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ORIGINAL RESEARCH

Helicobacter pylori Infection as a Risk Factor for Abnormal Serum Protein Levels in General Population of China

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Background: *Helicobacter pylori* (HP) infection is considered as a risk factor for nutritional and metabolic abnormalities, and serum protein is an important marker of the nutritional and immune status. It is still unknown whether HP infection affects serum protein levels.

Methods: The participants who underwent health screening from July 2020 to August 2021 were included, among whom, 1485 subjects with 14C-urea breath test (14C-UBT) values ≥100 disintegrations per minute (dpm) were defined as HP-positive cases, and 4864 cases with 14C-UBT values <100 dpm were defined as HP-negative cases. Anthropometric measurements were taken, and biochemical parameters of the blood were analyzed for all subjects. Categorical variables were compared using the $\chi 2$ test and continuous variables using Student's *t* test. Logistic regression analysis was used to determine the effect of HP infection on serum proteins.

Results: Age, the proportion of female, globulin levels, total cholesterol levels, and low-density lipoprotein cholesterol levels were significantly higher in the HP infected group than in the non-infected group ($P < 0.05$). Height, weight, body mass index, hip circumference, albumin levels, albumin to globulin ratio, triglycerides levels, and uric acid levels were significantly higher in the non-infected group than in the infected group ($P < 0.05$). Multifactorial analysis revealed that HP infection was significantly associated with the risk of decreased serum albumin levels (odds ratio [OR] = 0.809, $P = 3.51\times10^{-4}$); HP infection was significantly associated with the risk of increased serum globulin levels (model 1: OR = 1.257, $P = 1.39\times 10^{-4}$); and HP infection was significantly associated with the risk of decreased albumin/globulin ratio (OR= 0.775, $P = 2.30\times10^{-5}$).

Conclusion: HP infection was significantly associated with lower serum albumin levels, elevated globulin levels, and lower albumin/globulin ratio. Thus, it is an important factor affecting nutritional metabolism.

Keywords: *Helicobacter pylori*, nutrition, serum albumin, serum globulin, albumin/globulin ratio

Background

Helicobacter pylori (HP) is a Gram-negative bacterium found in the gastric mucosa. It is prevalent worldwide and is responsible for infecting more than 50% of the world's population encompassing up to 80% of the population in developing countries and about 40% in the developed countries. HP prevalence in Asian populations is approximately 53%. The prevalence of HP infection in the Chinese population is higher than the Asian population average at around 60%.[1,2] The prevalence of HP infection has been reported to increase with age, gradually increasing from 0 to 39 years, peaking at 39 years (59.3%) and gradually decreasing after 60 years.[3] HP was recognized as a group I human carcinogen by the World Health Organization's International Agency for Research on Cancer. About 50% of gastric cancers are associated with HP. It has been reported that HP infection enhances Th1-type immune response during carcinogenesis leading to apoptosis of gastric epithelial cells, which further leads to cell proliferation to compensate for cell loss[4,5.] The altered gastric environment caused by damage to the structure and function of the gastric epithelium may affect the absorption of nutrients and drugs and the production of hormones closely associated with growth regulation in the stomach. Chronic HP infection leads to decreased secretion of

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gastric acid, which may cause an increase in the levels of inflammatory cytokines such as tumor necrosis factor-alpha, interleukin and interleukin.[6] The surge in inflammatory cytokines may lead to metabolic changes and alterations in systemic immune responses, which are responsible for the formation of malignant tumors.[7,8]

Recent preliminary studies have shown that HP infection causes systemic metabolic and nutritional disorders. Dutta SK study has reported a higher prevalence of HP infection in obese patients.[9] In contrast, other study revealed that HP eradication significantly increased the prevalence of obesity in peptic ulcer patients, which was attributed to the increase in body mass index (BMI) and/or enhanced appetite in asymptomatic patients due to elevated plasma ghrelin levels and decreased leptin levels.[10,11] Franceschi et al showed that HP infection led to impaired absorption of vitamin B12, vitamin C, vitamin E, beta-carotene, folic acid, zinc, selenium, and other nutrients.[12] A recent meta-analysis showed that the prevalence of HP infection was significantly higher in patients with type 2 diabetes compared to non-diabetic patients.[13] To date, many epidemiological studies have reported the association among insulin resistance, metabolic syndrome, and HP infection.[14]

