Anthropometric Indices, Plasma Albumin, Uric Acid and Packed Cell Volume in Students of Tertiary Institutions

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Abstract

Background: Anthropometric indices, plasma albumin, uric acid and packed cell volume are good markers of malnutrition and the associated disorders. Aim and Objective: This work aimed to evaluate the anthropometric indices, plasma albumin, uric acid and packed cell volume in tertiary institution students. Materials and Methods: Anthropometric indices, plasma albumin, uric acid and packed cell volume (PCV) were evaluated in 200 students of two tertiary institutions in Owo-Nigeria which include Achievers University and Rufus Giwa polytechnic, Owo, Ondo state-Nigeria (comprising of 95 males and 105 females). Anthropometric measurements including weight, height, and waist and hips circumference were measured. Body mass index and waist-hip ratio were also calculated. Plasma uric acid, and albumin were estimated biochemically by spectrophotometry while PCV was determined by capillary tube method. Results: The results showed a statistically higher significant difference in the values of mid arm circumference obtained from Achievers University (10.48±0.72) than the values obtained in the students of Rufus Giwa Polytechnic Owo (9.72±1.14) with P < 0.05. The values of plasma albumin were also statistically significantly higher (P< 0.05) in students of Achievers University, Owo (47.84±4.5) than the values obtained in the students of Rufus Giwa Polytechnic Owo (42.36±4.89) with P < 0.05. There was also a significant gender difference in the values of mid arm circumference and plasma albumin obtained from the students of the two institutions with p<0.05. Conclusion: We therefore recommend routine measurements of anthropometric indices, Packed Cell Volume and biochemical parameters (Serum Uric acid and Albumin) are hereby suggested for early detection of malnutrition and its associated disorders among students of tertiary institutions due to significant alterations in the level of the parameter.

Keywords Anthropometric Indices, Albumin, Uric Acid, PCV, Students, Polytechnic, University, Tertiary

1. Introduction

Anthropometry measurement, plasma albumin, uric acid and packed cell volume are also utilized to assess nutritional status. Anthropometry involves the external measurement of morphological traits of human beings. It has a widespread and important place in nutritional assessment, and while the literature on anthropometric measurement and its interpretation is enormous, the extent to which measurement error can influence both measurement and interpretation of nutritional status is little considered. Anthropometry thus has an important advantage over other nutritional indicators; whereas biochemical and clinical indicators are useful only at the extremes of malnutrition[1].

Anthropometric measurements are highly reliable for determining the nutritional status when compared with more sophisticated methodologies (hydrodensitometry, dilution techniques and electronic bioimpedance), the use of which is restricted by complexity and cost in population studies [2]. Changes in life styles, nutrition and ethnic composition of populations lead to changes in the distribution of body dimensions (e.g. the obesity epidemic), and require regular updating of anthropometric data collections. Anthropometric values are closely related to nutrition, genetic makeup, environmental characteristics, social and cultural conditions, lifestyle, functional status and health [3, 4,5,6,7].

Serum albumin provides a simple method for estimating visceral protein level. Malnutrition and inflammation suppress albumin synthesis [8]. In an adult the normal range of serum albumin is defined as 35-50g/L and levels <35g/L are referred to as hypoalbuminemia[8] Serum albumin is generally used to assess the nutritional status, severity of disease, disease progression and prognosis. At moderate degrees of malnutrition activity and growth rates are affected to a greater degree and, in addition, signs of wasting and some biochemical abnormalities (e.g. reduction in serum albumin) begin to show[9]. Inadequacies in nutritional intake eventually after functional capacity and result in many adverse health outcomes that are distinct expressions of malnutrition’s different levels of severity. Inadequate diets through reduced physical activity and slowed rates of growth.
Anthropometric Indices, Plasma Albumin, Uric Acid and Packed Cell Volume in Students of Tertiary Institutions

