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Nutrition

The Affect of Salty Food Intake on the Risk of Helicobacter Pylori Infection among Patients Attending Benghazi Medical Center (A Retrospective Cohort Study)

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Abstract **Original Research Article**

Human infection by *Helicobacter pylori* is a great public health hazard because *they* colonize the stomach of approximately half world's population. The current work tries to detect and assess the association between salty foods and the prevalence of *H. Pylori* in Benghazi outpatients who attending Benghazi Medical Centre. It is retrospective cohort study on 293 patients in Benghazi Medical Center Gastroenterological Unit. The study includes all adult patients, a confirmed H. Pylori immunity test, a body weight records, and twenty four dietary recalls. Exclusion criteria; this work does not involve study of peptic ulcer and or any other gastric diseases. (69.7%) of the subjects prefer eating salty foods. (72.2%) of the subjects prefer pickled foods; and (83%) of the subjects prefer canning foods. Age, sex, body mass index, nutritional supplement intake were the variables associated with high salt intake among H. pylori patients. All patients in Benghazi Medical Center should be routinely screened for H. Pylori due to their health and financial consequences. Early nutritional intervention strategies including nutrition education should be implemented with an appropriate follow up.

Keywords: *H. Pylori*, Salty Foods.

INTRODUCTION

Helicobacter pylori (*H. pylori)* are gram-negative bacteria that are present in half of the world's population and persistently colony the human stomach despite a robust immune response. Although most *H. pylori*-infected persons remain asymptomatic, the presence of this organism in the stomach increases the risk of gastric adenocarcinoma, and *H. pylori* has been classified as a class I carcinogen. The clinical outcomes of *H. pylori* infection are determined by a variety of factors, including host genetics, environmental factors (including diet), and variation among *H. pylori* strains in expression of virulence determinants. [1-3] Some studies suggest that *H. pylori* play an important role in the natural stomach ecology, e.g. by influencing the type of bacteria that colonize the gastrointestinal tract. Other studies suggest that non-pathogenic strains of *H. pylori* may be beneficial, e.g., by normalizing stomach acid secretion, and may play a role in regulating appetite, since the bacterium's presence in the stomach results in a persistent but reversible reduction in the level of ghrelin, an hormone that increases appetite. [4, 5] In general, over 50% of the world's population has *H. pylori* in their upper gastrointestinal tracts with this infection (or colonization) being more common in developing countries. In recent decades, however the prevalence of *H. pylori* colonization of the gastrointestinal tract has declined in many countries. This is attributed to improved socioeconomic conditions: in the United States of America, for example, the prevalence of *H. pylori*, as detected by endoscopy conducted on a referral population, fell from 65.8 to 6.8% over a recent 10 year period while over the same time period in some developing countries *H. pylori* colonization remained very common with prevalence levels as high as 80%. In all events, *H. pylori* infection is usually asymptomatic, being associated with overt disease (commonly gastritis or peptic ulcers rather than the relatively very rarely occurring cancers) in less than 20% of cases. [6-8] to avoid the acidic environment of the interior of the stomach (lumen), *H. pylori* use their flagella to burrow into the mucus lining of the stomach to reach the epithelial cells underneath, where it is less acidic. *H. pylori* are able to sense the pH gradient in the mucus and move towards the less acidic region (chemotaxis). This also keeps the bacteria from being swept away into the lumen with the bacteria's mucus environment, which is constantly moving from its site of creation at the epithelium to its dissolution at the lumen interface. [9] *H. pylori* are found in the mucus, on the inner surface of the epithelium, and occasionally inside the epithelial cells themselves. It adheres to the epithelial cells by producing adhesions, which bind to lipids and carbohydrates in the epithelial cell membrane. In addition to using chemotaxis to avoid areas of low pH, *H. pylori* also neutralizes the acid in its environment by producing large amounts of urease, which breaks down the urea present in the stomach to carbon dioxide and ammonia. [10, 11] *Helicobacter pylori* are contagious, although the exact route of transmission is not known. Person-to-person transmission by either the oral–oral or fecal–oral route is most likely. Consistent with these transmission routes, the bacteria have been isolated from faeces, saliva, and dental plaque of some infected people. Findings suggest *H. pylori* are more easily transmitted by gastric mucus than saliva. Transmission occurs