Serum proteins are important for maintaining normal physiological status. The concentration of serum proteins is approximately 60–80 mg/mL, of which approximately 50–60% is albumin and 40% is globulin (10–20% is immunoglobulin G, IgG).[15] Recent data highlight the importance of measuring serum albumin levels for prognostic assessment of certain diseases. For example, the Kidney Disease Prognostic Quality Initiative guidelines suggest that monitoring of serum albumin levels is a valid and clinically useful tool for assessing protein-energy nutritional status in patients undergoing dialysis.[16] However, the correlation between HP infection and serum proteins remains unclear. In a study on the relationship between HP infection and serum albumin levels in hemodialysis patients,[17] HP infection was significantly and negatively associated with serum albumin levels. Another study comprising 98 hemodialysis patients revealed that HP infection was present in 39 patients, but there were no significant differences in nutritional markers between the HP-positive group and the HP-negative group[17.] The aforementioned study has some limitations, such as small sample size and the study mainly comprised patients with renal disease, which is recognized as an important factor affecting albumin levels. The relationship between HP infection and serum protein levels remains unclear due to the above limitations.

Therefore, the present study was designed to analyze the correlation between HP infection and serum protein levels based on clinical data from a large number of patients. Our study may lay the foundation for further studies planned to elucidate the effect of HP infection on systemic nutritional and immune profiles.

Methods

Study Design and Population

The participants aged 12–93 years who underwent annual health check-up (including 14C urea breath test [UBT]) at the People's Hospital of Guangxi Zhuang Autonomous Region from July 2020 to August 2021 were screened. The patients with ≥ 100 disintegrations per minute of 14C-UBT were defined as positive for HP infection (case) and those with <100 disintegrations per minute were defined as negative for HP infection (control). Participants in the HP positive group were matched 1:3 to those in the HP negative group. Inclusion criterion was detection of 14C-UBT and H. pylori. Participants with hepatobiliary disease (hepatitis, jaundice, cholecystitis, gallstones), abnormal liver function (alanine aminotransferase [ALT] or aspartate aminotransferase [AST] > 1.5 times the upper limit of normal), and abnormal kidney function (Cr > the upper limit of normal) were excluded. This study was approved by the Ethics Committee of Guangxi Zhuang Autonomous Region People's Hospital & Guangxi Academy of Medical Sciences (Number KY-ZC-2020-64). All participants provided written informed consent. For participants under 18 years of age, informed consent was provided by a parent or legal guardian. The study complies with the Declaration of Helsinki.

Anthropometric and Laboratory Measurements

The anthropometric measurements of each participant were taken by professional medical staff. The details of systemic or previous diseases such as diabetes mellitus, hypertension, hepatitis, jaundice, cholecystitis, and/or biliary stones were recorded. BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). The waist circumference (WC) was measured in centimeters at the level of the umbilicus. The hip circumference (HC) was the straight-line distance between the outermost projecting points of the left and right thigh. Blood pressure was measured

three times while the subject was seated and the average of the last two measurements was calculated. Blood samples were collected after overnight fasting. The results of serum biomarkers were collected from the hospital information system. The collected biomarkers included total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), alanine aminotransferase (ALT), aspartate aminotransferase (AST), total serum protein, albumin (ALB), globulin, albumin to globulin ratio (AGR), blood urea nitrogen (BUN), serum creatinine (Cr), uric acid (UA) and glycosylated hemoglobin (HbA1c).

Statistical Analysis

Normally distributed continuous variables are expressed as mean ± standard deviation (SD). They were compared using analysis of variance or *t*-test and the between-group comparisons were evaluated by chi-square test. Binary logistic regression analysis was used to calculate the odds ratio (OR) and 95% confidence interval (95% CI) Corrections were made for nine variables (age, sex, BMI, ALT, AST, TG, TC, LDL-C, and HDL-C) that were considered as potential confounders of serum proteins' levels. All analyses were done using SPSS, version 24.0 (SPSS Inc., Chicago, IL, USA). Differences with two-sided P value < 0.05 were considered significant.

