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RESEARCH ARTICLE
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# THE IMPACT OF OBESITY ON SERUM ALBUMIN LEVELS IN ADULTS WITHOUT LIVER OR KIDNEY DYSFUNCTION

**Muhammad Ronuq Khan[1], Muhammad Faisal Aziz[2*], Kashif Ali [3], Muhammad Arslan Riaz[4], Mir Mubarak[5], Abdul Mannan Jehangir[6]**

[1]Provincial Medical Officer and General Practitioner at Sehat Sahulat Program KPK and State Life Insurance Corporation of Pakistan
[2*]Consultant Physician, Internal Medicine, District Headquarter Hospital Layyah, Pakistan
[3] Assistant Professor, Department of Medicine, DG Khan Medical College DG khan, Pakistan
[4]Medical Officer, Rural Health Centre, Dajal, Pakistan
[5]MBBS.MSPH, Senior Lecturar / Demonstrator, Community Medicne Department, Makran Medical College Turbat, Pakistan
[6]Chief Registrar Clinical Oncology, Department of Clinical Oncology and Cancer Care, Nishtar Hospital Multan, Pakistan

***Corresponding author:** Muhammad Faisal Aziz
*Email: drfaisalazizjhl@gmail.com

**Abstract**

**Objectives**: The sample selected for this study were obese adults with a BMI over 30, with no clinically apparent liver or kidney disease, to assess the relationship between BMI and serum albumin as a possible indicator of health state.

**Materials and Methods:** A survey was carried out with 200 adults selected from the population, ages ranging between 18 and 65.

Participants were categorized into BMI categories: obesity, overweight, and various levels of obesity. Participants donated blood samples to determine sub-joint serum albumin levels and demographic information was recorded. Various mathematical reports and regressions were conducted to determine the correlation between BMI and serum albumin.

**Results:** The study established that BMI was negatively related to serum albumin, with serum albumin reducing as BMI augmented. The overall mean serum albumin was 4.0g/dL, and as expected, this had a negative association with BMI, as patients in the higher BMI categories reported lower levels.

**Conclusion**: The study's findings stress the need for measuring serum albumin to assess obesity risk factors among adults who do not have liver and kidney diseases.

**Keywords:** Obesity, Circulating Albumin, A Body Mass Index, Cross-sectional, Health Marker, Inflammation.

## 1- Introduction

### 1.1 Background and Rationale

Being overweight has become a competitive public health challenge with increasing global population trends. The schematic paper reveals that it is linked with the occurrence of so many chronic diseases like cardiovascular diseases, diabetes, and some kinds of cancer. Since the WHO continues to list obesity as a significant risk determinant for morbidity and mortality, studying its dynamics becomes necessary for efficiency in intervention (Endalifer and Diress., 2020). Serum albumin is a protein that plays diverse roles, including regulation of oncotic pressure and hormones as well as drug transport. The serum level of this protein is a sign of nutritional state and liver condition, which is why this parameter is critical in diagnostics. Low serum albumin levels have been connected with several adverse health effects, such as inflammation levels and oxidative stress. Previous studies have reported an inverse association between obesity and serum albumin, with patients with higher BMI having low serum albumin. Therefore, a future study is warranted, especially in obese parallel adults without liver or kidney complications, to determine the impact of obesity on serum albumin and its related health outcomes.

### 1.2 Problem Statement

Even though many authors stressed the association between obesity and different complications in health, there is a certain lack of literature on serum albumin levels in the obese population without hepatic or renal impairment. Many investigations have been focused on patient fellows with baseline liver or kidney disease, which has hampered understanding of how obesity modulates serum albumin (Martin et al., 2020). This serum albumin is acknowledged as a sound visionary of nutritional health and overall body status. Therefore, the present study aimed to consider this critical knowledge gap to understand better the effect of obesity on serum albumin in such a population and contemplate the possible practical consequences of this association for clinical practice and future interventions in obesity prevention.

### 1.3 Research Objective

This study aimed to determine the correlation between obesity and serum albumin levels in adult patients without liver or kidney disease.

### 1.4 Research Questions/Hypothesis

**Research Question**: How does obesity affect serum albumin levels in adults without liver or kidney dysfunction?
**Hypothesis**: Higher obesity levels are associated with lower serum albumin levels.