mainly within families in developed nations, yet can also be more acquired from the community in developing countries. *H. pylori* may also be transmitted orally by means of fecal matter through the ingestion of waste-tainted water, so a hygienic environment could help decrease the risk of *H. pylori* infection. [12, 13] Human infection by *H. pylori* is a great public health hazard because *H. pylori* colonize the gastric mucosa of approximately half of the world’s population. The infection is usually acquired in infancy and early childhood, and it is long lasting, often remaining for the entire lifespan. The prevalence of *H. pylori* shows large geographical variation, with infection rates much higher in developing countries (in some areas > 85%) than in Europe and North America (approximately 30%-40%). In various developing countries, more than 80% of the population is *H. pylori* positive, even at young ages. The prevalence of *H. pylori* in industrialized countries generally remains under 40% and is considerably lower in children and adolescents than in adults and elderly people. [13-16]There is a high degree of genetic diversity among clinical isolates of *H. pylori*. One of the strain-specific genetic features associated with adverse clinical outcome is known as the *cag* pathogenicity island (PAI). The presence of *PAI* requires several environmental conditions, including iron concentration, pH, and salt concentration. In fact, even a small number of *H. pylori* cells surviving in foods may represent a potential health hazard for consumers. [15] Other studies have been conducted on the survival of microorganisms in other more complex foodstuffs. *H. pylori* survives for approximately 7 days in ground beef at 4 °C, up to 3 days at -18 °C and for only 2 days in prepacked boneless, skinless chicken thighs. However, if the high level of salt presents in the ground beef, survival time increases to an undetectable level. The fate of *H. pylori* during the fermentation process of a traditional Turkish fermented sausage (*suck*) was investigated. The results of this study showed that the microorganism could survive and grow during the fermentation process of *suck* (22 °C for 7 days). A possible explanation is that some fermentation products, such as protein degradation compounds and carbon dioxide, might have been used by this pathogen and that indigenous bacteria might have created a microenvironment suitable for *H. pylori* growth. Moreover, *H. pylori* are able to survive in contaminated and pickled vegetables. [16] At least half the world's population is infected by the bacterium, making it the most widespread infection in the world. Actual infection rates vary from nation to nation; the developing world has much higher infection rates than the West, where rates are estimated to be around 25%. Despite high rates of infection in certain areas of the world, the overall frequency of *H. pylori* infection is declining. Since 1997, when the transmission of *H. pylori* through water and foods was hypothesized for the first time, several studies have evaluated the survival and the presence of this microorganism in different foodstuffs. [17, 18] Several studies have attempted to prove the occurrence of *H. pylori* in foodstuffs. The first report about the presence of *H. pylori* in sheep milk was prompted by the observation that Sardinian shepherds with direct animal contact had a higher prevalence of infection than did their same-household siblings. *H. pylori* were isolated in 1 out of 38 positive raw sheep milk samples and in one out of 6 positive sheep gastric tissue samples. After these findings, *H. pylori* have rarely been isolated from raw milk samples. [19-22] *H. pylori* was isolated in 25%, 37%, 22%, 28% and 14% of cow, sheep, goat, buffalo and camel meat samples and in 1.42% and 12.5% of hamburger and minced beef samples, respectively. *H. pylori* DNA was detected in 36% and 44% of raw chicken and ready-to-eat raw tuna meat samples, respectively. [22-24] Furthermore, an analysis of 550 samples of ready-to-eat foods, detecting *H. pylori* in 74% of samples; olive salad (36%), restaurant salad (30%), fruit salad (28%) and soup (22%) were the most commonly contaminated. Additionally, Ghorbani *et a.l* recovered *H. pylori* in 60 out of 300 ready-to-eat food samples (20%), including ready-to-eat fish (15%), chicken sandwiches (5%), vegetable sandwiches (18%), meat sandwiches (10%), and minced meat (32%). [25, 26] Between 1998 and 2001 *H. Pylori* were detected *in* Sterilized milk, pasteurized milk, tofu, yogurt, lettuce and chicken. In 2000, *H. Pylori were* detected *in* salty ground beef packaged in vacuum and air. During 2002, Jiang *et a.l* detected *H. Pylori in* salty ground beef, sterile milk, and apple and orange juices. In 2004, Gomes *et al.* detected *H. Pylori in* pickled lettuce and carrots. Between 2007 and 2010 Quaglia *et al.* and Buck *et al* detected *H. Pylori in* sterile milk, pasteurized milk and spinach. [27 -32[In 2011, *H. Pylori were* detected *in* traditional Turkish fermented sausage. During 2014 Atapoor *et al.*

