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Seroprevalence of *Helicobacter pylori* Ig G Antibody and Risk Factors in Hypertensive Patients at Dschang District Hospital in Cameroon

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Authors' contributions

This work was carried out in collaboration between all authors. Author JDDT designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors YATG and MEN managed the investigation and analyses of the study. Authors VLN, AKD and JRK helped in the statistical analysis and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Growing evidence suggests that certain extragastric diseases were associated with *Helicobacter pylori* infection. This study aimed to determine the seroprevalence of *H. pylori* Ig G antibody and risk factors among hypertensive patients at Dschang District Hospital in Cameroon.
Place and Duration of Study: Department of Biochemistry and District Hospital of Dschang, between November 2015 to March 2016.
Methods: A cross-sectional study was carried out on 158 consenting patients of average age 57.21 ± 10 years attending the hospital for medical check-up or admitted in the hospital. Two blood pressure measurements and the determination of anti-*H. pylori* IgG antibody by the indirect

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enzyme-linked immunosorbent assay (ELISA) technique, enabled us to distinguish four groups of patients. A questionnaire survey was administered to study participants and potential risk factors for *H. pylori* exposure sought. The variables were included into a multivariate logistic regression model, and the association of the potential risk factors with the studied pathologies was expressed as odds ratio (OR) with 95% confidence intervals (CIs). The Chi-square test was used to compare frequencies of risks factors in the various groups. SPSS 20.0 was used for statistical analyses. A $p < 0.05$ was considered significant for all analyses.

Results: The seroprevalence of anti-*H. pylori* IgG antibody was significantly higher in hypertensive patients than in controls (44.89% versus 33.33%; p = 0.029; OR = 2.43). Among the risk factors evaluated, sex (p = 0.001; OR = 1.269) and alcohol intake (p = 0.001; OR = 1.235) were observed to be independent risk factors of hypertension while the habit of sharing cutleries (p = 0.043; OR = 2.337) and family history of gastric pains (p = 0.001; OR = 39.0) were predictors of *H. pylori* infection. Finally, obesity was an independent predictor of hypertension (p = 0.0204; OR = 5.149) and *H. pylori* infection (p = 0.047; OR = 2.042).

Conclusion: Based on these results, it is conceivable that *H. pylori* infection and the identified risk factors can be reliable indicators for the assessment of cardiovascular problems such as hypertension.

Keywords: H. pylori infection; hypertension; seroprevalence; IgG antibody; risk factors; Cameroon.

ABBREVIATIONS

AT: antibody titers; BMI: Body mass index; CI: 95% confidence interval; DHD: District Hospital of Dschang; ELISA: indirect enzyme-linked immunosorbent assay; HDL: low density lipoprotein; Helicobacter pylori: H. pylori; HP+: Helicobacter pylori positive patients; HP+HT+: Helicobacter pylori positive and hypertensive patients; HT+: hypertensive patients; HT-HP-: Helicobacter pylori negative and normotensive patients; IgG: Immunoglobulin G; LDL: low density lipoprotein; OD: optical density; OR: odds ratio.

1. INTRODUCTION

Many diseases nowadays either human or animal can be caused by infections or originate from metabolic pathways. Infectious diseases are those caused by pathogenic microorganisms such as viruses, parasites, fungi, or bacteria [1]. Among these diseases, *Helicobacter pylori* infection spreads universally and is susceptible of touching all the population layers [2]. *H. pylori* is a Gram-negative, microaerophilic bacterium that can inhabit various areas of the stomach, particularly the antrum. The bacterium is present in saliva, gastric secretions, faeces, and dental plates and thus can be transmitted by oral-oral and oral-fecal routes [3,4].

