



INTERRELATIONSHIP BETWEEN HELICOBACTER PYLORI INFECTION, SUBJECTIVE APPETITE SENSATION AND FOOD INTAKE

Inter-relações entre Helicobacter pylori, sensação subjetiva de appetite e consumo alimentar

Interrelaciones entre Helicobacter pylori, sensación subjetiva del apetito y consumo de alimentos

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ABSTRACT

Objective: To evaluate the effect of *Helicobacter pylori* (Hp) infection on the subjective appetite sensation and food intake of patients using the Unified Health System. **Methods:** This is a cross-sectional study, carried out in two health units during the period from July 2012 to May 2013, which evaluated 14 Hp-positive and 24 Hp-negative subjects, totaling 38 patients who reported having only three main meals per day. The presence of infection was investigated through upper endoscopy. Food intake was investigated by means of two 24-hour recalls. Subjective appetite sensation was investigated with use of the Visual Analog Scale of Appetite (VAS). The patients were stratified as Hp-positive and Hp-negative. For all analyses, the significance level was $p < 0.05$. **Results:** There was no significant difference in the energy and macronutrients intake, per meal, between the groups. The subjective appetite sensation before and after each meal was similar between groups, except for hunger ($p = 0.016$) and satiety ($p = 0.008$) at breakfast. The influence of the previous meal on the subsequent one was verified, these findings being more evident among the Hp-negative patients. **Conclusion:** The study showed homogeneity of the two evaluated groups in regard to food intake. The subjective appetite sensation is different between the groups on the topics hunger and satiety related to breakfast. The relationship between the sensations perceived by the end of a meal and the beginning of the subsequent one is more evident in Hp-negative.

Descriptors: *Helicobacter pylori*; Appetite; Diet.

RESUMO

Objetivo: Avaliar o efeito da infecção por *Helicobacter pylori* (Hp) sobre a sensação subjetiva de appetite e consumo alimentar de pacientes usuários do Sistema Único de Saúde. **Métodos:** Trata-se de um estudo do tipo transversal, realizado em duas unidades de saúde durante o período de julho de 2012 a maio de 2013, em que foram avaliados 38 pacientes, 14 Hp positivos e 24 negativos, que relataram fazer apenas três refeições principais por dia. A presença da infecção foi investigada a partir de endoscopia digestiva alta. O consumo alimentar foi investigado por meio de dois recordatórios de 24 horas. A sensação subjetiva de appetite foi investigada utilizando-se a escala analógica visual (EAV) de appetite. Os pacientes foram estratificados em Hp positivos e Hp negativos. Para todas as análises considerou-se significante $p < 0,05$. **Resultados:** Não houve diferença significativa no consumo de energia e de macronutrientes, por refeição, entre os grupos. A sensação subjetiva do appetite antes e após cada refeição foi semelhante entre os grupos, exceto quanto à fome ($p = 0,016$) e saciedade ($p = 0,008$) no jejum. Constatou-se a influência da refeição anterior na refeição subsequente, sendo estes achados mais evidentes entre os pacientes Hp negativos. **Conclusão:** O estudo aponta homogeneidade dos dois grupos avaliados no que tange a ingestão alimentar. A sensação subjetiva do appetite é diferente entre os grupos nos tópicos fome e saciedade relacionados ao jejum. A relação entre as sensações percebidas ao final de uma refeição e início da subsequente é mais evidente entre pacientes Hp negativos.

Descritores: *Helicobacter pylori*; Appetite; Dieta.



RESUMEN

Objetivo: Evaluar el efecto de la infección por *Helicobacter pylori* (Hp) sobre la sensación subjetiva del apetito y el consumo de alimentos de pacientes usuarios del Sistema Único de Salud. **Métodos:** Se trata de un estudio del tipo transversal realizado en dos unidades de salud entre julio de 2012 y mayo de 2013 en el cual se evaluaron 38 pacientes siendo 14 Hp positivos y 24 negativos que relataron comer solamente tres comidas al día. La presencia de la infección ha sido investigada en la endoscopia digestiva alta. El consumo de alimentos ha sido investigado a través de dos recordatorios de 24 horas. La sensación subjetiva del apetito ha sido investigada utilizando la Escala Analógica Visual de Apetito (EAV). Los pacientes fueron clasificados en Hp positivos y Hp negativos. Para todos los análisis se consideró significativo el $p < 0,05$. **Resultados:** No hubo diferencia significativa entre los grupos para el consumo de energía y de macro nutrientes por comida. La sensación subjetiva del apetito antes y después de cada comida ha sido parecida entre los grupos, excepto respecto el hambre ($p=0,016$) y la saciedad ($p=0,008$) en ayunas. Se constató de modo más evidente entre los pacientes Hp negativos que la comida anterior influye en la siguiente. **Conclusión:** El estudio sugiere la homogeneidad de los dos grupos evaluados respecto la ingesta de alimentos. La sensación subjetiva del apetito es distinta entre los grupos respecto el hambre y la saciedad en ayunas. La relación entre las sensaciones percibidas al final de cada comida y el inicio de la siguiente es más evidente entre los pacientes Hp negativos.

