Full Length Research Paper

Serum albumin as a rough guide to the assessment of nutritional status of hospitalized patients: A study from Zaria, Northern Nigeria

Akuyam S. A.[1]*, Anaja, P. O.[1], Aliyu, I. S.[1], Mai A.[2] and Dahiru I. L.[3]

[1]Department of Chemical Pathology, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria.
[2]Department of Surgery, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria.
[3]Department of Traumatic and Orthopedic Surgery, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria.

Several studies have revealed that malnutrition is a common finding in hospitalized patients. The situation in our hospitals is not known. The objective of the present study was to compare serum albumin (ALB) among hospitalized, out-patients and apparently healthy subjects, with a view to assessing its status during hospitalization. Serum ALB concentrations were measured each in 50 of hospitalized and out-patients, as well as apparently healthy individuals. The data obtained were analyzed using Statistical Package for Social Sciences (SPSS 11.0) for Windows (SPSS, Chicago, IL). Student's t-test and one way analysis of variance (ANOVA) were employed for the comparison of the results obtained from different groups of the subjects. A p-value of equal to or less than 0.05 (p ≤ 0.05) was considered as statistically significant. Serum ALB concentrations in hospitalized patients, out-patients and apparently healthy subjects were 35.88 ± 1.56, 39.70 ± 1.77 and 42.32 ± 1.34 g/L, respectively. The differences in these values between hospitalized patients and apparently healthy subjects were statistically significant (p < 0.01), while there were no significant differences between out-patients and apparently healthy subjects. It is concluded from the findings of this study that serum ALB concentrations were significantly lower in hospitalized patients than in apparently healthy subjects, while it is similar in out-patients and apparently healthy subjects. It is recommended that serum ALB concentrations be routinely measured as part of the assessment of nutritional status in hospitalized patients.

Key words: Serum albumin, assessment of nutritional status, hospitalized patients, out-patients, apparently healthy individuals.

INTRODUCTION

Albumin (ALB) is the most abundant protein in human plasma, representing 55 to 65% of the total protein (Peters, 1975; Javed and Waqar, 2001). It is a low molecular weight protein (about 65,000) synthesized in the hepatocytes of the liver (Schultze and Heremans, 1970). Serum ALB estimation is one of the commonly requested tests in the Clinical Chemistry Laboratory for evaluation of protein disorders and in several disease conditions, including nephrotic syndrome, liver diseases, malnutrition and water and electrolytes imbalance (Grant et al., 1987; Margarson and Soni, 1998; Banh, 2006; Sundell, 2007).

Malnutrition is highly prevalent in hospitalized patients, most especially in the elderly ones and is associated with increased morbidity and mortality (Lowenstein, 1982; Mowe and Bohmer, 1991; Gariballa, 2001; Visvanathan, 2003; Singh et al., 2006). Malnutrition has been reported

*Corresponding author. E-mail: shehuakuyam@gmail.com. Tel: +23480328895; +2348023599243.

Table 1. Serum albumin (mean ± SEM) in hospitalized patients, out-patients and apparently healthy subjects.

Subject	n	Serum albumin (g/L)
Hospitalized patients	50	35.88±1.56
Out-patients	50	39.70±1.77
Apparently healthy subjects	50	42.32±1.34
*p-value		<0.05

n = sample size and SEM = standard error of the mean, *this was based on one way analysis of variance (ANOVA).

in up to 15% of community-dwelling and home-bound elderly individuals. It is also reported in up to 62% of hospitalized elderly patients and up to 85% of residents of nursing homes (Compan et al., 1999; Morley and Thomas, 1999; Visvanathan, 2003).