detected *H. Pylori* in salty vegetables and salad. In addition, during 2016 Hemmatinezhad *et al.* and Ghorbani *et al.* detected *H. Pylori in salty* ready-to-eat foods. Moreover, during 2017 *H. Pylori* were detected *in pickled* spring onion, cabbage, lettuce and spinach. During 2017, *H. Pylori* were detected *in salty* hamburger and minced meat. Based on these findings, several studies have attempted to prove the occurrence of *H. pylori* in foodstuffs. [33 -36] In 2002, Bakka *et al.* studied the prevalence of H pylori in Three hundred and sixty asymptomatic Libya subjects aged 1-70 years of age; an overall prevalence of 76% was detected in these subjects. In another study by Elzouki *et al.* in eastern part of Libya; the overall frequency of *H. pylori* infection was 63.2%. [37, 38] The high prevalence of *H. pylori* in ready-to-eat foods, meats, milks and vegetables could be due to post-processing contamination. In fact, the high prevalence of *H. pylori* in healthy human carriers suggests that foodstuff contamination due to poor hygiene management during milking, chilling and storage and during the handling, preparation and packaging of ready-to-eat foods may occur. [39]The current study aims to assess the salty food intake on the risk of helicobacter pylori infection among patients attending Benghazi Medical Center. In order to find any risk factor for *Helicobacter Pylori* infection; the current study will analyse various socioeconomic factors, medical characteristics, including dietary habits and anthropometric measurements. It aims to the impacts of gender, age, and other demographic factors on salt intake among helicobacter pylori infected patients. It also will try to investigate the dietary and anthropometric characteristics of helicobacter pylori infected patients and how these characters affect their salt intake.