Descriptores: *Helicobacter pylori*; Apetito; Dieta.

INTRODUCTION

Helicobacter pylori infection (*H. pylori*) is considered a major public health problem as it occurs worldwide and affects more than half of the population. It is most common in developing countries, affecting 70-90% of the population of all age groups. The prevalence is lower in developed countries, ranging from 25% to 50%⁽¹⁾. In Brazil, the prevalence rate in adults is around 82%⁽²⁾. The improvement of the living conditions of the population, even in the most underdeveloped regions, can promote a drastic reduction of this microorganism⁽³⁾.

The current body of evidence, although controversial, has pointed out the influence of infection with this microorganism on body weight regulation⁽⁴⁾. *H. pylori* may interfere with the levels of ghrelin, a peptide secreted primarily in the stomach, which stimulates appetite and is released into the bloodstream prior to meals⁽⁵⁾. The hypothesis is that individuals infected with this microorganism have lower levels of ghrelin compared to groups without infection⁽⁶⁾.

There are few studies that relate appetite and food intake to *H. pylori* infection. However, the influence of this infection on digestive secretions and on gastric and motility distension, whether or not involving ghrelin, can affect hunger and satiety sensations, influence dietary intake and, consequently, body weight⁽⁷⁾.

Appetite can be measured with the aid of subjective assessments. When properly used, these evaluations are reproducible and sensitive and can predict food consumption^(8,9). Appetite assessment allows for a deeper analysis of food behavior when compared with the observation of food consumption alone⁽¹⁰⁾.

Considering the clinical practice perspective, it may be relevant to investigate the appetite of carriers and non-carriers of the infection as compared to their caloric intake. Such investigation has not been performed in the care routines, but has become important as it can assist in the formulation of interventions to prevent weight loss among carriers. Thus, the objective of this study was to evaluate the effect of *Helicobacter pylori* infection on the subjective appetite sensation and food intake of patients using the Unified Health System.

METHODS

This is a cross-sectional study carried out in two health centers that serve patients enrolled in Brazil's National Health System, also known as the Unified Health System (*Sistema Único de Saúde – SUS*), in Fortaleza, Ceará. Centers featuring teaching, research and extension programs and that provided Digestive Endoscopy Services were selected. Endoscopy is one of the methods available to diagnose the presence of *H. pylori* infection.

The convenience sample consisted of 144 patients: 72 tested positive for *H. pylori* and 72 tested negative for this microorganism. In order to allow for greater homogeneity of the sample for the assessment of appetite, only patients who ate just 3 meals per day were included in the study. Snacks were not included because they were very inconsistent among participants. Thus, 38 patients participated in the study: 14 tested positive for *H. pylori* and 24 tested negative for *H. pylori*. Data collection took place from July 2012 to May 2013.

Adult residents of Fortaleza (to facilitate follow-up) of both genders served in the aforementioned services who had only 3 meals a day were included. Gastric cancer patients, pregnant women, individuals who had undergone gastric surgery or those undergoing dietary therapy, those with current digestive bleeding, and those who had used proton pump inhibitors and/or antibiotics in the last four weeks were excluded from the research.

Demographic and socioeconomic information (gender, age, self-reported skin color, years of study and monthly household income) were obtained from the patients. The patients followed 6 hours of absolute fasting and 8 hours of dairy products fasting for upper gastrointestinal endoscopy. Following the services routine, three fragments of the antrum were collected using endoscopic forceps. A disposable needle was then used to transfer the fragments directly to the test tube containing the URETEST® urea solution, which was stored in an environment close to 36°C. Results were checked after 24 hours. The patient was considered *Helicobacter pylori* positive when the urease test detected the presence of the microorganism, which, according to the manufacturer, is demonstrated by the change in the color of the solution from yellow to red. Thus, the participants were divided into two groups: *Helicobacter pylori* positive (*Hp* positive) and *Helicobacter pylori* negative (*Hp* negative).