Results

Clinical Characteristics of the Study Population

In total, 6349 subjects (4864 negative and 1485 positive for HP infection) were included in this study. The baseline characteristics of the participants in both groups are presented in Table 1. We found a significant correlation between

Table 1 Comparison of Clinical Characteristics of Subjects Stratified by the Presence and Absence of *Helicobacter pylori* Infection

	Negative for *H. pylori* (n = 4864) (Mean±SD)	**Positive for *H. pylori* (n = 1485) (Mean±SD)**	**P value**
Age (years)	44.21±12.64	45.22±12.17	0.006
Sex			
Male (n%)	3067 (63.1%)	888 (59.8%)	0.023
Female (n%)	1797 (36.9%)	597 (40.2%)	
WC (cm)	84.08±10.36	84.42±21.52	0.576
HC (cm)	95.79±6.62	95.34±6.40	0.026
Height (cm)	164.65±7.96	163.96±7.60	0.005
Weight (kg)	66.50±12.78	65.67±12.14	0.028
BMI (kg/m^2)	24.40±3.58	24.30±3.39	0.013
SBP (mmHg)	124.74±16.89	125.27±17.20	0.291
DBP (mmHg)	77.73±11.22	78.09±11.25	0.317
Total protein (g/L)	75.49±4.14	75.43±4.53	0.641
Globulin (g/L)	30.16±3.59	30.51±4.42	0.005
Albumin (g/L)	1.53±0.50	1.47±0.50	3.51×10^{-4}
Albumin/globulin	1.53±0.21	1.50±0.22	8.00×10^{-6}
Total cholesterol (mmol/L)	5.50±1.10	5.58±1.12	0.013
Triglycerides (mmol/L)	1.72±1.83	1.63±1.49	0.002
HDL-C (mmol/L)	1.47±0.32	1.47±0.32	0.663
LDL-C (mmol/L)	3.25±0.79	3.35±0.78	3.90×10^{-5}
ALT (U/L)	26.83±23.71	25.84±20.05	0.114
AST (U/L)	25.40±13.74	25.15±12.37	0.504
BUN (mmol/L)	4.90±1.39	4.96±1.21	0.096
Serum creatinine (μmol/L)	70.89±25.43	70.26±16.72	0.274
Uric acid (μmol/L)	377.92±98.03	370.59±98.20	0.012
HbA1c (mmol/L)	5.60±1.13	5.59±0.89	0.640

Abbreviations: WC, waist circumference; HC, Hip circumference; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; HbA1c, glycated hemoglobin.

ALB levels and HP infection with significantly lower ALB levels in the HP positive group than in the HP negative group ($P=3.51\times10^{-4}$). Age, the proportion of female, globulin levels, TC levels, and LDL levels were significantly higher in the HP-infected group than in the non-infected group ($P<0.05$). In contrast, Height, Weight, HC, BMI, AGR, triglycerides levels, and uric acid levels were significantly higher in the non-infected group than in the infected group ($P < 0.05$). Furthermore, no correlation was found between total protein levels and HP infection ($P > 0.05$).

Impact of HP Infection on the Correlation of Common Clinical Variables

To assess the impact of HP infection on the correlation of common clinical variables, we divided the population into two cohorts according to the presence or absence of HP infection and performed independent correlation analyses. In both cohorts, we found a significant positive correlation between TP and ALB as well as GLB and a significant negative correlation between TP and ARG ($P<0.05$, Figure 1A-B). ALB was significantly negatively correlated with GLB ($P<0.05$). Interestingly, HP infection might have an impact on the correlation between waist circumference (WC), hip circumference (HC) and BMI. In the non-HP-infected cohort, WC was significantly and strongly positively associated with HC and BMI (HC: r=0.79; BMI: r=0.86). However, in the HP infection cohort, WC was weakly positively correlated with HC (r=0.29) and moderately positively correlated with BMI (r=0.33). In the both cohort, ALB had a weak positive correlation with cholesterol. HbA1c is weakly and positively correlated with AGR.