METHODOLOGY

This is a retrospective cohort study carried out from 21th December 2019 to 30th July 2020 on Helicobacter pylori patients in Benghazi Medical Center (BMC). In this retrospective cohort study the outcome ((Helicobacter pylori)) already exits and the research went backward to assess whether or not the study subjects have consumed salty foods. The inclusion criterion for enrolment in the present study was all adult out-patients from the Gastroenterological Unit of BMC. Patients who aged eighteen years and older and had confirmed immunity results for the mentioned bacteria, a body weight records, and twenty four dietary recall. Exclusion criteria; this work does not involve study of peptic ulcer and or any other gastric diseases. To minimize any known confounding effects, the subjects with the following conditions have been excluded from the study: subjects with habits such as smoking, tobacco chewing, and alcohol consumption; on corticosteroid therapy at pharmacological levels for duration of more than 6 months. Based on this criterion a total of 293 patients were assessed between 4th January 2020 to 30th March 2020 (Period of data collection on Monday and Thursday every week) were randomly approached to participate in the study. Out of the 332 patients, 18 refused to participate in the study and 21 subjects were excluded from the study because they were unable to answer all the questions required for the study. A total of 293 patients who answered the complete questionnaire clearly were finally enrolled for the study giving a response rate of 86.6 %. Informed consent was obtained from the subjects who were also assured of the confidentiality of the information collected. The research was approved by the administration of the concerned hospital. Prior to the start of the project the respective hospital administrations were informed in writing about the aim of the study to obtain the maximum possible cooperation to conduct the study. The patients were approached at the respective hospital and briefed about the purpose of the study before questionnaire was interviewer administered. The questionnaire was divided into various sub-sections. It includes socio-economic information, clinical history, gastrointestinal disorders, anthropometric evaluation, physical activity and dietary history. The first section covered various socio-economic characteristics like gender and age, marital status. Physical activity levels were defined based on the contribution of the type, amount and frequency of the self reported activities of the subjects. Detailed information was collected regarding the salty foods, special diet and who is prescribed by and its compliance. It also contained sub-sections for collecting medical information related to chronic diseases. The next part of the questionnaire had a section for obtaining information pertaining to nutritional intake like, self perceived food allergies, food aversions and nutritional supplement. Finally each subject was also asked to provide a 24 hours food recall. Each subject was explained in detail how to correctly and accurately fill in the recall form. In case discretionary or added salt was used during the recall period, the subjects were cautioned to also report its amount as accurately as possible in standardised household measures (level teaspoon). For all patients, energy and nutrient intakes were measured using a 3-day 24 h recall (two week days and one weekend day). Three-day food diary form contains foods at every meal, snack, and the amount consumed per person. A validated food frequency questionnaire was also used to determine dietary habits during the previous year. The information was obtained through face to-face interviews, with standard food models, and a variety of measuring tools to evaluate intake. The 24 hours recall collected from each subject was used to calculate the sodium in milligrams using the online *United States Department of Agriculture* (USDA) nutritive value calculation tool. Representative recipes of typical servings of traditional Libyan dishes not found; consequently these dishes were analysed for their contents. For pre-packaged foods and beverages the nutritive value considered was as indicated on its wrapping. Wherever necessary commonly used household measures, easily recognizable units and pictorial aids 16 were used to help respondents in identifying their portion sizes.[40] Height and weight measurements used to calculate Body Mass Index (BMI) were taken in a private area using standard techniques as recommended by the World Health Organisation (WHO). [41] Similarly the knee height or demi-span method, as an alternative method to estimate the height of non-ambulatory patients was measured as per standard technique. BMI was calculated according to the formula: (weight in kilograms / (height in meter). [42] All data were coded prior to being entered in a computer. Description and analysis of data was done by SPSS version 22. Level of significance was set at *P* value < 0. Descriptive Statistics were used to describe the subjects' characteristics. Individual variables were compared using *t* test for continuous variables and x^2 *for* categorical data. The contiguous variables distribution was examined for difference. Variables that were found to differ between the two groups were entered in to a logical regression model, with positive Helicobacter pylori as the dependent variable.