Anthropometric measurements were performed. Weight and height were measured according to the protocol described in the literature⁽¹¹⁾ using a Filizola® scale with a capacity of 200kg and an interval of 100g and a coupled ruler with a capacity of 2.00m and an interval of 0.5cm. Weight and height were measured with the patient barefoot. Height was measured with the participant standing upright and looking straight. Body mass index (BMI) (kg/m²) was calculated and the nutritional status of the participants was categorized according to the World Health Organization (WHO)⁽¹²⁾. Class 1, 2 and 3 obesity classifications were grouped into obesity.

Subjective appetite sensation was assessed using a visual analog scale (VAS) adapted from another scale⁽¹³⁾. Volunteers answered eight questions about current sensations of hunger, satiety and fullness, and the desire to eat general or specific foods (fatty, salty, sweet and savory). The questions were as follows: 1) How hungry do you feel?; 2) How satisfied do you feel?; 3) How full do you feel?; 4) How much do you think you can eat?; 5) Would you like to eat something sweet?; 6) Would you like to eat something salty?; 7) Would you like to eat something savory?; 8) Would you like to eat something fatty?

The scale is composed of a line of 100mm in length that describes the extremes of present or absent sensation without graduation. The volunteers were asked to make a mark across the line corresponding to their feelings before and after each meal. The point marked by the individual was measured using a ruler for further quantification and comparison of the measurements. The evaluation of the results of the scale was performed using the score marked by the volunteers. The mean score of each question was used to compare the groups. These data collection and analysis procedures are described in the literature^(13,14).

Food intake was assessed using two 24-hour food recall before endoscopy: one covering one day of food intake at home, obtained by telephone contact or by home visit, and the other covering food intake on one weekend day, as recommended by researchers⁽¹⁵⁾. The data provided by patients in cooking measurements were transformed into grams⁽¹⁶⁾. After this procedure, the data were entered into the DietWin Professional 2.0® software for analysis of calories and macronutrients, establishing daily intake based on the average of the two recalls.

The groups were compared on demographic and socioeconomic variables using the Fisher's exact test, turning them into dichotomous variables: age <30 years and ≥ 30 years; years of study ≤ 8 years and > 8 years; self-reported white skin color and nonwhites; monthly household income <3 and ≥ 3 minimum wages; nutritional status of normal weight and excess weight (overweight and obesity). Student's t-tests or Mann-Whitney tests were used for independent comparisons between the two groups on mean energy and macronutrient intake and the mean VAS scores for appetite. Paired comparisons were performed using the Wilcoxon and Friedman tests. In all statistical analysis, p<0.05 was considered significant.

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RESULTS

Participants were 14 (36.8%) *H. pylori*-positive individuals and 24 (63.2%) *H. pylori*-negative individuals. The majority were women, (73.7%, n=28), older than 30 years (63.7%, n=28), with at least 9 years of study (71.0% n=27) and self-reported nonwhite skin color (83.3%, n=30). With regard to monthly income, there was a higher prevalence of individuals with low monthly household income (71%, n=27). There was a predominance of excess weight, i.e., overweight and obesity (65.8%, n=25). The mean age of the group was 37.9 ± 12.3 years and the mean monthly household income was 2.54 ± 2.47 minimum wages (Table I).

Table I - Characterization of the patients analyzed as for demographic and socioeconomic data and presence of *Helicobacter pylori*. Fortaleza, Ceará, 2013.

Variables	<i>Hp</i> -negative		<i>Hp</i> -positive		Total	
	n	%	n	%	n	%
Gender						
Men	5	20.8	5	35.7	10	26.3
Women	19	79.2	9	64.3	28	73.7
Age group						
< 30	5	20.8	5	35.7	10	26.3
≥ 30	19	79.2	9	64.3	28	63.7
Years of study						
≤ 8	5	20.8	6	42.9	11	29.0
> 8	19	79.2	8	57.1	27	71.0
Self-reported skin color						
White	4	18.2	2	14.3	6	16.7
Non-white	18	81.7	12	85.7	30	83.3
Monthly household income						
< 3	18	75.0	9	64.3	27	71.0
≥ 3	6	24.9	5	35.6	11	28.9
Nutritional status						
Normal weight	8	33.3	5	35.7	13	34.2
Excess weight	16	66.6	9	64.3	25	65.8

Hp: Helicobacter pylori.

There was no difference in energy and macronutrients (proteins, carbohydrates and lipids) intake between the groups (positive and negative *Hp*) (Table II). The subjective appetite scale, the mean values obtained for each question and the values before and after each meal in each group of participants are described in table III. It is observed that there is homogeneity of the groups, except for questions 1 and 2 at breakfast.