More than 50% of the world's population harbor *H. pylori* in their upper gastrointestinal tract [5]. Infection is more prevalent in developing countries, and incidence is decreasing in Western countries [5]. A study carried out in Yaoundé (Cameroon) found the prevalence of this infection equal to 72.50% [6]. Over 80% of individuals infected with the *H. pylori* are asymptomatic [7]. This bacterium causes a chronic low-level inflammation of the stomach lining and is strongly linked to the development of duodenal and gastric ulcers and stomach cancer. *H. pylori* can also causes extra-digestives diseases among which arterial hypertension [8]. Arterial hypertension is a pathology touching about 20% of the world's population [9] and represents the most important risk factor for cardiovascular diseases. In Cameroon, recent studies have estimated the prevalence of arterial hypertension to be 24.6% [10]. It has been found that a significant decrease in blood pressure values, in particular in diastolic blood pressure values, occurs after *H. pylori* eradication in hypertensive patients [11]. The possible links between high blood pressure and *H. pylori* infection may involve the activation of the cytokine cascade with the release of vasoactive substances from the primary site of infection, or molecular mimicry between the CagA antigens of *H. pylori* and some peptides expressed by endothelial cells and smooth muscle [11]. This causes inflammation and hence leads to atherosclerosis which is a risk factor for high blood pressure. In addition, *H. pylori* may induce lipid peroxidation [12], and oxidized LDL is an

important component both of early development and late evolution of atherosclerotic lesions [13]. Numerous studies were carried out to find the exact predictors of young age hypertension in our society and *H. pylori* infection is one of noticeable suggestion. Thus, this study aimed to determine the seroprevalence of *H. pylori* Ig G antibody and risk factors among hypertensive patients at Dschang District Hospital in Cameroon.

2. METHODOLOGY

2.1 Study Design

A cross sectional study was carried out from November 2015 to March 2016 in the District Hospital of Dschang (DHD), Western Region of Cameroon.

2.2 Study Area and Population

The DHD is one of the well-equipped hospitals in the Western Region of Cameroon. Moreover, hypertensive center is present and function well. One hundred and fifty eight volunteer' patients were enrolled in this study and divided into four groups according to the diagnosis of *H. pylori* infection and hypertension. They were hypertensive (HT+), *H. pylori* positive (HP+), both *H. pylori* positive and hypertensive (HP+HT+) and *H. pylori* negative and normotensives (HT-HP-) attending the hospital for medical check-up or admitted in the hospital. Two blood pressure measurements were performed using a manual sphygmomanometer. Body mass index (BMI; kg/m^2) was calculated by dividing the body weight (kg) by height squared (m^2).

2.3 Questionnaire Administration and Sample Collection

When patients arrived at the DHD, they were received by nurses who attended to them and directed them to different doctors for consultation. These nurses were in charge of taking patients parameters (age, weight, blood pressure and body size). If a patient answered to our inclusion criteria, the nurses politely ask him for sound agreement of participating in the research work by presenting to him the information notice and the consent form. After the participants returned their consent forms duly signed, they were each provided with a structured questionnaire to fill. Those who could not read were assisted to fill the questionnaires by the nurses. The questionnaires contained simple closed ended questions regarding known risk factors of *H. pylori* exposure and hypertension in addition to socio-demographic information.

After filling the questionnaire, venous blood was collected from the patient. Blood collection was specifically done by a qualified technician. The antecubical vein of the forearm was selected and disinfected with 70% alcohol cotton wool swab. Five millilitres of venous blood were collected into a dry tube pre-labelled with an anonymised patient codes. The blood sample was allowed to clot completely before centrifugation at 3000 rpm for 15 min to obtain serum. Serum was separated from the clot into tightly screwed microfuge tubes and stored at -20 °C. These frozen sera were later tested for the presence of *H. pylori* immunoglobulin G antibody.