RESULT

Table-1 shows the age distribution; subjects were predominantly between the ages 40-59 years old (52.2 %). The remaining half was between 18-39 years (31.3 %) and 60-79 years old (16.7 %). The total means age ± standard deviation (SD) was 50.8 years ± 13.5. Most of the subjects (97.5 %) were of Libyan nationality. A majority of the subjects were married (95 %). Aalthough most of the subjects had some sort of formal education it was mostly as basic level (41.3 %) with fewer percentages with secondary education or its equivalent (12.4 %) or with at least a university degree (17.3 %). One quarter of the subjects did not have any formal education and were either illiterate or could only read or write (29%). The retired and the unemployed formed the two lowest segments of the subjects: 11.5 % and 20% respectively. Those currently employed which included those re-employed after retirement was 68.5 %. The most common three disorders among subjects were diabetes Miletus (DM) hypertension, and gastrointestinal disorders, with percentages of (26.3 %), (23.9) and (21.65%) respectively. Regarding family of Helicobacter pylori; more than half of the subjects (67%) come from families that suffer one or more of their members of this microbe as shown in table 3. More than half of the subjects (61.7 %) had been prescribed special diet as shown in table 4. Most of the subjects (92.1 %) did not have any food intolerance and among those who had any sort of food intolerance it was mostly relate to dairy products, meat and egg (57.5%). Others (42.5%) included any other foods like chocolate, and peanuts. Table-4 gives information about the use of nutritional supplement (either prescribed by the doctor or self administered) among the study subjects. Only 29.5 % of the subjects reported a current use of any nutritional supplement as opposed to 70.5 % who denied their use. As shown in Table-4 more than half of the subjects (69.7%) prefer eating salty foods such as fried salty foods, salty meat and meat contain meals, sour milk, salty cheese and other. In detail, (72.2%) of the subjects mentioned that they prefer pickled foods specially vegetables. Regarding canning foods most of the subjects (83%) mentioned that they prefer canning foods. When questioned about the daily discretionary use of table salt in food (table 4), more than half the subjects (55.5 %) admitted a daily use of additional amount of salt in their food. Among those using additional salt in their food, 45.5 % of such subjects admitted to limiting this discretionary use of salt to a quarter teaspoon each day while 34.7 % and 19.8 % were using half a teaspoon and at least a teaspoon of salt respectively on a daily basis. As per the categorization of the WHO for the BMI range, the study subjects were classified as normal, underweight and overweight and/or obese. Most of the subjects (77.1 %) were overweight and/ or obese while 19.1 % were normal as per the WHO BMI range for the elderly. Only 3.7 % of the subjects were categorized as underweight.

Table-1: Subject Characteristics

Age (Years)	**Total No. (%)**		**Total**
	Male	**Female**	
18-39	41(14)	50(17.1)	91(31.1)
40-59	71(24.2)	82(28)	153(52.2)
60-79	18(6.1)	31(10.6)	49(16.7)
Total	130(44.4)	163(55.6)	293(100)
Age (Years) Mean ± SD	50 ± 2.3	49 ± 1.9	50.8 ± 13.5

Table-2: Socio-Economic Characteristics of Subjects

Characteristics	Subject	
	Number	%
Libyan	286	97.5
Others	7	2.5
Unmarried	12	4
Married	230	78.5
Widow/widower	29	10
Divorcee	22	7.5
Illiterate/RW*	85	29
Basic education	121	41.3
Secondary and its level	36	12.4
University degree	51	17.3
Employed	200	68.5
Unemployed	59	20
Retired	34	11.5

Table-3: Chronic Diseases characteristics of subjects

Chronic Diseases	Total	
	No	%
No	22	7.5
Diabetes Miletus	77	26.3
Hypertension	70	23.9
GIT Disorders	55	18.8
Heart Diseases	31	10.6
Renal Diseases	18	6.1
Comorbidity	20	6.8
Family History of H Pylori		
Yes	196	67
No	97	33

Table-4: Diet Characteristics

Diet Characteristics	Number	%
Diet follow up		
Yes	181	61.7
No	112	38.3
Food intolerance		
Yes	23	7.9
No	270	92.1
Type of food intolerance		
Dairy, meat, poultry	13	57.5
Others	10	42.5
Nutritional supplement		
Yes	86	29.5
No	207	70.5
Salty foods preference		
Yes	204	69.7
No	89	30.3
Pickled foods Preference		
Yes	211	72.2
No	82	27.8
Canning foods Preference		
Yes	243	83
No	50	17
Added salt		
Yes	163	55.5
No	130	44.5
Daily amount of discretionary salt (Tsp*)		
Quarter		
Half	74	45.5
1 or more	57	34.7
	32	19.8

Table-5: BMI categorization

Characteristics	Total	
	Number	%
Underweight	11	3.7
Normal	56	19.1
Overweight or obese	226	77.1