Table II - Mean dietary intake of calories, proteins, carbohydrates and lipids per meal in *Hp*-positive and *Hp*-negative patients served by the Unified Health System. Fortaleza, Ceará, 2013.

Meals		<i>Hp</i> -positive	<i>Hp</i> -negative	p-value*
Breakfast	Energy, kcal	270.7 (126.5)	341.7 (181.8)	0.206
	Proteins, g	10.0 (5.4)	13.6 (15.4)	0.408
	Carbohydrates, g	35.5 (16.1)	51.9 (35.2)	0.110
	Lipids, g	10.1 (6.1)	11.8 (9.5)	0.544
Lunch	Energy, kcal	698.5 (342.6)	640.8 (243.6)	0.548
	Proteins, g	32.4 (17.0)	39.4 (19.1)	0.260
	Carbohydrates, g	78.0 (45.9)	55.4 (40.2)	0.336
	Lipids, g	27.7 (12.1)	26.1 (11.1)	0.694
Dinner	Energy, kcal	447.1 (236.1)	516.4 (245.0)	0.399
	Proteins, g	17.7 (10.4)	24.2 (14.7)	0.152
	Carbohydrates, g	55.4 (40.2)	56.4 (32.8)	0.932
	Lipids, g	17.1 (11.6)	21.0 (12.5)	0.351

*Comparison of means was performed using Student's t-test. Significance level was set at p<0.05. *Hp: Helicobacter pylori.* g: gram; kcal: kilocalorie.

Table III - Mean values obtained on the subjective appetite scale before and after meals in Hp-positive and Hp-negative patients served by the Unified Health System. Fortaleza, Ceará, 2013.

Question	Hp-positive			Hp-negative			p-value*	
	Before	After	Difference ^a	Before	After	Difference ^a		
Breakfast	1	4.6	3.1	-1.4 (3.0)	5.9	1.6	-4.3 (4.3)	0.016
	2	5.5 [#]	6.4	1.0 (2.7)	2.9 [#]	7.1	4.2 (4.3)	0.008
	3	6.0 [#]	7.5	1.5 (2.5)	3.5 [#]	6.7	3.2 (4.4)	0.345
	4	5.1	3.9 [#]	-1.2 (2.8)	4.4	1.8 [#]	-2.6 (4.0)	0.201
	5	7.2	7.5	0.3 (4.7)	7.7	8.0	0.3 (2.4)	0.273
	6	5.9	7.5	2.0 (3.8)	5.2	8.6	3.4 (4.5)	0.410
	7	7.1	7.3	0.3 (2.5)	7.4	7.9	0.5 (2.1)	0.964
	8	7.7	8.4	0.7 (2.0)	7.6	9.1	1.5 (3.5)	0.777
Lunch	1	4.4	2.7	-1.7 (3.5)	5.2	2.1	-3.1 (5.3)	0.135
	2	3.8	7.1	3.3 (3.4)	3.4	7.8	4.3 (3.8)	0.445
	3	5.1	7.3	2.2 (3.2)	3.2	8.1	4.9 (4.2)	0.082
	4	5.6	2.7	-2.9 (3.6)	5.2	1.4	-3.9 (3.6)	0.361
	5	8.7	8.6 [#]	-0.1 (3.4)	7.6	5.0 [#]	-2.6 (5.1)	0.071
	6	6.2	8.1	1.9 (4.0)	6.5	9.0	2.4 (4.6)	0.560
	7	4.8	8.9	4.1 (4.1)	4.1	7.9	3.9 (5.8)	1.000
	8	7.1	9.4	2.3 (3.1)	7.9	9.1	1.2 (2.6)	0.501
Dinner	1	4.5	4.1	-0.6 (3.2)	5.0	3.4	-1.4 (5.7)	0.463
	2	5.1	6.5	0.8 (4.0)	3.1	6.5	3.2 (5.8)	0.260
	3	5.2	7.1	1.3 (3.8)	3.8	7.6	3.5 (5.4)	0.223
	4	5.1	3.0	-2.2 (3.3)	4.3	2.0	-2.1 (4.7)	0.709
	5	7.9	6.3	-2.0 (3.5)	6.9	5.7	-1.2 (5.5)	0.893
	6	5.9	9.1	2.3 (3.7)	6.1	8.1	1.8 (4.9)	0.687
	7	6.5	8.0	0.8 (4.8)	6.0	8.2	2.0 (4.9)	0.823
	8	7.9	8.7	0.1 (2.8)	8.7	8.8	0.1 (3.3)	0.709

^aValues described as mean and standard deviation. **Comparison of means was performed using Mann-Whitney test. [#]Comparison of means before and after between the groups. Statistical significance was set at p<0.05.

