\beta} + z_{1-(\alpha/2)})^2 \; (\delta_1^{\,2} + \delta_2^{\,2})}{(\mu_1 - \mu_2)^2}$$

Where the study power is equal to 90% and significance level is equal to 5% [17].

And,

$z_{1-\beta}$ = 90% power of the study

$z_{1-(\alpha/2)}$ = 5% level of significance

μ_1 = Anticipated mean Albumin levels in healthy controls

μ_2 = Anticipated mean Albumin levels in obese cases

δ_1 = Standard deviation of Albumin levels in healthy controls

δ_2 = Standard deviation of Albumin levels in obese cases

n = Minimum sample size for each group

The Statistical Package for Social Sciences (SPSS) version 20.0 was leveraged to assess the complete data (IBM Statistics Incorporated, Chicago, IL, USA). Frequency and percentage were given for gender and hypoalbuminemia. The chi-square test was utilised to evaluate the relationship between obese and morbidly obese status and hypoalbuminemia. Additionally, p-value ≤ 0.05 was taken as significant.

RESULTS

Out of 90 subjects, 30 were obese, 30 were morbidly obese and 30 were healthy control. The mean age of the healthy control was 37.7 ± 14.7, the mean age of the obese group was 41.5 ± 13.7 and the mean age of the morbidly obese group was 45.8 ± 13.5. According to one-way ANOVA test, no statistically crucial differentiation in mean age among groups was discovered. Table 1.

Variables	Healthy controls	Obese	Morbidly obese	P-Value
Age (in years)	37.7 ± 14.7	41.5 ± 13.7	45.8 ± 13.5	0.087

Table 1: showing mean age of among groups

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Chi square test showed that gender distribution was similar among all three groups with a p-value of 0.295, Table 2.

Category	Gender		P-Value
	Male	Female	
Healthy control	16 (53.3%)	14 (46.7%)	0.295
Obese	10 (33.3%)	20 (66.7%)	
Morbid obese	13 (43.3%)	17 (56.7%)	

Table 2: showing gender distribution among groups

Diabetic patients were higher in the obese and morbidly obese group however; this difference was statistically insignificant with a p-value of 0.094, Table 3.

Category	Diabetes Mellitus		P-Value
	Yes	No	
Healthy control	8 (26.7%)	22 (73.3%)	0.094
Obese	14 (46.7%)	16 (53.3%)	
Morbid obese	16 (53.3%)	14 (46.7%)	

Table 3: diabetic patients among groups

The percentage of hypoalbuminemia was 10.0% in healthy controls, 40.0% in the obese group, and 46.7% in the morbidly obese. The chi-square test showed that the hypoalbuminemia rate was significantly higher in obese and morbidly obese groups as compared to healthy controls, Table 4.

Category	Hypoalbuminemia		P-Value
	Yes	No	
Healthy control	3 (10.0%)	27 (90.0%)	0.005
Obese	12 (40.0%)	18 (60.0%)	
Morbid obese	14 (46.7%)	16 (53.3%)	

Table 4: showing a comparison of hypoalbuminemia among groups

The median albumin levels of healthy control were 4.1 (3.7 - 4.3), the median albumin levels of the obese group were 3.8 (3.3 - 3.9) and the median albumin levels of the morbidly obese group was 3.6 (3.3 - 3.8). -+Kruskal-Wallis test revealed a statistically significant variation in median albumin status among groups. Pair wise comparison indicated that the median albumin levels of obese and morbidly obese group was significantly lower as compared to healthy controls while no significant variation was determined between obese and morbidly obese groups, Table 5.

Variables	Healthy controls	Obese	Morbidly obese	P-Value
Albumin (g/dL)	4.0 ± 0.33	3.7 ± 0.39	3.6 ± 0.25	< 0.001
	4.1 (3.7 - 4.3)	3.8 (3.3 - 3.9)	3.6 (3.3 - 3.8)	

Table 5: Showing mean albumin among groups

DISCUSSION

The results of this study recommends significant hypoalbuminemia status in comparison with healthy control group (p-value 0.005) with obese and morbidly obese patients. There was no impact of including age, sex and diabetes mellitus in results. So individuals with normal BMI had a low incidence of hypoalbuminemia. The results of our study align with that of prior conducted studies, demonstrating a negative correlation between obesity and children and adults' albumin levels [13,17]. Prior researches have revealed a negative association between albumin and BMI among adults but only diabetic patients were included in these previously described studies [14-15] and instead of simple albumin, they assessed glycated albumin [14] or only compared albumin levels among various obesity groups [18]. According to a Brazilian study, more than 85% of overweight and obese elderly individuals, admitted to the hospital had hypoalbuminemia in correlation with age and nutritional status instead of BMI and metabolic syndrome [19]. While our study compares the hypoalbuminemia in obese and morbidly obese subjects with the healthy control group. Medical and surgical outcomes of the patient can be predicted using serum albumin levels [20-22]. Mortality and morbidity in critically ill patients can be independently predicted using albumin levels [23]. Surgical data also suggested that patients with hypoalbuminemia had poor surgical outcomes like delayed wound healing, need for repeat surgery, and higher readmission rates.

CONCLUSIONS

In our studied population, the prevalence of hypoalbuminemia was significantly high among obese and morbidly obese persons as compared to the healthy control group. As hypoalbuminemia is an important independent prognostic factor among surgical, medical, and critically ill patients, internationally clear consensuses are needed to interpret hypoalbuminemia among obese and morbidly obese persons. This study may help make these consensuses but further studies may also be needed.

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