A Chi Square test was carried out to see if there was any statistically significant association between the consumption salty foods among the H. Pylori patients, with various physiological and non physiological factors including select socio-economical factors. Age group, and sex, were the socio-economic factors associated ($p< 0.05$) with the consumption salty foods among the subjects. Age group was inversely associated ($p< 0.05$) consumption of salty foods among H. Pylori patients. As the age group increased there was a lowering in the consumption of salty foods. Subjects belonging to an older age group had a lower percentage of those consuming salty foods. Likewise there were a greater percentage of subjects belonging to salty foods eating and preferring category among the younger age group as compared to the higher age group as shown in (Table-6). Male gender was associated ($p< 0.05$) with better salt consumption status. Male as compared to females had a higher percentage of normal salt consumption status and a lower percentage of having high and moderate salt consumption as shown in (Table-6). BMI was associated ($p < 0.05$) with the salty food consumption of the subjects. The subjects classified as overweight or obese according to their BMI had the least percentage (26.3 %) of having a normal salt consumption status and the highest percentage of high salt consumption (36.8 %). However even the normal BMI group had 42.3 % and 23.7 % of subjects who consume moderate and high salt respectively, as shown in Table-6. Within the individual questions about dieting and salty foods that have a statistically significant ($p < 0.05$) correlation ($r = -0.23$) with the. H Pylori are associated inversely with nutritional supplement intake. No association was found between other salt intake parameters and occurrence of H. Pylori among the current studied subjects.

Table-6: Association of age group (years) and gender with salt intake of the subjects

Age group (Years)	Consumption of salty foods		
	Low	Moderate (Normal)	High
18-39	30.0	35.3	5.1
40-59	33.3	48.9	17.8
60-79	59.6	50.0	20.0
Female	43.4	37.1	19.5
Male	49.0	36.6	14.2
Underweight	63.8	36.8	0.8
Normal	34.0	42.3	23.7
Overweight/ obese	26.3	35.8	36.8