Association Between Age and HP Infection

Stratified analysis was used to elucidate the relationship between HP infection and age (Table 2). Analysis was done after stratifying the subjects by age. Participants were divided into the following five groups: <20 years, 20–29 years, 30–39 years, 40–49 years, and ≥50 years. Stratified analysis showed significant difference in HP infection between the 30–39 years and ≥50 years' age groups (P=0.002). The subjects aged ≥50 years had a higher incidence of HP infection than those aged 30–39 years.

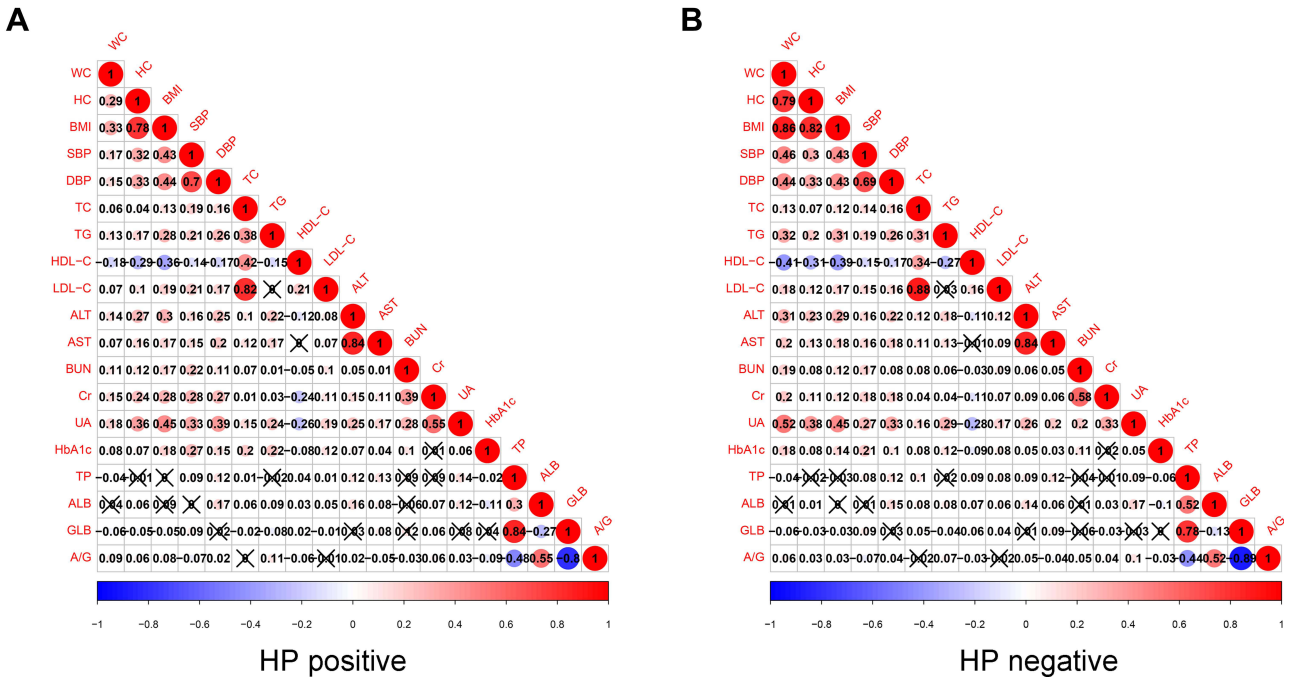

Figure 1 Impact of HP infection on the correlation of common clinical variables. (**A**) Correlation Heatmap of clinical variables in participants with HP positive. (**B**) Correlation Heatmap of clinical variables in participants with HP negative. Red represented positive correlation and blue represented negative correlation. Numbers represented correlation coefficients. Larger circles indicated larger correlation coefficients. A cross indicated that the correlation did not reach the level of significance.

Table 2 Analysis of *Helicobacter pylori* Infection Stratified by Age

	Age (Years)						
	<20	**20–29**	**30–39[a]**	**40–49**	**≥50[a]**	**Total**	**P value**
Negative for *H. pylori*	10 (76.9%)	510 (79.2%)	1493 (79.1%)	1307 (75.9%)	1544 (74.1%)	4864 (76.6%)	0.002
Positive for *H. pylori*	3 (23.1%)	134 (20.8%)	394 (20.9%)	415 (24.1%)	539 (25.9%)	1485 (23.4%)	
Total	13	644	1887	1722	2083	6349	

Note: [a]The difference between the two groups was statistically significant.