Question 1: hunger; Question 2: satiety; Question 3: fullness; Question 4: desire to eat; Question 5: desire to eat sweet foods; Question 6: desire to eat salty foods; Question 7: desire to eat savory foods; Question 8: desire to eat fatty foods.

Hp: *Helicobacter pylori*.

With regard to question 1, which measures hunger sensation, Hp-negative patients presented higher values before breakfast and lower values after this meal (p=0.016). Regarding question 2, which measures satiety sensation, Hp-negative participants reported less satiety before breakfast compared to the Hp-positive group (p<0.05); however, a significant increase in satiety after breakfast was found in the Hp-negative group (p=0.008).

Table IV shows the findings of the analysis of the subjective sensation of appetite before and after each meal in each group. Pre- and post-meal sensations are similar for each meal in both groups, but some differences have stood out. In the case of Hp-positive patients, satiety before lunch is lower than that observed before breakfast and dinner (p=0.028). Among Hp-negative patients, the differences occurred after meals: the reduction of hunger and satiety is lower after dinner and the desire to eat something sweet is lower after breakfast (p<0.05).

Table IV - Analysis of the subjective sensation of appetite before and after each meal in Hp-positive and Hp-negative patients served by the Unified Health System. Fortaleza, Ceará, 2013.

Hp-positive		Before			After			
VAS	Breakfast	Lunch	Dinner	p*	Breakfast	Lunch	Dinner	p-value*
1	4.6	4.4	4.5	0.663	3.1	2.7	4.1	0.273
2	5.5 ^a	3.8 ^b	5.1 ^a	0.028	6.4	7.1	6.5	0.132
3	6.0	5.1	5.2	0.178	7.5	7.3	7.1	0.832
4	5.1	5.6	5.1	0.920	3.9	2.7	3.0	0.852
5	7.2	8.7	7.9	0.431	7.5	8.6	6.3	0.670
6	5.9	6.2	5.9	0.898	7.5	8.1	9.1	0.472
7	7.1	4.8	6.5	0.053	7.3	8.9	8.0	0.761
8	7.7	7.1	7.9	0.853	8.4	9.4	8.7	0.900

Hp-negative		Before			After			
VAS	Breakfast	Lunch	Dinner	p*	Breakfast	Lunch	Dinner	p-value*
1	5.9	5.2	5.0	0.906	1.6 ^a	2.1 ^a	3.4 ^b	0.042
2	2.9	3.4	3.1	0.696	7.1 ^a	7.8 ^a	6.5 ^b	0.009
3	3.5	3.2	3.8	0.331	6.7	8.1	7.6	0.291
4	4.4	5.2	4.3	0.250	1.8	1.4	2.0	0.504
5	7.7	7.6	6.9	0.516	8.0 ^a	5.0 ^b	5.7 ^b	0.036
6	5.2	6.5	6.1	0.888	8.6	9.0	8.1	0.133
7	7.4	4.1	6.0	0.069	7.9	7.9	8.2	0.886
8	7.6	7.9	8.7	0.557	9.1	9.1	8.8	0.098

*Friedman test. Different letters indicate statistical significance.

Question 1: hunger; Question 2: satiety; Question 3: fullness; Question 4: desire to eat; Question 5: desire to eat sweet foods; Question 6: desire to eat salty foods; Question 7: desire to eat savory foods; Question 8: desire to eat fatty foods.

Hp: *Helicobacter pylori*.

The impact of the subjective sensation of appetite after a meal on the sensations perceived before the subsequent meal was assessed. Thus, the values of the VAS of appetite after breakfast were compared with the values before lunch and, likewise, the values after lunch were compared with the values before dinner in each group of participants (Table V).

Among Hp-positive patients, a higher mean value for satiety and fullness after breakfast was associated with lower satiety (p=0.004) and fullness (p=0.005) before lunch. In addition, higher values for satiety (p=0.013) and fullness (p=0.026) after lunch were also associated with lower satiety and fullness before dinner. A higher mean value for the desire to eat something salty after lunch impacted on a lower desire to eat something salty before dinner (p=0.021). Similar profile was observed in the desire to eat something savory after breakfast and before lunch (p=0.016). Corroborating with these findings, similar results were found in the questions on the desire to eat savory and fatty foods after lunch, with an immediate impact before dinner.

Considering Hp-negative patients, more statistical differences were found: low hunger, high satiety and fullness and low desire for food after breakfast and after lunch were always associated with opposite sensations before the subsequent meal. In the case of desire for specific foods, the lower desire for salty, savory and fatty foods after breakfast was associated with a higher desire to eat the same foods before lunch. The lower desire for salty food after lunch was associated with a higher desire for the same food before dinner (Table V).