Derangement in packed cell volume especially anaemia could be associated with malnutrition[13]. Another simple biochemical marker of nutrition is serum uric acid. Serum uric acid (SUA) being a risk factor is currently controversial [10]. There is however little controversy regarding its association as a risk marker associated with cardiovascular (CVD) and renal disease (especially in patients with hypertension, diabetes, and heart failure) which can be caused by overnutrition. Serum uric acid seems to be a graded marker of risk for the development of coronary heart disease (CHD) or cerebrovascular disease. These investigators were able to demonstrate that elevations of SUA levels were independent of variables commonly associated with gout or the metabolic syndrome in association with Cardiovascular [11]. This study was therefore designed to compare the values of anthropometric indices, plasma albumin, uric acid and packed cell volume in students of tertiary institutions.

2. Materials and Methods

2.1. Materials

Subjects: A total number of one hundred students from Achievers University, Owo and also one hundred students from Rufus Giwa Polytechnic, Owo aged 17 – 52 years (comprising of 95 males and 105 females) were recruited for this study.

2.1.1. Period of Investigation

This study took place between June to September, 2013.

2.1.2. Blood Sample

Five millilitres (5mL) of blood was obtained from the antecubital fossa vein with disposable needle using 5mL plastic syringe, and 3mL of the sample was dispensed into lithium heparin bottle for uric acid and albumin while the remaining 2mL was dispensed into EDTA bottle for PCV (packed cell volume). The 3mL blood that was dispensed into lithium heparin bottle was centriﬁuge at 2500rpm for 5 minutes and the plasma was separated for biochemical assays.

2.2. Methodology

2.2.1. Anthropometric Measurements

This was carried out at the Nutrition and Dietetics department of Federal Medical Centre, Owo-Ondo state-Nigeria.

\[ \text{Uric acid} + O_2 + H_2O \xrightarrow{\text{Uricase}} \text{Allantoin} + \text{CO}_2 + H_2O_2 \]

\[ 2H_2O_2 + 3.5-\text{di-chloro-2-hydroxyl-benzenesulfonic acid} + 4-\text{amino-phenazone} \]

\[ \xrightarrow{p. \text{orosidias N}} 3-\text{choro-5-sulfonate} - p-\text{benzo-quinone imine} \]

The colour solution is read spectrophotometrically at 546nm wavelength.

2.2.1.1. Weight

The scale was adjusted to Zero before every measurement. The subject was asked to remove their shoes and were asked to stand upright in the center without looking down and the weight of the subject was taken in kilogram.

2.2.1.2. Height

The subjects were instructed to remove their shoes. The subject was asked to stand with his/her back to the height rule. The subjects were asked to look straight and the measurement was taken by pressing the hair in meters.

2.2.1.3. Waist Circumference

Waist circumference was measured at a level midway between the lower rib margin and iliac crest with the tape all around the body in horizontal position, and the waist measurement was taken in centimeters.

2.2.1.4. Hip Circumference

Hip circumference was measured as the maximal circumference over the buttocks and hip measurement was taken in centimeters.

2.2.1.5. Body Mass Index (BMI)

BMI was estimated by dividing weight (kg) by height\(^2\) (m\(^2\)). That is

\[ \frac{\text{Weight (kg)}}{\text{Height}^2 \text{ (m}^2)} \]

2.2.1.6. Waist Hip Ratio (WHR)

Waist hip ratio was estimated by dividing waist circumference by hip circumference [14].

2.2.2. Biochemical Assays

2.2.2.1. Uric Acid

Method: Uric acid was determined by Enzymatic Endpoint Method using the reagent kit of Randox.