Association Between HP Infection and Albumin Levels

Binary logistic regression was used to analyze the association between HP infection and albumin levels. As shown in Table 3, in univariate analysis, HP infection was significantly associated with the risk of decreased serum albumin levels without adjusting for confounding factors (model 1: OR = 0.809, 95% CI = 0.720–0.909, P = 3.51×10^{-4}). The OR remained significant after adjusting for age and sex (model 2: OR = 0.852, 95% CI = 0.755–0.962, P=0.010); after adjusting for age, sex, BMI, ALT, and AST (model 3: OR = 0.857, 95% CI = 0.755–0.973, P = 0.017); and even after adjusting for age, sex, BMI, ALT, AST, TG, TC, LDL-C, and HDL-C (model 4: OR = 0.858, 95% CI = 0.755–0.976, P = 0.020).

Association Between HP Infection and Globulin Levels

Binary logistic regression was used to analyze the association between HP infection and globulin levels. As shown in Table 4, in univariate analysis, HP infection was significantly associated with a risk of increased serum globulin levels without adjusting for confounding factors (model 1: OR = 1.257, 95% CI = 1.118–1.415, P = 1.39×10^{-4}). The OR remained significant after adjusting for age and sex (model 2: OR = 1.232, 95% CI = 1.093–1.389, P = 0.001); after adjusting for age, sex, BMI, ALT, and AST (model 3: OR = 1.223, 95% CI = 1.079–1.386, P= 0.002), and even after adjusting for age, sex, BMI, ALT, AST, TG, TC, LDL-C, and HDL-C (model 4: OR = 1.211, 95% CI = 1.068–1.373, P = 0.003).

Table 3 *Helicobacter pylori* Infection Poses Risk of Reduced Albumin Levels

	Albumin Levels		
	Odds Ratio	**95% Confidence Interval**	**P value**
Model 1	0.809	0.720–0.909	3.51×10^{-4}
Model 2	0.852	0.755–0.962	0.010
Model 3	0.857	0.755–0.973	0.017
Model 4	0.858	0.755–0.976	0.020

Notes: Participants negative for *Helicobacter pylori* infection were defined by 0 and those positive for *H. pylori* infection were defined by 1. Model 1 is unadjusted. Model 2 is adjusted for age and sex. Model 3 is adjusted for age, sex, body mass index (BMI), alanine aminotransferase (ALT), and aspartate aminotransferase (AST). Model 4 is adjusted for age, sex, BMI, ALT, AST, triglycerides, total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.

Table 4 *Helicobacter pylori* Infection Poses Risk of Increased Globulin Levels

	Globulin Levels		
	Odds Ratio	**95% Confidence Interval**	**P value**
Model 1	1.257	1.118–1.415	1.39×10^{-4}
Model 2	1.232	1.093–1.389	0.001
Model 3	1.223	1.079–1.386	0.002
Model 4	1.211	1.068–1.373	0.003

Notes: Participants negative for *Helicobacter pylori* infection were defined by 0 and those positive for *H. pylori* infection were defined by 1. Model 1 is unadjusted. Model 2 is adjusted for age and sex. Model 3 is adjusted for age, sex, body mass index (BMI), alanine aminotransferase (ALT), and aspartate aminotransferase (AST). Model 4 is adjusted for age, sex, BMI, ALT, AST, triglycerides, total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.

Association Between HP Infection and Total Protein Levels

Binary logistic regression was used to analyze the correlation between HP infection and total protein levels. As shown in Table 5, no significant correlation was found between HP infection and total serum protein levels in the univariate analysis and even after adjusting for confounding factors ($P > 0.05$ in all cases).