2.4 Serological Test for *H. pylori* IgG Antibody

The presence of specific anti–*Helicobacter pylori* IgGs in the participants' sera was determined using an indirect Enzyme-Linked Immunosorbent Assay (ELISA). This was done using the commercial ELISA kit (Golden Bio Technologies Corp – USA) according to the manufacture's instructions. The *H. pylori* IgG ELISA Kit had a specificity of 95 % and a sensitivity of 95 %. The optical density (DO) of every well was read at 450 nm using the microplate reader (Bio-RAD 680, USA). The ODs gotten from the standards solutions of concentrations: 0, 6.25, 12.5, 25, 50, and 100 U/ml permitted to draw a curve that served to determine the concentrations of antibody in the samples. According to the manufacturer's instruction, the following cutoff values were used: patients with IgG antibody titers (AT) = 12 U/ml was considered negative, AT = 12 - 20 U/ml was considered indeterminate and AT = 20 U/ml was considered positive.

2.5 Ethical Consideration

This investigation was conducted according to the principles expressed in the Declaration of Cameroon Bioethics Initiative. It was approved by the Ethics Review and Consultancy Committee of the Cameroon Bioethics Initiative. An authorization to collect and analyse blood samples was also obtained from the District Hospital of Dschang. All participants were duly informed of the study goals, procedures, potential harm and benefits, cost as well as the finality of the study. They willingly provided

informed consent either by signing or placing their thumbprint on the consent form after being satisfied with responses to all questions asked the investigator. Information was provided in English, French or interpreted in the local dialect by a volunteer independent of the study team. Participants' blood samples and results were anonymised. Left over blood samples were destroyed according to hospital biosafety procedures.

2.6 Statistical Analysis

Study participants were divided into four groups. The seroprevalence of *H. pylori* infection in hypertensive patients was calculated as the proportion of serologically positive anti-*H. pylori* Ig G samples among all samples tested at 95 % confidence interval (CI). The variables were included into a multivariate logistic regression model, and the association of the potential risk factors with the studied pathologies in the final model was expressed as odds ratio (OR) with 95% confidence intervals (CIs). The Chi-square test was used to compare frequencies of risks factors in the various groups. All the analyses were made using software SPSS 20.0. Statistical significance was set at 5 % and all the associations that showed a $p < 0.05$ were considered significant.

3. RESULTS

3.1 Prevalence of *H. pylori* IgG Antibody in Hypertensive Patients

The study was carried out on 158 volunteer's patients of the two sexes and of average age 57.21 ± 10 years. Sixty-four (64) of 158 participants were positive for *H. pylori* giving a prevalence of 40.5% of *H. pylori* infection in the general population. Interestingly, the seroprevalence of *H. pylori* IgG antibody was significantly higher in hypertensive patients than in non-hypertensive patients (44.89% versus 33.33%; $X^2 = 8.51$; $p = 0.029$; OR = 2.43) (Table 1).

3.2 Risk Factors for *H. pylori* Infection and Hypertension

Among the risk factors evaluated, the prevalence of hypertension in female was high in the groups HT+ and HT+HP+ compared to that in male (Fig. 1). The percentage of excess salt intake and cigarette smokers was low in all the groups while that of alcohol consumers was high in the group HP+ (Fig. 1). As regards family history of hypertension, the percentage was comparable in all the groups and no significance difference exist between this risk factor and the two pathologies ($p = 0.05$). The percentage of participants not practicing sports was high in all the groups (Fig. 1). However, comparison of different frequencies in the various groups showed no significant difference in the groups. The family history of gastric pains and habit of sharing cutleries were significantly high ($p < 0.05$) in the groups HP+ and HT+HP+ (Fig. 2). Obese participants and vegetables consumers were well represented in all the groups (Fig. 2).

Results of multiple logistic regression analysis showed that sex ($p = 0.001$; OR = 1.269) and alcohol intake ($p = 0.001$; OR = 0.235) were independent predictors of hypertension (Table 2). The value of OR indicates that being a female increases the risk of 1.269 time of presenting hypertension. Non-significant negative effects exist between hypertension and cigarette intake ($p = 0.867$; OR = 1.229), excess salt intake ($p = 0.909$; OR = 1.077), family history of hypertension ($p = 0.471$; OR = 1.26) and physical inactivity ($p = 0.119$; OR = 1.742). Further, a significant association was found between *H. pylori* infection and family history of gastric pains ($p = 0.001$; OR = 32.0) and habit of sharing cutleries ($p = 0.043$; OR = 2.337) (Table 2). Obesity was an independent predictor of hypertension ($p = 0.0204$; OR = 5.149) and *H. pylori* infection ($p = 0.047$; OR = 2.042) whereas no significant association was observed between the two pathologies and consumption of fruits and vegetables.