Nutritional assessment is an important part of management in every patient, including hospitalized ones. The objective of this assessment is to identify those patients who are already malnourished or who are at increased risk of developing malnutrition (Baron, 1986). Dozens of assessment techniques are currently available and in common use. Blackburn et al. (1977) have recommended an extensive panel of clinical and laboratory assessments which include anthropometric mea-surements, and laboratory analysis including serum albumin measurement. The use of serum ALB and total protein concentrations and other biochemical tests as indices of nutritionl status have been fully documented (World Health Organization (WHO), 1966). The levels of serum proteins, including ALB have been reported pre-viously in several Nigerian and African subjects (Edozien, 1957; Isichei, 1975; Onwuameze, 1989; Anaja et al., 1997).

The aspect of nutritional assessment is neglected in the management of patients in most of the Nigerian hospitals, including ABUTH, Zaria. Moreover, there is paucity of data on the nutritional assessment in hospitalized patients in Nigeria, including Zaria. The reported studies on this aspect were carried out elsewhere in the world (Baron, 1986; Chima et al., 1997; Kagansky *et al*, 2005; Beckman Coulter; 2007). In view of its clinical im-portance, there is therefore the need to carry out a study on the nutritional assessment in hospitalized patients in Ahmadu Bello University Teaching Hospital (ABUTH), Zaria. This could help for the diagnostic, therapeutic and prognostic purposes, including provision of nutritional support for the malnourished hospitalized patients and therefore reduces the morbidity and mortality among this group of patients in our hospitals. The objective of the present study was therefore to compare serum ALB among hospitalized, out-patients and apparently healthy subjects with a view to assessing its status during hospitalization.

MATERIALS AND METHODS

The study was conducted in the Department of Chemical Pathology of ABUTH, Zaria, Northern Nigeria. It is a cross-sectional study which was approved by the Ethical Committee of the ABUTH, Zaria in accordance with Helsinki declaration. A total of 150 subjects (88 males and 62 females) were recruited for this study. This consisted of 50 [31 males and 19 females; mean age 41 ± 26 (range 15 to 70 years)] hospitalized patients (in-patients), 50 [25 males and 25 females; mean age 46 ± 31 (range 15 to 70 years)] out-patients with different disease conditions and 50 (32 males and 18 females; mean age 36 ± 21 (range 15 to 60 years)] apparently healthy individuals (control). The target populations were adult patients who were on admission in various wards or who were attending various out-patients clinics of ABUTH, Zaria, respectively. The apparently healthy individuals were recruited from the population of staff and students of ABUTH, Zaria.

Patients aged between 15 and 70 years of age presenting to any one of the above mentioned facilities of ABUTH, Zaria with various disease conditions, such as diabetes mellitus (DM), hypertensive heart disease (HHD), peptic ulcer disease (PUD) and others were included in the study. Apparently healthy individuals who have not been diagnosed to have any one of the above mentioned disease and who were within the same age range with patients were included in the study as controls. Patients with any one of the disease conditions known to affect serum ALB, such as liver and kidney diseases, malnutrition, cancer and others were excluded from the study. Similarly, all subjects who were below 15 and above 70 years were excluded from this study. All subjects who declined to give consent for inclusion were also excluded from the study.

At the respective locations, arrangements were made with the clinicians whereby consecutive subjects who satisfied the study inclusion criteria were selected. Informed consent for inclusion into the study was obtained from the subjects. The nature of the study was explained to the subjects using an appropriate language. A full history was obtained from the selected subjects. This was followed by clinical examination and collection of blood specimens. The main findings were documented. Blood specimen (about 5 ml) was collected from a peripheral vein (antecubital venefuncture). This was transferred into a plain bottle and allowed to clot for about 30 min. This was then centrifuged for 5 min at 1,200 g. The serum was separated from the cells and stored frozen at - 20°C until the time for analysis. Serum ALB concentrations were measured using method of Doumas et al. (1971) by the use of reagent diagnostic kit which was procured from RANDOX Laboratories Ltd. (United Kingdom).

The data obtained were analysed using Statistical Package for Social Sciences (SPSS 11.0 for Windows) (SPSS Inc., Chicago, IL). One way analysis of variance (ANOVA) statistical method was employed for comparison of the results of serum ALB obtained from 3 different groups of the subjects and Student's t-test was used for post-hoc analysis, for the comparison of results between 2 different groups of studied subjects. A p-value of equal to or less than 0.05 (p ≤ 0.05) were considered as statistically significant.