Association Between HP Infection and Albumin/Globulin Ratio

Binary logistic regression was used to analyze the association between HP infection and albumin/globulin ratio. As shown in Table 6, in the univariate analysis, HP infection was significantly associated with the risk of decrease in albumin/globulin ratio without adjusting for confounding factors (model 1: OR = 0.775, 95% CI = 0.689–0.872, $P = 2.30\times10^{-5}$). The OR remained significant after adjusting for age and sex (model 2: OR = 0.803, 95% CI = 0.710–0.908, $P = 4.47\times10^{-4}$); after adjusting for age, sex, BMI, ALT, and AST (model 3: OR = 0.795, 95% CI = 0.700–0.904, $P = 4.51\times10^{-4}$); and even after adjusting for age, sex, BMI, ALT, AST, TG, TC, LDL-C, and HDL-C (model 4: OR = 0.803, 95% CI = 0.706–0.914, P = 0.001).

Discussion

HP is the dominant bacterial species of the gastric microbiota, and HP infection can lead to inhibition of gastric acid secretion, thereby causing chronic inflammation of the gastric mucosa and altering the gastric microenvironment.[18] Recent research has been focused on the fact that HP infection causes changes in the gastric environment and that HP plays an important role in maintaining the nutritional balance in the gastric environment.[19] The mechanisms underlying the nutritional and metabolic changes caused due to HP infection are yet unclear. To the best of our knowledge, this is the first study to investigate the effect of HP infection on the levels of metabolic and nutrition-related serum proteins in a large Chinese population.

Our findings revealed that HP infection affected the lipids' levels, wherein TC and LDL-C levels increased significantly and TG levels decreased significantly in the HP-infected group. A Korean study that included 15,195 participants reported that HP-positive participants had significantly higher BMI, WC, TC, LDL-C, and HDL-C levels than the seronegative participants. After adjusting for the confounders, high TC, low HDL-C, and high LDL-C levels

Table 5 The Risk of *Helicobacter pylori* Infection on Total Protein Levels

	Total Protein Levels		
	Odds Ratio	**95% Confidence Interval**	**P value**
Model 1	0.995	0.885–1.120	0.939
Model 2	1.011	0.898–1.138	0.859
Model 3	1.024	0.905–1.159	0.705
Model 4	1.015	0.897–1.149	0.811

Notes: Participants negative for *Helicobacter pylori* infection were defined by 0 and those positive for *H. pylori* infection were defined by 1. Model 1 is unadjusted. Model 2 is adjusted for age and sex. Model 3 is adjusted for age, sex, body mass index (BMI), alanine aminotransferase (ALT), and aspartate aminotransferase (AST). Model 4 is adjusted for age, sex, BMI, ALT, AST, triglycerides, total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.

Table 6 *Helicobacter pylori* Infection Poses Risk of Reduction in Albumin to Globulin Ratio

	Albumin/Globulin Ratio		
	Odds Ratio	**95% Confidence Interval**	**P value**
Model 1	0.775	0.689–0.872	2.30×10^{-5}
Model 2	0.803	0.710–0.908	4.47×10^{-4}
Model 3	0.795	0.700–0.904	4.51×10^{-4}
Model 4	0.803	0.706–0.914	0.001

Notes: Participants negative for *Helicobacter pylori* infection were defined by 0 and those positive for *H. pylori* infection were defined by 1. Model 1 is unadjusted. Model 2 is adjusted for age and sex. Model 3 is adjusted for age, sex, body mass index (BMI), alanine aminotransferase (ALT), and aspartate aminotransferase (AST). Model 4 is adjusted for age, sex, BMI, ALT, AST, triglycerides, total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.

were associated with HP seropositivity.[20] Another study comprising 15,679 participants from Japan, wherein lipid profiles and HP infection status in generally healthy individuals were assessed, revealed that HP infection had a significant positive effect on LDL-C and TC levels, and a negative effect on HDL-C and TG levels.[21] HP infection was also found to be positively associated with low HDL-C levels in the study by Zhao et al. The findings of our study are consistent with those of the aforementioned studies. Notably, our results further suggest that HP infection may cause metabolic abnormalities as indicated by both high levels of serum LDL-C and low levels of serum HDL-C, which are the risk factors for atherosclerosis and coronary artery disease. Thus, the results of this study suggest that HP infection can affect the lipid profile and may indirectly lead to various diseases caused due to abnormal lipid metabolism.