Principle: Uric acid is converted by uricase to allantoin and hydrogen peroxide, which under the catalytic influence of peroxidase, oxidizes 3,5-di-chloro-2-hydroxybenzene sulfonic acid and 4-amino-phenazone to form a red violet quinoneimine compound. The colour solution is read spectrophotometrically at 546nm wavelength.
Table 1. Anthropometric and Biochemical Parameters in Students of Achievers University, Owo (AUO) And Rufus Giwa Polytechnic (RGPO), Owo-Ondo State

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Students of AUO n=100</th>
<th>Students of RGPO n=100</th>
<th>'t' value</th>
<th>P-Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index</td>
<td>21.46 ± 2.23</td>
<td>22.54 ± 2.70</td>
<td>-1.56</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mid Arm Circumference</td>
<td>10.48 ± 0.72</td>
<td>9.72 ± 1.14</td>
<td>2.55</td>
<td>p&lt;0.05</td>
<td>Significant</td>
</tr>
<tr>
<td>Waist Hip Ratio</td>
<td>0.89 ± 0.07</td>
<td>0.88 ± 0.06</td>
<td>0.60</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Albumin</td>
<td>47.84 ± 4.53</td>
<td>42.36 ± 4.89</td>
<td>3.94</td>
<td>p&lt;0.05</td>
<td>Significant</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>0.44 ± 0.09</td>
<td>1.53 ± 5.93</td>
<td>-9.10</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Haematocrit(PCV)</td>
<td>38.80 ± 4.13</td>
<td>37.00 ±3.72</td>
<td>1.66</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Table 2. Anthropometric and Biochemical Parameters in Females And Males of Achievers University and Rufus Giwa Polytechnic, Owo-Ondo State

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Male students n=95</th>
<th>Female students n=105</th>
<th>'t' value</th>
<th>p-value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index</td>
<td>23.19 ± 3.76</td>
<td>22.28 ± 2.43</td>
<td>1.14</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mid Arm Circumference</td>
<td>10.55 ± 1.14</td>
<td>9.67 ± 0.89</td>
<td>2.67</td>
<td>p&lt;0.05</td>
<td>Significant</td>
</tr>
<tr>
<td>Waist Hip Ratio</td>
<td>0.86 ± 0.05</td>
<td>0.88 ± 0.06</td>
<td>-1.17</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Albumin</td>
<td>48.20 ± 9.32</td>
<td>45.20 ± 4.53</td>
<td>1.38</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>0.33 ± 0.09</td>
<td>0.30 ± 0.07</td>
<td>1.61</td>
<td>p&lt;0.05</td>
<td>Not significant</td>
</tr>
<tr>
<td>Haematocrit(PCV)</td>
<td>35.35 ± 4.53</td>
<td>33.96 ± 3.15</td>
<td>1.17</td>
<td>p&gt;0.05</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

2.2.2.2 Albumin

Methods: Bromocresol Green

Principle: The measurement of serum albumin is based on its quantitative binding to the indicator 3,3,5,5-tetrabromocresol sulphophethalein (bromocresol green, BCG). The albumin – BCG- complex absorbs maximally at 578nm, the absorbanc being directly proportional to the concentration of albumin in the sample. The colour solution is read photometrically at 630nm[12,13].

2.2.2.3 Hematocrit (Packed Cell Volume)

Method: Microhaematocrit

Principle: The packed cell volume is the proportion of whole blood occupied by red cells expressed as a ratio. Anticoagulated blood in a glass capillary tube is centrifuged in a microhematocrit centrifuge at 12000g for 5mins to obtain constant packing of the red cells[13].

2.3. Statistical Analysis

Statistical Analysis: the data was subjected to statistical analysis to determine the mean values, standard deviation and student’s’ t test, for t value, p value and level of significance at 0.05 using online Student T-Test Calculator for 2 Independent Means.

2.4. Ethical Approval

The proposal was reviewed and approved by the Research and Ethical Committee of the Department of Medical Laboratory Science, Achievers University, Owo – Nigeria(Ref: AUO/REC/19/241). Students that consented and volunteered themselves for the study were recruited.