4. DISCUSSION

The high prevalence of 44.9% of *H. pylori* infection amongst hypertensive patients shows that this infection is an independent risk factor for hypertension. Hence, *H. pylori* infection increases the risk of developing hypertension. Previous studies demonstrated that *H. pylori* infection had significant association with hypertension as compared to controls [14-19]. *H. pylori* as a risk factor for development of hypertension which might be theoretically attributed to its involvement in inducing chronic atrophic gastritis and chronic inflammation [20]. However, few studies have failed to find an association between *H. pylori* infection and hypertension [21-24].

Table 1. Seroprevalence of *H. pylori* immunoglobulin G antibody according to hypertensive and non-hypertensive status

Status	Hypertensive patients n (%)	Non-hypertensive patients n (%)	Odds ratio (95% CI)	p-value
Seropositive *H. pylori* n (%)	44 (44.89%)	20 (33.33%)	2.43 (0.936-3.470)	0.029
Seronegative *H. pylori* n (%)	54 (55.11%)	40 (66.67%)	0.62 (0.34-1.87)	0.034

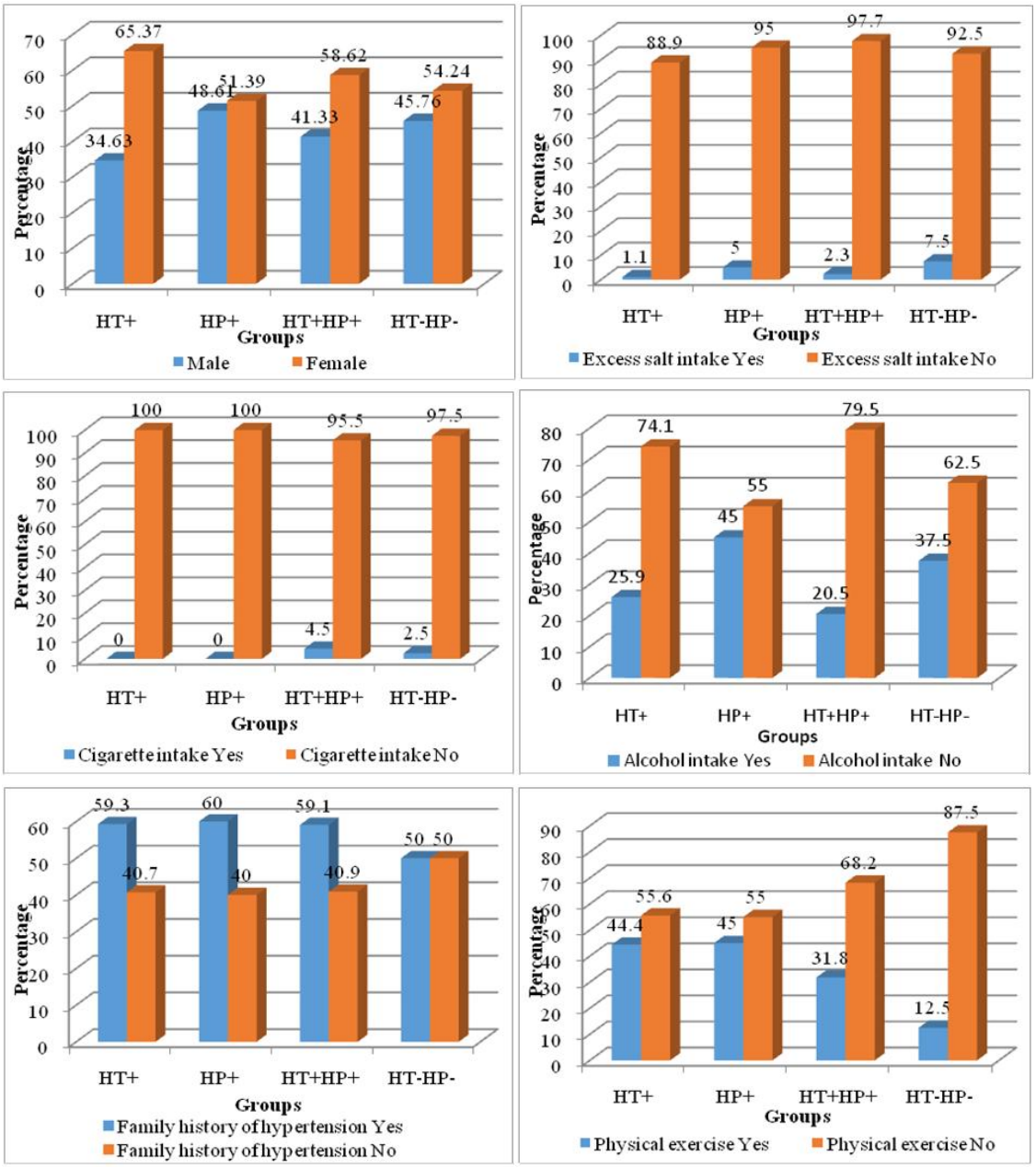

Fig. 1. Distribution of some sociodemographic factors in the different groups of the study population

HT+: hypertensive, HP+: H. pylori positive, HP+HT+: H. pylori positive and hypertensive, HT-HP-: H. pylori negative and normotensive