In our study, serum albumin levels and AGR were significantly lower in HP-positive participants than in HP-negative participants, and low levels of serum albumin and low AGR were associated with HP positivity after adjusting for confounding factors, including age, sex, BMI, ALT, AST, triglycerides, total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol. Therefore, HP infection may be a risk factor for low serum albumin levels. In a study by Furuta et al, levels of serum total protein, albumin, and total cholesterol were significantly higher in subjects with HP eradication.[22] In another study, the incidence of hypoproteinemia was significantly higher in HP-positive patients than in HP-negative patients and it decreased significantly after HP eradication, thus suggesting that HP eradication restores gastrointestinal digestion and absorption, which may be instrumental in improving nutritional parameters.[23] The authors hypothesized that HP infection may lead to impaired gastric acid secretion because the median gastric pH of patients with hypoproteinemia was much higher than the patients with normal protein levels. Thus, HP infection may reduce albumin levels by increasing gastric pH and thereby affecting gastric digestion and absorption. In addition, damage to the gastric mucosa caused by HP infection weakens the digestive and absorptive functions of the stomach, resulting in a decrease in serum albumin.[24] When HP contacts the gastric mucosal epithelium, the epithelium undergoes cytoskeletal reorganization and tyrosine phosphorylation, which in turn activates nuclear factor-κB (NF-κB) and leads to the secretion of chemokines such as IL-8 by epithelial cells, thereby chemotactic and activating inflammatory cells, causing them to migrate from the blood vessels to the gastric epithelium. Neutrophils and macrophages release a variety of inflammatory mediators and cytokines, including prostaglandins, leukotrienes, blood alkane boluses, TNF-α and various ILs, which have direct cytotoxic effects on gastric epithelial cells.[25] Finally, HP infection can promote the formation of microproteinuria leading to a decrease in serum albumin levels. Balat et al reported that a significant higher proteinuria in HP infected patients compared to non-infected individuals.[26] Potential mechanisms may be indirect damage to the urinary system due to systemic inflammatory immune response induced by HP infection and direct damage to the urinary system by virulence factors released by HP.[27]

We found that HP infection was positively correlated with serum globulin. We speculated that the underlying mechanism was that when a foreign microbe like HP is present in the body, the immune organs of the body activate the immune mechanism to increase globulins in order to destroy the invaders.[28] AGR is often used as a prognostic marker and reduced AGR is associated with poor prognosis of the disease. Interestingly, in the present study, AGR was significantly lower when albumin levels were reduced and globulin levels were increased, thus, indicating the poor prognosis of the patients. In contrast, the total protein levels in the HP positive group were lower than those in the HP negative group, but the difference was not statistically significant. By analyzing TP, ALB, globulin, and AGR simultaneously in the HP infected group, we were able to reflect the nutritional status and inflammatory response of the patients more accurately and comprehensively.

This study has some limitations. First, many variables that may be related to or affect serum proteins had not been evaluated, including skin fold thickness, lean body mass, eating habits, smoking, etc. Second, globulin electrophoresis was not performed, so we could not identify the components of the globulin that had changed. Third, the clinical significance of serum protein abnormalities due to HP infection needs to be further explored. In the next study, we will carry out this in patients undergoing surgery to investigate the rate of postoperative complications and wound healing in people with HP infection.

Conclusion

Our analysis of a large cohort based on the general Chinese population showed that HP infection was an independent risk factor for reduced serum albumin levels, increased serum globulin levels and reduced AGR. The results of this study have important implications for the elucidation of the effects of HP infection on systemic nutrition-immunity and provide a basis for exploring the impact of HP infection on surgical complications and the recovery process in the disease state.

Data Sharing Statement

The dataset supporting the conclusions of this article is included within the article.

Ethics Approval and Consent to Participate

This study was approved by the Ethics and Human Subject Committee of Guangxi Zhuang Autonomous Region People's Hospital & Guangxi Academy of Medical Sciences (Number KY-ZC-2020-64). All participants provided written informed consent.

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Disclosure

The authors report no conflicts of interest in this work.

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