Table V – Influence of previous meal on the next meal in *Hp*-positive and *Hp*-negative patients served by the Unified Health System. Fortaleza, Ceará, 2013.

Hp-positive Question	After breakfast	Before lunch	p-value	After lunch	Before dinner	p-value
1	3.1	4.4	0.347	2.7	4.5	0.181
2	6.4	3.8	0.004	7.1	5.1	0.013
3	7.5	5.1	0.005	7.3	5.2	0.026
4	3.9	5.6	0.109	2.7	5.1	0.033
5	7.5	8.7	0.790	8.6	7.9	0.505
6	7.5	6.2	0.050	8.1	5.9	0.021
7	7.3	4.8	0.016	8.9	6.5	0.028
8	8.4	7.1	0.161	9.4	7.9	0.038
Hp-negative Question	After breakfast	Before lunch	p-value	After lunch	Before dinner	p-value
1	1.6	5.2	0.002	2.1	5.0	0.009
2	7.1	3.4	0.003	7.8	3.1	<0.001
3	6.7	3.2	<0.001	8.1	3.8	0.001
4	1.8	5.2	0.002	1.4	4.3	0.002
5	8.0	7.6	0.861	5.0	6.9	0.088
6	8.6	6.5	0.074	9.0	6.1	0.009
7	7.9	4.1	0.031	7.9	6.0	0.198
8	9.1	7.9	0.023	9.1	8.7	0.109

*Wilcoxon test. Question 1: hunger; Question 2: satiety; Question 3: fullness; Question 4: desire to eat; Question 5: desire to eat sweet foods; Question 6: desire to eat salty foods; Question 7: desire to eat savory foods; Question 8: desire to eat fatty foods.
Hp: *Helicobacter pylori*.

DISCUSSION

The carriers and non-carriers of *H. pylori* infection presented similar sociodemographic and socioeconomic profiles, which eliminates potential confounding factors in the interpretation of findings related to food intake and subjective appetite sensation.

The study was intended to assess an equal number of people in each group. However, the need to standardize the number of daily meals (three main meals in both groups) for a more accurate analysis of the interpretation of the subjective sensation of appetite resulted in the inclusion of a majority of non-carriers. This rigor for better interpretation of the data and this selection of meals made can be considered a research bias.

The most prevalent nutritional status (55.3%) in both groups was overweight. This finding is consistent with the data from the POF 2008/2009⁽¹⁶⁾, a survey carried out by IBGE that indicated 49% of overweight in the Brazilian population above 20 years of age. The finding is also supported by the Vigitel⁽¹⁷⁾ survey, which reported a predominance of overweight individuals (55.7%), regardless of gender, in the population living in Fortaleza.

However, the specific literature on the association of nutritional status and *H. pylori* infection is controversial. Research has found an association between the indicators⁽¹⁸⁾, with a higher prevalence of overweight among patients with the infection. Other authors do not identify this association^(19,20). In contrast, infected people were found to be thinner than non-infected people⁽²¹⁾. A study carried out with patients with eradicated infection⁽²²⁾ found no statistical differences in nutritional status before and after eradication treatment.

No significant differences in energy and macronutrient intake in the three meals were found between the two groups, which shows that the presence of the microorganism did not influence the composition of the diet.

The presence of *H. pylori* did not affect food intake in relation to the chemical composition of the diet and no associations with patient's gender were found⁽⁷⁾. However, another study⁽²³⁾ carried out with carriers and non-carriers of *H. pylori* found a lower fat intake by *Hp*-positive children, but without significant difference.

A study⁽²⁴⁾ that focused on patients with eradicated infection showed that eradication of the microorganism did not influence food intake and that a greater proportion of excess weight (pre-obesity and obesity) occurred among patients with eradicated infection when positive and negative patients were compared.

Although it is known that people do not eat food only when they are hungry and that they do not stop eating a meal only when they are satisfied⁽²⁵⁾, the data on the subjective sensations of appetite found here show some points that deserve further analysis.

Curiously and different from what was expected, question 1, which assesses hunger at breakfast, was answered at the intermediate level by both groups and for all meals, showing that the patients are not very hungry at meal time. For questions 2 and 3, which measure satiety and fullness respectively, lower values were expected before and after the meal. In turn, for question 4, which assesses fullness, higher values were expected before meals and lower values were expected after the meal.

There was homogeneity between the groups, except for questions 1 and 2, which assess hunger and satiety at breakfast. *Hp*-negative patients had higher hunger and satiety mean values before breakfast and lower mean values after the meal. On the other hand, the *Hp*-positive patients presented less elimination of hunger after the meal. As for satiety, *Hp*-positive patients reported less satiety.