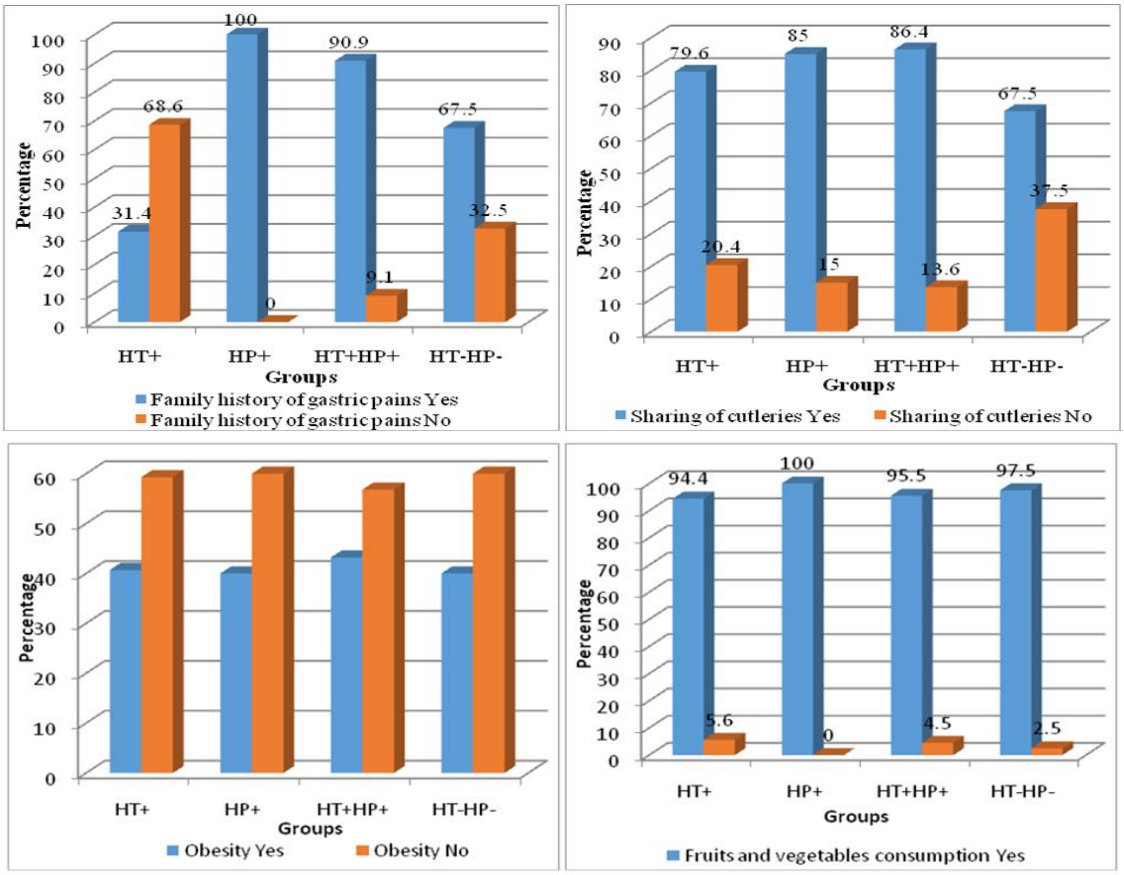

Fig. 2. Distribution of some unhygienic conditions and sociodemographic factors in the study population

HT+: hypertensive, HP+: H. pylori positive, HP+HT+: H. pylori positive and hypertensive, HT-HP-: H. pylori negative and normotensive

Table 2. Relationship between predictor variables and the two diseases following multi-variate logistic regression analysis

Predictor	*H. pylori* infection		Hypertension	
	Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value
Sex	0.924 (0.475-1.799)	0.817	0.284 (0.143-0.563)	0.000*
Family history of hypertension	1.180 (0.620-2.247)	0.613	1.269 (0.664-2.425)	0.471
Physical exercise	1.437 (0.738-2.797)	0.285	1.742 (0.863-3.514)	0.119
Cigarette	3.00 (0.266-33.801)	0.351	1.229 (0.109-13.854)	0.867
Alcohol intake	0.552 (0.279-1.092)	0.086	0.235 (0.117-0.469)	0.000*
Excess salt intake	0.305 (0.064-1.460)	0.118	1.077 (0.302-3.845)	0.909
Family history of gastric pains	32.00 (10.640-96.241)	0.000*	1.137 (0.595-2.174)	0.697
Obesity	2.042 (0.960-3.594)	0.047*	5.149 (1.528-25.076)	0.0204*
Fruits and vegetables consumption	1.378 (0.245-07.755)	0.715	0.315 (0.036-2.766)	0.273
Sharing of cutleries	2.337 (1.012-5.397)	0.043*	2.042 (0.955-4.368)	0.063

**p < 5%: statistical significant; OR > 1 and OR < 1: association of variable with H. pylori infection*

As anthropometric and sociodemographic risk factors on the development and complication of the studied diseases are concerned, the results of the present study showed that physical exercise, fruits and vegetables consumption, cigarette and excess salt intakes did not influence significantly (p = 0.05) the occurrence of hypertension. Some of these findings do not

corroborate with previous studies carried out. Indeed, according to Buttar and Ravi [25], regular moderate physical activity (approximately 30 min/day) has highly beneficial effects in lowering blood pressure, decreasing blood coagulation, improving fibrinolytic capacity and helping in vascular remodeling. Also, they suggest that exercise assists in improving plasma lipid profiles by increasing the HDL-cholesterol to total cholesterol ratio and reducing the LDL-cholesterol to total cholesterol ratio. In the same line, Excess salt intake showed no significant difference amongst the groups although this is a high risk factor of hypertension. It is then possible that participants of the present study didn't reply correctly to the questions although He *et al*. [26] obtained the same results as far as salt consummation is concerned. It may then be important to make a review of the questions that were asked to the participants to identify what was wrong. The results of excess salt intake do not corroborate those of the early reports [11,27-29]. Indeed, salt intake may in some probable way facilitate *H. pylori* infection [27]. A high-salt diet might irritate the gastric mucosa and allow *H. pylori* to enter the body [28]. Within Japan, an association has been reported between the intake of salty food and the risk of *H. pylori* infection [29]. This might explain the association of *H. pylori* with hypertension as there is a known relation between salt intake and hypertension.