RESULTS

The results of serum ALB in hospitalized and out-patients, as well as apparently healthy individuals are presented in Table 1. These results show significant differences between the 3 groups of the studied subjects (p < 0.05, ANOVA). The results of serum ALB in hospitalized patients and controls are shown in Table 2.

Table 2. Serum albumin (mean ± SEM) in hospitalized patients and apparently healthy individuals.

Subject	n	Serum albumin (g/L)
Hospitalized patients	50	35.88±1.56
Apparently healthy subjects	50	42.32±1.34
*p-value		<0.01

n= sample size and SEM= Standard error of the mean, *this was based on Student's t-test.

Table 3. Serum albumin (mean ± SEM) in out-patients and apparently healthy individuals.

Subject	n	Serum albumin (g/L)
Out-patients	50	39.70±1.77
Apparently healthy subjects	50	42.32±1.34
p-value		>0.05

n = sample size and SEM = standard error of the mean, *this was based on Student's t-test.

Table 4. Serum albumin (mean ± SEM) in hospitalized patients and out-patients.

Subject	n	Serum albumin (g/L)
Hospitalized patients	50	35.88±1.56
Out-patients	50	39.70±1.77
p-value		>0.05

n = sample size and SEM = standard error of the mean, *this was based on Student's t-test.

The results in this table show that serum ALB in hospitalized patients were significantly lower than those obtained in controls ($p < 0.01$, Student's t-test).

Serum ALB obtained from out-patients and controls are shown in Table 3. These results show that serum ALB concentrations in out-patients were not significantly different from that observed in controls ($p > 0.05$, Student's t-test). The results of serum ALB concentrations obtained from hospitalized and out-patients are presented in Table 4. The results show that ALB values in hospitalized were not significantly different from that observed in out-patients counterparts ($p > 0.05$, Student's t-test).

DISCUSSION

ALB concentrations have been measured in hospitalized patients, out-patients and apparently healthy individuals to compare the results between these groups of subjects, with a view to assessing its status during hospitalization

to serve as a baseline study. The findings of the present study show that the results of serum ALB obtained from hospitalized patients were significantly lower than those obtained from apparently healthy individuals, while there was no statistically significant difference in serum ALB between out-patients and apparently healthy individuals. Similarly, the concentrations of serum ALB obtained from hospitalized patients and out-patients were not statistically different. These results therefore demonstrate that serum ALB was decreased during hospitalization. These findings agree well with the previous reports by Margarson (1998), Banh (2006) and Gariballa (2001) who reported that serum ALB concentrations deteriorate steadily during hospitalization period which results in hypoalbuminaemia and immediately following discharge. It has been reported that the low serum levels of ALB found in hospitalized patients positively correlated with poor nutritional status in these patients (Gariballa, 2001).

The use of serum ALB and total protein concentrations and other biochemical tests as indices of nutritional status have been fully documented (World Health Organization, 1966). Serum albumin is the most widely measured biochemical analyte for the assessment of nutritional status in both patients and for the nutrition surveys. This is because of ease of its measurement as regard to cost, short turn-around time and ability to detect malnutrition. The fact that serum ALB concentrations were significantly low in hospitalized patients supports the report that malnutrition is common in hospitalized patients and may be associated with increased morbidity and mortality.

Several studies across the world revealed that malnutrition is highly prevalent in hospitalized patients most especially in the elderly ones, and this is associated with increased morbidity and mortality (Lowenstein, 1982; Mowe and Bohmer, 1991; Gariballa, 2001; Visvanathan, 2003; Kagansky et al., 2005; Singh et al., 2006). Malnutrition has been reported in up to 15% of community-dwelling and home-bound elderly individuals and in up to 62% of hospitalized elderly patients and 85% of residents of nursing homes (Compan et al., 1999; Morley and Thomas, 1999; Visvanathan, 2003). Many studies have shown that poor nutrition leads to complications during hospitalization and increases mortality (Potter et al., 1988; Constans et al., 1992; Sullivan and Walls, 1995). The poor nutritional status in hospitalized patients is associated with various factors, including chronic diseases, anorexia, medications, isolation, psycho-social problems and decline in cognitive and functional status (Kagansky et al., 2005). It has been suggested that the cases of malnutrition in hospitalized patients can be divided into 3 major categories: (1) decreased oral intake, (2) increased nutritional losses and (3) decreased nutrient requirements, which may be due to psycho-social problems (Baron, 1986).