With regard to the appetite scale applied in another study⁽⁷⁾, there was a homogeneity of the distribution of values in the two groups, which does not coincide with reports that the responses are not equal, with physiological and psychological modulations of appetite in specific groups of subjects, although common experiences can synchronize profiles of hunger, fullness and other sensations⁽²⁶⁾. Although there were no differences in the energy and macronutrient composition, there may have been a different dietary intake, an aspect that was not investigated here. In fact, it has been reported that the sensory qualities of foods, among other factors, contribute to the modulation of satiety⁽¹⁴⁾.

In the present study, the *Hp*-positive group had a higher desire for sweet foods after lunch and dinner. Studies on this subject are scarce, but another study⁽⁷⁾ also found a higher desire for sweet foods after lunch and dinner, although there was no significant difference in the presence of *H. pylori* bacteria. Likewise, the desire to eat fatty foods neither before nor after the three meals was not evident in any of the two groups in the present study. It may be assumed that the word “fatty” triggers a judgment that it is inappropriate, which prevents the participants from crossing a mark on the scale.

Regarding the sensations of appetite before and after meals in infected and non-infected patients, the patients who had the bacteria had a higher satiety after breakfast and lunch and a lower satiety before lunch ($p=0.004$) and dinner ($p=0.013$), a fact that occurs in the general population in other studies⁽²⁷⁾.

In a study carried with children⁽⁴⁾, it was observed that those who had *H. pylori* showed an increase in leptin and gastrin levels, as well as a reduction in plasma ghrelin levels. This phenomenon, therefore, may contribute to changes in appetite.

The results were very significant when analyzing the influence of one meal on the next. The data from this study show significant values for responses to the questions regarding satiety and the desire for specific foods (savory, salty and fatty) in positive patients and for responses to the questions on hunger, satiety and preference for salty foods in negative patients. It was also found that in *Hp*-negative patients, the lower desire for salty, savory, and fatty foods was associated with a higher desire for these foods before lunch, while the lower desire for salty foods after lunch was associated with a higher desire for these foods before dinner. In *Hp*-positive patients, the low desire for food after lunch resulted in a higher desire before dinner, while the low desire for savory foods after breakfast impacted on a higher desire for these foods before lunch.

The study has some limitations, mainly the small sample size and the possibility of inadequate or incomplete filling of the scale, since it was filled several times a day.

It should be noted that there are few studies that relate appetite, food intake and *H. pylori* infection. There is a need, therefore, for more studies to confirm if there is indeed any associations between these variables and what types of associations exist between this infection and appetite, food intake and nutritional status, as well as which factors are involved in such associations. The findings of the present study constitute a starting point for new investigations and point to the need for assessing the subjective sensation of appetite versus food consumption in clinical practice in carriers and non-carriers of *H. pylori* in order to broaden and deepen the care of these patients.

CONCLUSION

The study found a homogeneity of the two groups with regard to food intake. The subjective sensation of appetite is different between the groups with regard to hunger and satiety when related to breakfast. The relationship between perceived sensations at the end of one meal and at the start of the subsequent meal was more evident among *Hp*-negative patients.

REFERENCES

1. Rosa FB. A infecção por *Helicobacter pylori* em populações de Angola [tese] Lisboa: Universidade Nova de Lisboa: Faculdade de Ciências Médicas; 2015.
2. World Gastroenterology Organization - WGO. Practice Guidelines: *Helicobacter pylori* nos países em desenvolvimento. Wisconsin: WGO; 2010.
3. Pontes RML. A erradicação do *Helicobacter pylori* na atualidade e o problema da resistência [dissertação] Porto: Universidade do Porto; 2014.
4. Franceschi F, Annalisa T, Teresa DR, Giovanna D, Ianiro G, Franco S, et al. Role of *Helicobacter pylori* infection on nutrition and metabolism. *World J Gastroenterol*. 2014;20(36):12809–17.
5. Serrenho DVL. Ghrelin receptor activation regulates hippocampal spine dynamics. [dissertação] Coimbra: Universidade de Coimbra; 2016.
6. Polinska B, Matowicka JK, Kemona H. The role of ghrelin in the organism. *Postepy Hig Med Dosw* (online). 2016;65:1-7.
7. Rocha DC, Sampaio HAC, Lima JWO, Carioca AAF, Lima GP, Oliveira TR, et al. Association of *Helicobacter pylori* infection with nutritional status and food intake. *Nutr Hosp*. 2015;32(2):905-12.