Fruits and vegetables consumptions had no incidence ($p = 0.273$) on both hypertension and *H. pylori* infection but protective effect against hypertension. Fresh fruits and vegetables contain antioxidants which have been shown to reduce the risk of cardiovascular diseases and some forms of cancer. Clinical evidence indicates that antioxidants have the ability to slow the process of atherosclerosis by preventing the oxidation of LDL cholesterol. Oxidized LDL cholesterol seems to lay the foundation for endothelial arterial plaques and is regarded as a culprit in the development of coronary artery diseases and stroke. Antioxidant deficiency may lead to oxidative stress, resulting in the production of free radicals that cause cell injury and tissue damage [25]. A positive correlation was observed between cigarette intake and hypertension (OR = 1.229). Hence, cigarette intake is a risk factor for hypertension as stated by previous studies [30-32].

Alcohol has been identified as a risk factor for global burden of diseases, attributing an increased risk of cardiovascular problems such as hypertension. In this study, alcohol consumption was significantly ($p = 0.001$) associated to hypertension. This finding concurs with that reported from Malaysia [33] and can be explained by the fact that alcohol intake acts directly on the muscles of vessels, consequently, causes these vessels to become resistant. Further, obesity was significantly ($p = 0.047$) associated to hypertension in this study. Indeed, obesity is a well-established risk factor for hypertension [34]. Obesity induces accumulation of fats on the walls of the arteries and as such reduces the sights of arteries and consequently a rise in the level of blood pressure and hence hypertension. Female sex was also positively associated to hypertension. Early report showed that the proportion of women with hypertension rose two times faster than the proportion of men [34]. Many factors in women may contribute to a higher prevalence of hypertension than in men. Some of these factors are pregnancy and menopause [34]. The common pathogenic mechanism of pregnancy-induced hypertension appears to be placental ischemia, followed by placental release of vasopressor substances. Menopause is linked to an increased incidence of metabolic syndrome, the constellation of cardiovascular risk factors characterized by abdominal obesity, insulin resistance, and dyslipidemia. Increasing body mass index and aberrations in glucose metabolism resulting from estrogen deficiency at menopause may contribute to the development of the metabolic syndrome in older women, conferring a higher risk of cardiovascular diseases and hypertension in this population. On the other hand, sex showed no significance difference ($p = 0.817$) with *H. pylori* infection. This is in accordance with the findings of Graham et al. [35] in South-Eastern and Central South Brazil and from Africa and India who showed that *H. pylori* touches indifferently the two sexes. Sharing cutleries showed a positive correlation (OR=2.337) with *H. pylori* infection. As such the habit of sharing cutleries is a potential risk factor for *H. pylori* infection. This result is similar to that reported from Palestine [36]. This could be explained by the fact that *H. pylori* can be transmitted through contaminated objects [37].

5. CONCLUSION

The results obtained showed that the prevalence of *H. pylori* infection (44.9%) in hypertensive patients was high and probably linked to the interaction between the two pathologies. Hypertension and *H. pylori* infection are strongly

influenced by certain sociodemographic factors in particular, obesity, alcohol consumption, sex, unhygienic conditions and family history of gastric pains. Excess salt consumption, physical exercise, vegetables consumption and cigarette intake were not associated to hypertension probably due to the incorrect answers given to question asked to patients. Based on these results, it is conceivable that *H. pylori* infection and the identified risk factors can be reliable indicators for the assessment of cardiovascular problems such as hypertension.

CONSENT

All participants willingly provided informed consent either by signing or placing their thumbprint on the consent form.

ETHICAL APPROVAL

This investigation was approved by the Ethics Review and Consultancy Committee of the Cameroon Bioethics Initiative.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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