Table-7: Correlation of Individual Questions about Salty Foods with *H Pylori*

Question	Correlation Coefficient (r)
Nutritional supplement intake	-0.23*

** Pearson's correlation at p < 0.05*

DISCUSSION

Helicobacter pylori are a Gram-negative bacterium that is present in half of the world's population. Epidemiological studies have shown that there is an association between *H. pylori* infection and high dietary salt intake. However, to our best knowledge this is the first Libyan study in this area. Epidemiological studies have shown that *H. pylori* is probably one of the most common bacterial infections throughout the world, involving 30% of the population living in developed countries and up to 80%–90% of the population in developing countries. A synergistic interaction between *H. pylori* infection and diet has been suggested. [1, 12] In this study; the researchers assess the influence of salty food intake on the risk of helicobacter pylori infection among patients attending Benghazi Medical Center. Age, sex, body mass index, nutritional supplement intake were the variables associated with high salt intake among H. pylori patients. During the current research younger people consume more salt and this associate with more risk of H. Pylori. Libyans consume a large amount of sodium. Although some sodium is needed to control blood volume and to help cells function properly, most Libyans consume far more than is necessary, or recommended. Results from the 2004 Libyan Community Health Survey indicate that, among people aged 19 to 70; over 85% of men and 60% of women had sodium intakes exceeding the recommended upper limit beyond which health risks increase. Most sodium is consumed as sodium chloride. [43] A study has estimated that 90% of sodium intake comes from sodium chloride. Processed foods are the main source, accounting for 77% of average daily sodium intake. Another 12% occurs naturally in foods, and salt added during cooking (6%) or at the table (5%) makes up the remainder. [44] The Institute of Medicine (IOM) has established a "tolerable upper intake level", which ranges from 1,500 mg to 2,300 mg of sodium per day for people aged up to 60 years. Consumption exceeding these limits increases the risks of adverse health effects. Young people intake was found to be excess the average daily intake of sodium far beyond the recommended tolerable upper intake level. [3, 43] A number of studies have shown a link between sodium intake and H Pylori. When sodium intake rises in susceptible individuals, risk of H pylori tends to increase. The results from the several studies about adding salt to food at the table suggest that people aged 51 or older seem to be aware that they should reduce their salt consumption for controlling hypertension. They were significantly less likely to report salting their food either “occasionally” or “very often. [44] Male gender was associated ($p< 0.05$) with better salt consumption status. Male as compared to females had a higher percentage of normal salt consumption status and a lower percentage of having high and moderate salt consumption. Gender-associated differences in salt intake have been observed in animals as well as in humans. Thus, in humans, men have lower salt intake levels than women until the age of 60 to 70 years, when salt intake becomes progressively more comparable in both men and women. Hence, men are also at lower risk for developing salt intake related diseases such as H. Pylori, cardiovascular and renal complications. The mechanisms responsible for these gender differences are not well understood, but several hypotheses have been proposed suggesting a role of androgens and female sex hormones. According to the hypothesis of Guyton *et al*. a decrease in renal sodium excretion or a rightward shift of the pressure–natriuresis relationship can lead to a long-term increase in salt intake. [45] Female sex hormones also modulate the renal handling of sodium and thereby contribute to the gender-associated differences observed in animal models and in humans is also a subject of controversy. Of note, female sex hormones may affect not only renal sodium excretion but perhaps also sodium intake per se. Indeed, in many mammals, the spontaneous free sodium intake appears to be greater in females than in males of the same species. In this respect, estradiol has recently been found to modulate the sodium intake of hypertensive (and normotensive female rats, and is positively correlated with sodium intake in both strains. [46] BMI was associated ($p < 0.05$) with the salty food consumption of the subjects. The subjects classified as overweight or obese according to their BMI had the least percentage (26.3 %) of having a normal salt consumption status and the highest percentage of high salt consumption (36.8 %). The association between salt and obesity may also be partially caused by excessive consumption of processed food that is high in both calorie and salt. However, increasing evidence suggests that there may be a direct link between salt intake and obesity independent of total energy intake. There is consistent significant association between salt intake and various measures of adiposity, including BMI, waist circumference, and body fat mass, after adjusting for potential confounding factors, including total energy intake and sugar-sweetened beverage consumption. These findings suggest a direct association between salt intake and obesity independent of energy intake among H. Pylori patients. [47] Our findings are consistent with the main body of evidence in this area. Several previous studies showed that salt intake was positively related to weight status and the significant association persisted after adjusting for energy intake despite there were methodological problems, such as inaccurate measurement of salt intake and uncontrolled misreporting of energy intake among H. Pylori patients. [48] Within the individual questions about dieting and salty foods that have a statistically significant ($p < 0.05$) correlation ($r = -0.23$) with the. H Pylori are associated inversely with nutritional supplement intake. Epidemiological studies show that high intake of food-bound vitamin C and E reduces the risk of H. Pylori. Vitamin C or vitamin E supplementation leads to some short- term protective effects on *H. pylori*- induced gastritis in Mongolian gerbils. These effects seem to subside over time when the infection persists [49].

CONCLUSION

Helicobacter pylori are a Gram-negative bacterium that is present in half of the world's population. The current study aims to assess the influence of salty food intake on the risk of helicobacter pylori infection among patients attending Benghazi Medical Center. (69.7%) of the subjects prefer eating salty foods such as fried salty foods, salty meat, sour milk, and salty cheese. (72.2%) of the subjects prefer pickled foods specially vegetables; and (83%) of the subjects prefer canning foods. Age, sex, body mass index, nutritional supplement intake were the variables associated with high salt intake among H. pylori patients. Accordingly, all patients in Benghazi Medical Center should be routinely screened for H. Pylori due to their health and financial consequences. Early nutritional intervention strategies including nutrition education, involving a multidisciplinary team of clinicians, dieticians and nursing staff should be implemented with an appropriate follow up. Multi faceted and tailor made strategies to counteract specific malnutrition need to be planned, implemented, monitored and evaluated among the malnourished and at nutritional risk patients. Additional studies need to be carried out among H. Pylori patients in different settings as well as other regions of Libya to identify the specific prevalence of diet related factors associated with it.

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