

Association between serum albumin and cardiovascular diseases among adult population of Kaski district, Nepal

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Abstract

BACKGROUND

Serum albumin is an abundant circulatory protein. Several studies were reported that a low level of serum albumin associated with a high risk of cardiovascular diseases (CVDs) mortality. Therefore, the present study aimed to investigate serum albumin levels and find out the association between serum albumin and CVDs and their correlation with cardiovascular risk factors.

METHODS

This was a cross-sectional study. Patients with confirmed CVDs were enrolled in this study while patients with CVDs plus acute or chronic liver and intestinal diseases were excluded in this study. Data were collected and analyzed by using SPSS version 21. P-value (two-tailed) < 0.05 was considered statistically significant.

RESULTS

A total of 400 subjects were enrolled, out of which 200 healthy control (male 125 and female 75) and 200 patients with CVDs (male 130 and female 70). The mean level of total protein, albumin, globulin, and HDL-C were statistically ($p < 0.005$) lower while TC, TG, and FBS were statistically ($p < 0.005$) higher in CVDs subjects in compared to healthy control. The serum albumin was lower in 35 (17.5%) of patients with CVDs, out of which 19 (9.5%) were male and 16 (8.0%) were female. Serum albumin showed a statistically significant negative correlation with age ($p = 0.000$) and a positive correlation with TC ($p = 0.000$). In multinomial logistic regression analysis, model-I, II, and III showed a statistically significant ($p < 0.05$) association between serum albumin with CVDs.

CONCLUSION

This study concluded, low serum albumin was found in patients with CVDs and it was significantly associated with CVDs. Therefore, measurement of serum albumin can be performed routinely in patients with CVDs.

KEY WORDS

Serum albumin, Cardiovascular diseases, Cardiovascular risk factors

INTRODUCTION

Cardiovascular diseases (CVDs) are major cause of death worldwide. The cardiovascular risk factors are obesity, smoking, drinking, lipid levels, physical inactivity, diabetes mellitus, and hypertension.¹⁻³ Several studies were reported that a low level of serum albumin associated with a high risk of CVDs mortality.⁴⁻⁶

Serum albumin is a negative acute-phase protein and has several vital physiological functions which include maintaining oncotic pressure and microvascular integrity, regulating metabolic functions, antioxidant activities, providing binding ligands, and inhibiting platelet aggregation.^{7,9} Many studies showed that a low level of serum albumin is associated with a higher risk of myocardial infarction morbidity⁶, and mortality of coronary heart disease and stroke.¹⁰⁻¹² Inflammation is associated with CVDs incidence and mortality and serum albumin levels decrease approximately 20 percent during the inflammation process.^{13,14} Yang et al (2016) showed a strong association between low serum albumin levels with the occurrence of first or recurrent myocardial infarction, after adjusting for traditional risk factors.¹⁵ Based on previous studies, low serum albumin is associated with CVDs and there are no such studies were conducted in Nepali adults. Therefore, the present study aimed to investigate serum albumin levels and find out the association between serum albumin and CVDs and their correlation with cardiovascular risk factors.

METHODS

This was a cross-sectional study and was conducted in a clinical biochemistry laboratory at Manipal Teaching Hospital, Pokhara, Kaski, Nepal. The study was conducted from January 2018 to December 2020. Patients with confirmed CVDs were enrolled in this study while Patients with CVDs plus acute or chronic liver and intestinal diseases were excluded in this study.

Age, gender, family history, presence of any other diseases, dietary habits, smoking or drinking habits, and ethnicity were collected with the help of a pre-validated questionnaire. Using standard techniques and protocols, body weight, height, waist and hip circumferences, and blood pressure of all the patients were measured.

In the gel tube, five ml of venous blood were collected and allowed to clot then centrifuged at 4000 rpm for 10 minutes. The serum was obtained and level of albumin, total protein, fasting blood sugar (FBS), total cholesterol (TC), triglycerides (TG), high-density lipoprotein-cholesterol (HDL-C) were measured using a fully automated dry chemistry-based analyzer (VITROS® 350 chemistry system, Ortho clinical diagnostics, UK). Glycated hemoglobin (HbA1c) was measured by using a fully automated Biorad D-10 HbA1c analyzer. CVDs were defined based on one or more findings: elevated cardiac markers, abnormal ECG findings, and echocardiogram. The low albumin was defined level of <3.5 gm/dl. The written consent was obtained from all the participants before enrollment. The ethical clearance was taken from the Institutional Review Committee (IRC) of the Manipal College of Medical Sciences, Pokhara, Nepal.

The difference in means in healthy control and CVDs was found with the help of an independent student's t-test. Pearson's correlation coefficient test (two-tailed) was applied to investigate the correlation between serum albumin and CVDs risk factors. Multinomial logistic regression analysis was used to find the association between serum albumin and CVDs using SPSS version 21. P-value (two-tailed) < 0.05 was considered statistically significant.

RESULTS

Baseline characteristics of study subjects

A total of 400 subjects were enrolled, out of which 200 healthy control (male 125 and female 75) and 200 patients with CVDs (male 130 and female 70). The mean age of healthy control and CVDs were 53.0±9.7 and 61.3±12.7 respectively. The mean of body mass index (BMI), waist-to-hip ratio, systolic blood pressure (SBP), and diastolic blood pressure (DBP) were 24.8±2.5, 0.9±0.6, 118.9±7.5, and 79.14±8.6 in healthy control whereas 25.6±3.1, 1.0±0.4, 122.2±15.2, and 78.2±10.2 in CVDs subjects respectively. In healthy control, 18 (9%) had smoking and 95 (47.5%) had drinking habits.