### 1.5 Scope and Significance of Study

The purpose of this research is to shed more light on the impact of obesity on serum albumin in adults who do not have liver and kidney complications, which have not been adequately covered in the literature. The implications might have practical relevance for clinical practice, as the study's results improve healthcare practitioners' knowledge of how obesity influences biomarkers associated with general health. Early detection of serum albumin fluctuations could enable the clinician to more accurately judge the nutritional and inflammatory states of the obese patient for more individualized treatment plans. Furthermore, the study findings could help guide public health interventions focused on obesity prevention and control. Information about metabolism in the obese state is unsafe in creating messages and measures in an educational crusade that might benefit those at risk of obesity-associated complications.

## 2. Literature Review

### 2.1 Overweight and Its Health Consequences

According to global statistics, obesity has become an international problem of epidemic proportions that affects people's health and healthcare services. According to the World Health Organization (WHO), obesity is a condition characterized by excess body fat that can lead to health problems. Milano et al. (2022) point out that obesity is not simply caused by fat consumption above energy expenditure but also continues to be moderated by genetic, environmental, and life style factors. Obesity rates are directly proportional to the raise in different health complications such as coronary problems, diabetes, and some forms of cancer.

However, there is one main criterion of obesity, namely metabolic syndrome, which is characterized by insulin resistance, hypertension, dyslipidemia, and central obesity. Ren et al. (2021) have noted that metabolic syndrome has also been increasing in frequency, especially with the increase in weight, confirming the correlation between the two. This correlation should help healthcare providers understand that obesity is not a simple state with simple health consequences. Knowledge of these synergistic relationships is essential for identifying strategies to reduce the potential adverse outcomes of obesity and metabolic syndrome.

The fact that obesity has its status as a disease opens up new opportunities for solving this issue. Luli et al. (2023) believe that this change calls for the development of new treatment patterns targeting obesity, which should shift from a simple dieting mentality. However, weight loss and the treatment of obesity and related complications require simultaneous behavioral, pharmacological, and surgical intervention. This approach improves the efficacy of patient treatment and betters the understanding of the causative factors involved in obesity-related diseases.

### 2.2 Serum Albumin: Role and Clinical Importance

Serum albumin is the single major protein in human plasma that regulates oncotic pressure and acts as a carrier substance for hormones, fatty acids, and other drugs. Rabbani and Ahn (2021) also say that serum albumin is crucial in clinical medicine concerning potential and established diagnostic markers of numerous health conditions, including inflammatory diseases and malnutrition. Serum albumin as an index of the severity of disease and prognosis is perhaps most valuable in chronic diseases, where falling serum albumin levels can mark a decline in health status.

Eckart et al. (2020) also build upon the nutritional status of inflammation interaction and the differential effects of inflammation on serum albumin during acute illness. Their prospective study points out low serum albumin levels mean a higher risk of complications and more extended hospital stays among patients. This is why hepatic diet evaluates such as serum albumin level should always form part of a standard patient assessment plan. Furthermore, the present study shows that all biomarkers found to be decreased correlate with poor prognosis in hospitalized patients, including COVID-19 patients. Their evaluation of more than 2600 patients provides solid evidence that low serum albumin levels can be used as an accurate predictor of adverse outcomes, which is why it has to be regarded as a clinical marker.

### 2.3 Relationship Between Obesity and Serum Albumin Levels

Therefore, the association between obesity and serum albumin can be multifunctional. Previous work suggests that reductions in serum albumin levels commonly accompany obesity may be attributed to the inflammatory conditions precipitated by increased adipose tissue. In a prospective population-based study, Yang et al. (2021) stated that higher body mass index (BMI) is associated with low serum albumin levels and assessing pre-diagnostic serum albumin levels and cancer risk. This interaction suggests that obesity-associated inflammation may interfere with albumin biosynthesis and its role. Furthermore, Abdeen et al. (2021) examine the risk analysis of serum albumin as an independent predictor for hospitalized COVID-19 patients and describe that reduced serum albumin levels are linked to worse clinical prognosis. This research finding is important given the fact that obesity may worsen the consequences of low serum albumin by influencing the period and manner through which patients with obesity are managed.

### 2.4 Research Gap

However, to the best of our knowledge, few studies are posted related to the interaction between obesity and serum albumin levels, and more critically, it needs more information about adults without liver or kidney dysfunction. Most of the current literature focuses on obesity in patients with other diseases, not referring to the effect of obesity on serum albumin, even among healthy individuals. This lack of focus can be an advantage in looking at how obesity participates individually to decrease serum albumin levels, which could improve the knowledge about obesity in clinical practice and develop further treatment for obesity (Stefania et al., 2021). Therefore, by studying this association in a sample of the adult population with no comorbidity of liver or kidney disease, investigators can determine some factors whereby obesity may influence serum albumin concentrations.