3. Results

Asignificantly higher mean value of mid arm circumference was obtained in the Achievers University, Owo students than Rufus Giwa Polytechnic, Owo-Nigeria, and in the male students than the females with p<0.05. There was also a significantly higher mean value of plasma albumin in Achievers University, Owo students than Rufus Giwa Polytechnic. There was no gender difference in the mean values of plasma albumin, uric acid, PCV, waist/hip ratio and Body Mass Index(Tables 1 & 2).

4. Discussions

This work was carried out to determine if there are differences in the values of anthropometric parameters, plasma Uric acid, albumin and PCV among students of Achievers University and Rufus Giwa Polytechnic, both in Owo, Ondo state.

The mid arm circumference was found to be higher in the males than the females and also in Achievers University than the value of the parameter obtained from the students of Rufus Giwa Polytechnic, Owo-Nigeria. These findings might be due to inadequate feeding because it was stated by WHO [14], that mid arm circumference is also used as a marker to assess nutritional status. Dairo et al[8] in Ibadan Nigeria, reported a higher value of 15.47 ± 1.4 cm. Their higher value may be explained by the fact that the subjects studied were children living in urban Ibadan whereas the
Centre where the present study was done is located in a rural area and as such most of the patients who present to the hospital are rural dwellers. Hop et al [15], in Hanoi, Vietnam carried out a study aimed to observe the development of mid arm circumference of children on a longitudinal basis. They found that mid arm circumference increased by about 1cm for boys and 1.5cm for girls agrees with the present study. The discovery that serum albumin was greater in Achievers University, Owo students than the values of plasma albumin obtained from Rufus Giwa Polytechnic Owo, Ondo state could be due to consumption of foods that are rich in protein common in Achievers University Owo compared to the Rufus Giwa Polytechnic, Owo-Ondo state as measurement of serum albumin is used in the assessment of nutrition and decrease in plasma albumin level may also be due to stress (because protein is used to repair worn out tissue) and poor protein intake. Although Albumin is a fairly indicator of nutritional status, an estimation of serum transferrin would have been given a better indicator of nutritive assessment [16].

The gender influence on the value of Mid-Arm Circumference is consistent with the fact that changes in body composition differ in men and women at different life stages and are reflected in anthropometric and biochemical measures [16].

The result of this study could also be attributed to differences in the lifestyle including food intake in both sexes and that biochemical (albumin) and anthropometric values are closely related to nutrition, genetic makeup, environmental characteristics, social and cultural conditions, lifestyle, functional status, differences in academic stress affecting eating habits, and health. [16-23]. Also Poor eating habits is a major public health concern among young adults who experienced transition into university life, during which, they are exposed to stress and lack of time which could lead total dependence on fast foods rich in fat and protein. These factors pose a barrier against adoption of healthy behaviors, such as poor eating habits and substance abuse. Although these behaviors of students are considered temporary, as part of university life; unhealthy habits picked up at this age generally persist in older adult life[16-23]. The findings of this work could also be associated with the differences of socioeconomic status (which may affect the eating habit and consequently the nutritional status) between the two school because Achievers University, Owo, Ondo state- Nigeria is a fee paying private university that runs first degrees in Ordinary and Higher National Diplomas in different fields has a student population of about 1,000 dominated by students from families of high socio-economic status while Rufus Giwa Polytechnic, Owo-Nigeria is a resident public (State Government owned) Polytechnic offering Ordinary and Higher National Diplomas in different fields has a student population of about 5,000 especially those that could not afford the school fees of private schools of equivalent status. The Students of the university are fully accommodated in the campus while majority of the Polytechnic students including the study sample live off-campus [16-23].

4.1. Conclusions

This work revealed a significant gender difference and a significantly higher mean value of mid arm circumference and plasma albumin in Achievers University, Owo students than the results obtained

4.2. Recommendation

Measurement of mid arm circumference and plasma albumin among the students of tertiary institution is recommended for possible detection of malnutrition and its associated disorders.

REFERENCES

[8] Dairo M.D, Fatokun M.E, Kuti M.Reliability of the mid upper arm circumference and plasma albumin in Achievers University, Owo students than the results obtained.