The striking reduction of serum ALB in the hospitalized patients of the present study and the previous reports could be due partly to the poor appetite and hence decrease calorie intake which may be as a result of psychologic trauma caused by hospitalization. The significant reduction of serum ALB in hospitalized patients could be attributed to immobilization which has been suggested to be one of the causes of hypoalbuminaemia (Czajka-Narins, 1987; Veldee, 1999). Prolonged immobilization, as in the case of hospitalization, is associated with haemodilution which is known to cause significant reduction of serum ALB (Peralta and Rubery, 2006). The haemodilution in this group of patients could be due to ascites and oedema which are secondary to increased vascular permeability, which permits the loss of ALB into these spaces (Johnson et al., 1999). The limitations of the present study were inability to measure other markers for the nutritional assessment such as transferin, which are more sensitive than the ALB and inability to measure the serum ALB before and after admission for better assessment than measuring it only once during admission.

CONCLUSIONS AND RECOMMENDATIONS

It is concluded from the findings of the present study that serum ALB concentrations were significantly lower in hospitalized patients than in apparently healthy individuals, while serum ALB concentrations in out-patients and apparently healthy individuals were similar. It is recommended from the findings of the present study that serum ALB concentrations be routinely measured as part of the assessment of nutritional status in hospitalized patients, and that assessment of nutritional status be part of the management of every patient, most particularly hospitalized ones. This is to complement the findings from history, physical examination and anthropometric measurements. This could aid in identifying those patients who are already malnourished or who are at increased risk of developing malnutrition and its complications. Hence it could help for the diagnostic, therapeutic and prognostic purposes, including provision of nutritional support for the malnourished hospitalized patients, and therefore reduces the morbidity and mortality among this group of patients in our hospitals. A comprehensive follow-up study which involves measuring anthropometric parameters, serum ALB, transferin and other important markers is also needed for the better assessment of nutritional status of hospitalized patients.

ACKNOWLEDGEMENT

REFERENCES

Peters T Jr, Serum albumin (1975). In: Putnam F (Ed.). The plasma proteins, Vol 1. Academic Press, New York. p 133.

Javed MU, Waqar SN (2001). An enzymatic method for the detection of human serum albumin. Exp. Mol. Med. 33(2): 103-5.

Schultze HE, Heremans JE (1970). Physiology and pathology of plasma proteins. J. Clin. Pathol. 2:321.

Grant GH, Silverman LM, Christenson RH (1987). Amino acids and proteins. In: Tietz NW (Ed.). Fundamentals of clinical chemistry, 3rd Edn . WB Saunders Co., London. pp. 291-345.

Margarson MP, Soni N (1998). Serum albumin: touchstone or totem? Anaesthesia 53:789-803.

Banh L (2006). Serum proteins as markers of nutrition: What are we treating. In: Parirish CR (ed.), Nutrition issues in gastroenterology. Practical Gastroenterol. Series 43:1-14.

Sundell MB, Pupim LB, Ikizler T (2007). Nutrition in advanced chronic kidney disease: Biomarkers and body composition tools. Nutr. Today 42: 22-7.

Lowenstein FW (1982). Nutritional status of the elderly in the United States of America, 1971-1974. J. Am. Coll. Nutr. 1:165-77.

Mowe M, Bohmer T (1991). The prevalence of undiagnosed protein-calorie under nutrition in a population of hospitalized elderly patients. J. Am. Geriatr. Soc. 39:1089-92.