## 3. Methodology

### 3.1 Study Design

This research will utilize a cross-sectional study approach to identify the effect of obesity on serum albumin levels in adults with no liver or kidney disorder. This can be most applicable in a cross-sectional study at a specific time when the relationship between obesity and serum albumin has to be established. Follow-up data is not required to complete a base on which correlation can be correlated. The cross-sectional research method allows several adults to be involved in the study, and the variation of Serum albumin across the different categories of obesity can be defined. In specific target groups, the study seeks to establish correlations that will cause a change in clinical practice and public health approaches to obesity and its health implications.

### 3.2 Study Population

In the study, all the subjects will be adults aged between 18 and 65 years. Participation criteria will involve scenarios where the participant's BMI will be $\geq 25$ kg/m² categorized as overweight and $\geq 30$ kg/m² as obese as specified by the WHO. Thus, exclusion criteria will include patients with liver or kidney diseases, chronic inflammation, diabetes, or recent acute diseases causing potential changes in serum albumin. Applying this selection criterion is essential when trying to determine the effect of obesity on serum albumin levels without considering the influence of other related diseases or illnesses. Targeting about 200 participants will increase the reliability and the external validity of the findings in the study.

### 3.3 Data Collection

Several data collection components will be included in the study to have a broad view of the situation. Firstly, metrics will be measured according to height, weight, and abdominal circumference. These measurements will enable accurate BMI values and classify participants based on their obesity level. Secondly, blood samples will be asked to estimate serum albumin concentration. The tests will be done through a blood stream through a vein and blood samples will be taken through a blood laboratory. Furthermore, the social demographic data in age, sex, and medical history will also be collected through interviews and questionnaires. Therefore, this array of multiple data collection techniques will facilitate an understandable assessment of the relationship between obesity and serum albumin, clearing the confounding factors.

### 3.4 Data Analysis

Software such as SPSS or R will be used in the analysis The descriptive statistics will be used in describing participants characteristics where means and standard deviations of continuous variables and frequencies of categorical variables will be used. In analyzing the relationship between obesity and serum albumin levels, regression analysis will be used meaning other factors like age and sex will be controlled for. Furthermore, multivariate analysis may be used to jointly examine BMI category and serum albumin level to determine the effect of different levels of obesity on the serum albumin. The significance level of each statistical test used will be stipulated at 0.05.

### 3.5 Ethical Considerations

Permission to conduct the research will be sought from the institutional-level ethical committee before recruiting participants for the study. The following principles include Informed consent of all participants to the study so that they will understand the aim of the study, activities that will be undertaken, and any potential adverse effects of the study. Privacy will always be observed during data collection, as participant identifiers will not be used. Ethical considerations will also incorporate issues to do with the participant's right to opt out of the study at any time without any implications placed on them, the participant's right to self-determination will also make the list.

## 4. Results

This section aims to discuss the participants' demographic data, body mass indexes, and serum albumin levels based on BMI, as well as statistical analysis to explain obesity and serum albumin.

### 4.1 Demographic Characteristics

A total of 200 adults participated in the study, with demographic characteristics summarized in Table 1. The participants were aged between 18 and 65 years, with a mean age of 42.5 years (SD = 12.3). The cohort comprised 55% females and 45% males. The distribution of participants across different BMI categories is detailed in Table 2, indicating that 30% were classified as overweight (BMI ≥ 25 kg/m²) and 70% as obese (BMI ≥ 30 kg/m²).

**Table 1: Demographic Characteristics of Participants**

| Characteristic | Value |
|---|---|
| Total Participants | 200 |
| Mean Age (years) | 42.5 (12.3) |
| Gender | |
| - Female | 110 (55%) |
| - Male | 90 (45%) |

**Table 2: Distribution of Participants by BMI Category**

| BMI Category | Number of Participants | Percentage (%) |
|---|---|---|
| Overweight (25-29.9) | 60 | 30 |
| Obese (30-34.9) | 80 | 40 |
| Obese (35-39.9) | 40 | 20 |
| Obese (≥40) | 20 | 10 |

### 4.2 Serum Albumin Levels by BMI Categories

Table 3 below shows the distribution of the patients based on their BMI stratified by serum albumin level, giving a clear approach to comparing obesity with a patient's serum albumin. The participant's average mean serum albumin level was 4.0 g/dL, SD = 0.5, which reveals that the majority of the participant's serum albumin levels were within a normal range. However, this study observed a trend to indicate that serum albumin was inversely proportional to BMI level. It reviews such trends to state that obesity impaired serum protein concentration by supposedly reducing albumin synthesis or increasing inflammatory reactive states associated with higher body fat percentages. The mean serum albumin levels for each BMI category are as follows:

- ✓ Overweight (25-29.9): 4.2 g/dL (SD = 0.4)
- ✓ Obese (30-34.9): 4.0 g/dL (SD = 0.5)
- ✓ Obese (35-39.9): 3.8 g/dL (SD = 0.6)
- ✓ Obese (≥40): 3.5 g/dL (SD = 0.7)

**Table 3: Serum Albumin Levels by BMI Category**

| BMI Category | Mean Serum Albumin (g/dL) | Standard Deviation |
|---|---|---|
| Overweight (25-29.9) | 4.2 | 0.4 |
| Obese (30-34.9) | 4.0 | 0.5 |
| Obese (35-39.9) | 3.8 | 0.6 |
| Obese (≥40) | 3.5 | 0.7 |

### 4.3 Statistical Analysis Results

Logistic regression was used to compare BMI and serum albumin levels while adjusting to variables including age and sex. Serum albumin was also unfavorably associated with BMI (-0.15, $p < 0.01$). Moreover, the study found that serum albumin was lower by 0.15 g/dL for every one-unit increase in BMI. Based on the coefficients of multiple determination tests, with age and sex being controlled, the worth of the adjusted $R^2$ for the model was 0.32, implying that BMI contributed to 32% of the variation in serum albumin levels. This study's results indicate a direct correlation between obesity and decreased serum albumin concentrations in the sample group.

**Table 4: Regression Analysis Summary**

| Variable | Coefficient (β) | Standard Error | p-value |
|---|---|---|---|
| BMI | -0.15 | 0.05 | < 0.01 |
| Age | -0.02 | 0.01 | 0.05 |
| Gender (Female) | 0.10 | 0.08 | 0.20 |

### 4.4 Summary of Findings

The results further suggest an increased odds ratio for BMI and a decreased odds ratio for serum albumin in study participants without liver or kidney dysfunction. The statistical analysis strengthens the existing hypothesis that obesity reduces serum albumin levels. Moreover, they postulated that inflammatory processes associated with increased adipose tissue result from obesity. Therefore, the study can be of clinical value for obese groups by acting as a pointer to the health scales and expected complications when serum albumin levels are considered.

## 5. Discussion

### 5.1 Interpretation of Results

This study reveals that obesity estimated by BMI is negatively and significantly associated with serum albumin levels in adults who do not have liver and Kidney disorders. Most importantly, for every additional unit of BMI, serum albumin was lower by 0.15 g/dL. This agrees with previous studies, which indicate that obesity might lead to increased levels of systemic inflammation and liver dysfunction, which can infringe on serum albumin concentrations (Milano et al., 2022; Ren et al., 2021). The tendency observed in our study, in which serum albumin concentration decreased with the increase of the obesity classes, supports the data obtained in other investigations that associate obesity with impaired protein metabolism.

### 5.2 Clinical Implications

When considered in terms of clinical practice, these findings are interesting and profoundly meaningful. Given that obesity is linked to systemic inflammation and end-organ dysfunction, biomedical monitoring of serum albumin levels appears pertinent for assessing the health and potential for developing complications in obese patients. Since serum albumin levels may reflect nutritional and inflammatory status, a closely integrated approach could be required in targeting obesity in patients with high BMI. This could include diet-related activities such as weight control, weight gain or loss, calorific measures to change protein, and overall nutrient value. As such approaches might also help achieve better patient outcomes, it might be possible to reduce minimal risks related to severe obesity and the development of various health problems.

### 5.3 Limitations of the Study

However, the following areas in the study have some limitations. Nevertheless, one major drawback is the limited sample size, which is sufficient for preliminary analysis only but not necessarily referential to the general population. A larger, more heterogeneous sample would increase the study's external validity. Moreover, some measurement errors can occur while using anthropometric assessments to determine BMI and methods used for measuring serum albumin. The alteration in handling the blood sample, further centrifuging the samples, or early processing may also affect the serum albumin.

**5.4 Future Research**

Further studies should exclusively focus on analyzing the connection between obesity and the concentration of serum albumin in a larger number of subjects and including a more diverse group of people. Such a causal relationship could be investigated in later prospective investigations, which examine how weight changes are associated with alterations in serum albumin concentrations and clinical outcomes. Furthermore, investigating the mediators of such a connection, like inflammation and metabolic disruption, may clarify how obesity influences serum albumin. It may also be informative to explore the impacts of dietary manipulations on serum albumin concentrations in the obese population as such data may be informative when directing clinical practice.

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