Similarly, among CVDs subjects, 98 (49%) had smoking and 120 (60%) had drinking habits.

Correlation of serum albumin with CVDs risk factors

Pearson’s correlation analysis results were tabulated in table 1. Serum albumin showed a statistically significant correlation with age (p=0.000) and TC (p=0.000). The level of serum albumin showed a positive correlation with WHR, SBP, DBP, TC, TG, HDL-C, smoking habits, and drinking habits and a negative correlation with age, BMI, and FBS which showed no statistically significant (p>0.05).

Association between serum albumin and CVDs

Multinomial logistic regression analysis results were represented in table 2. The different models were adjusted with CVDs risk factors. Model-I, II, and III showed a statistically significant (p<0.05) association of serum albumin.

Table 1: Correlation between serum albumin and cardiovascular risk factors

	Albumin	
	Correlation (r)	p-value
Age	-0.260**	0.000
BMI	-0.018	0.800
WHR	0.010	0.892
SBP	0.037	0.601
DBP	0.009	0.905
FBS	-0.029	0.679
TC	0.310**	0.000
TG	0.136	0.054
HDL-C	0.122	0.084
Smoking habits	0.021	0.768
Drinking habits	0.040	0.574

** Correlation is significant at the 0.01 level (2-tailed). BMI (Body mass index), WHR (waist-to-hip ratio), SBP (Systolic blood pressure), DBP (Diastolic blood pressure), FBS (Fasting blood sugar), TC (Total cholesterol), TG (Triglyceride), HDL-C (High-density lipoprotein-cholesterol)

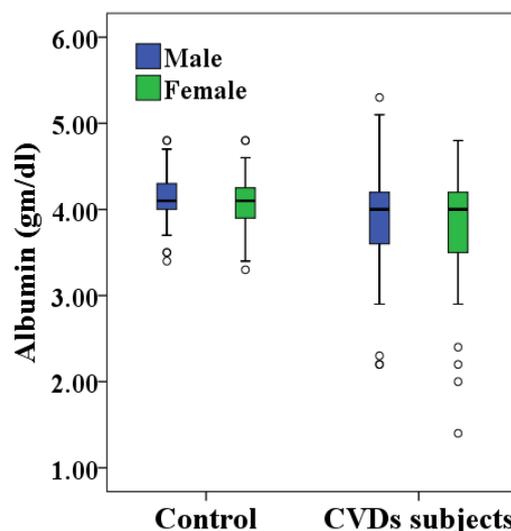


Figure 1: Serum level of albumin in control and CVDs subjects by gender. The box indicates the central data of distribution and the median is presented as a line inside the box.

Table 2: Association between serum albumin and CVDs

	Albumin	
	OR (95% CI)	p-value
Model-I	0.372 (0.215-0.644)	0.000
Model-II	0.405 (0.201-0.816)	0.011
Model-III	0.348 (0.149-0.813)	0.015
Model-IV	0.408 (0.156-1.072)	0.069

Model-I: Adjusted for age and sex
Model-II: adjusted for age, sex, BMI, WHR, HbA1C, SBP, and DBP
Model-III: Adjusted for age, sex, BMI, WHR, HbA1C, SBP, DBP, TC, TG & HDL-C
Model-IV: adjusted for age, sex, BMI, WHR, HbA1C, SBP, DBP, TC, TG, HDL-C, smoking habits, and drinking habits

DISCUSSION

Cardiovascular diseases are major health issues and causes of morbidity, mainly in developing countries.² The low level of serum albumin could act as a modifiable risk factor in patients with some cardiovascular diseases.^{16, 17} In the present study, a low level of albumin was found in 17.5% of patients with CVDs. Our finding was supported by many observational studies showing the prevalence of hypoalbuminemia in different types of CVDs.

The prevalence of hypoalbuminemia varies from one to another, 13% in stable coronary disease, 20-30% in acute coronary syndromes and myocardial infarction, 20-25% in chronic heart failure, 14-30% in congenital heart disease, stroke, and infective endocarditis.¹⁸⁻²⁴

The low serum albumin results from the decreased synthesis in the liver, increased catabolism, increased vascular permeability, and loss through the kidney.²⁵ But, these mechanisms were not investigated in the present study. However, inflammation play important role in the occurrence of hypoalbuminemia, and CVDs are directly associated with inflammation.^{13,14}

In the present study, serum albumin was associated with CVDs after adjustment with cardiovascular risk factors and showed a significant correlation with age and TC. Our finding was supported by several previous studies. A large population study reported that low serum albumin level was strongly associated with the occurrence of myocardial infarction, after adjusting for risk factors.⁶ The Framingham Offspring study reported that serum albumin was an independent predictor of first myocardial infarction.¹⁵ Some of the studies showed low serum albumin independently predicts incident heart failure.²⁵⁻²⁷

The strength of the present study was serum albumin adjusted with cardiovascular risk factors and the weakness of the study was small sample sizes and hospital-based study. Therefore, a population-based study is necessary to explore the association between serum albumin and CVDs.

CONCLUSION

This study concluded, low serum albumin was found in patients with CVDs and it was significantly associated with CVDs. Hypoalbuminemia may cause worsening of some cardiovascular conditions like heart failure, ischemic heart diseases by enhancing myocardial edema. Therefore, measurement of serum albumin can be performed routinely in patients with CVDs to decrease the worsening of the condition which may arise due to a decreased level of serum albumin.

CONFLICT OF INTEREST

None declared

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