Gariballa SE (2001). Malnutrition in hospitalized elderly patients: when does it matter? Clin. Nutr. 20(6):487-91.

Visvanathan R (2003). Under-nutrition in older people: a serious and growing global problem. J. Postgrad. Med. 49:352-60.

Singh H, Watt K, Veitch R, Cator M, Duerksen DR (2006). Malnutrition is prevalent in hospitalized medical patients: Are house staff identifying the malnourished patient? Nutrition 22:350-4.

Compan B, di Castri A, Plaze JM, Arnaud-Battandier F (1999). Epidemiological study of malnutrition in elderly patients in acute, sub-acute and long-term care using the MNA. J. Nutr. Health Aging 3:146-51.

Morley JE, Thomas DR (1999). Anorexia, and aging: pathophysiology. Nutr. 15:499-503.

Baron RB (1986). Malnutrition in hospitalized patients-diagnosis and treatment. West J. Med. 144:63-7.

Blackburn GL, Bistrian BR, Maini BS (1977). Nutritional and metabolic assessment of the hospitalized patients. JPEN 1:11-22.

World Health Organization (1966). Joint FAO/WHO Technical Meeting on Methods of Planning and Evaluation in Applied Nutrition Programmes. TRS No. 340.

Edozien JC (1957). The serum proteins of healthy adult Nigerians. J. Clin. Path. 10: 276-8.

Isichei UP (1975). Total serum protein and protein pattern among healthy Northern Nigerians. Trop. Geo. Med. 27: 265-8.

Onwuameze IC (1989). Specific protein patterns in adults healthy Nigerians. Afr. J. Med. Sci. 18:49-53.

Anaja HP, Oshafunmi DS, Iroko EA, Tiam EA, Isah HS (1997). Serum albumin as a rough index of nutritional status in adult rural northern Nigerians. Niger. J. Med. 6:73-76.

Chima CS, Barco K, Dewitt ML, Maeda M, Teran JC, Mullen KD (1997). Relationship of nutritional status to length of stay, hospital costs, and discharge status of patients hospitalized in the medicine service. J. Am. Diet. Assoc. 97:975-980.

Kagansky N, Berner Y, Koren-Morag N, Peralman L, Knobler H, Levy S (2005). Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. Am. J. Clin. Nutr. 82: 784-791.

Beckman Coulter (2007). Nutritional assessment. Beckman Coulter, Inc. pp.1-3.

Doumas BT, Watson WA, Biggs HG (1971). Albumin standard and the measurement of serum albumin with bromocresol green. Clin. Chim. Acta 31: 87-96.

Potter JF, Schafer DF, Bohi RL (1988). In-hospital mortality as a function of body mass index: an age-dependent variable. J. Gerontol. 43: 59-63.

Constans T, Bacq Y, Brechot JF, Guilmot JL, Choutet P, Lamisse F (1992). Protein-energy malnutrition in elderly medical patients. J. Am. Geriatr. Soc. 40:263-8.

Sullivan DH, Walls RC (1995). The risk of life-threatening complications in a select population of geriatric patients: the impact of nutritional status. J. Am. Coll. Nutr. 14:29-36.

Czajka-Narins DM (1987). Nutrition. In: Tietz NW(Ed.). Fundamentals of clinical chemistry, 3rd Edn . London, WB Saunders Co. pp. 482-96.

Veldee MS (1999). Nutritional assessment, therapy and monitoring. In: Burtis CA, Ashwood ER (eds), Tietz Textbook of Clinical Chemistry, 3rd edition. WB Saunders Company, London. pp. 1359-94.

Peralta R, Rubery BA (2006). Hypoalbuminaemia. HONcode principles of the Health. American Association of Clinical Chemistry.

Johnson AM, Rohlfs EM, Silverman LM (1999). Proteins. In: Burtis CA, Ashwood ER (Eds). Tietz Textbook of Clinical Chemistry, 3rd edition. WB Saunders Company, London. pp. 477-540.