8. Ribeiro G, Santos O, Camacho M, Torres S, Mucha-Vieira F, Sampaio D, et al. Translation, Cultural Adaptation and Validation of the Power of Food Scale for Use by Adult Populations in Portugal. *Act Med Port.* 2015;28(5):575-82.
9. Daundasekara SS, Beasley AD, O'Connor DP, Sampson M, Hernandez D, Ledoux T. Validation of the intuitive Eating Scale for pregnant women. *Appetite.* 2017;112:201-9.
10. Stubbs RJ, Hughes DA, Johnstone AM, Rowley E, Reid C, Elia M, et al. The use of visual analogue scales to assess motivation to eat in human subjects: a review of their reliability and validity with an evaluation of new hand-held computerized systems for temporal tracking of appetite ratings. *Br J Nutr.* 2000;84(4):405-15.
11. Alvarez BR, Pavan AL. Alturas e comprimentos. In: Petroski EL, editor. *Antropometria: técnicas e padronizações.* Porto Alegre: Pallotti; 1999. p. 29-51.
12. World Health Organization. *Obesity preventing and managing the global epidemic.* Geneva: WHO; 1998.
13. Flint A, Raben A, Blundell JE, Astrup A. Reproducibility, power and validity of visual analogue scales in assessment of appetite sensations in single test meal studies. *Int J Obes Relat Metab Disord.* 2000;24(1):38-48.
14. Lluch A, Hanet-Geisen N, Salah S, Salas-Salvado S, Bouron DL, Halford JCG. Short-term appetite-reducing effects of a low-fat dairy product enriched with protein and fibre. *Food Qual Prefer.* 2010;21(4):402-9.
15. Fisberg RM, Marchioni DML, Colucci ACA. Avaliação do consumo alimentar e da ingestão de nutrientes na prática clínica. *Arq Bras Endocrinol Metab.* 2009;53(5):617-24.
16. Instituto Brasileiro de Geografia e Estatística. *Pesquisa de orçamentos familiares 2008-2009: antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil.* Rio de Janeiro: IBGE; 2010.
17. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde. *Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: VIGITEL 2014.* Brasília; 2015.
18. Kopacova M, Koupil I, Seifert B, Fendrichova MS, Spirkova J, Vorisek V, et al. Body indices and basic vital signs in *Helicobacter pylori* positive and negative persons. *Eur J Epidemiol.* 2007;22(1):67-75.
19. Vo HD, Goli S, Gill R, Anderson V, Stefanov DG, Xu J, et al. Inverse correlation between *Helicobacter pylori* colonization and obesity in a cohort of inner city children. *Helicobacter.* 2015;20(1):64-8.
20. Lender N, Talley NJ, Enck P, Haag S, Zipfel S, Morrison M, et al. Review article: associations between *Helicobacter pylori* and obesity: an ecological study. *Aliment Pharmacol Ther.* 2014;40(1):24-31.
21. Wu MS, Lee WJ, Wang HH, Huang SP, Lin JD. A case-control study of association of *Helicobacter pylori* infection with morbid obesity in Taiwan. *Arch Intern Med.* 2005;165(13):1552-5.
22. Rodriguez MMR, Araguez C, Pareja C, Alcaide J, Fernandez C, Garach M, et al. Carbohydrate metabolism improvement after *Helicobacter pylori* eradication. *Diabetes Metab.* 2016;42(2):130-4.
23. Janjetic MA, Mantero P, Rua EC, Balcarce N, Palma GZ, Cataelano M, et al. Dietary and anthropometric indicators of nutritional status in relation to *Helicobacter pylori* infection in a pediatric population. *Br J Nutr.* 2015;113(7):1113-9.
24. Oliveira TR, Sampaio HAC, Rocha DC, Lima GP, Vergara CMAC, Lima JWO, et al. Influência da infecção por *Helicobacter pylori* e de sua erradicação sobre o consumo e estado nutricional. *Acta Gastroenterol Latinoam.* 2015;45(4):288-94.
25. Coelho SB. Efeitos do amendoim sobre o apetite e níveis de leptina, insulina e ghrelina e análise de polimorfismos para o promotor da leptina e seu receptor, em indivíduos eutróficos [tese]. Viçosa: Universidade Federal de Viçosa; 2007.
26. Blundell J, De Graaf C, Hulshof T, Jebb S, Livingstone B, Lluch A, et al. Appetite control: methodological aspects of the evaluation of foods. *Obes Rev.* 2010;11(3):251-70.
27. Klok MD, Jakobsdottir S, Drent ML. The role of leptin and ghrelin in the regulation of food intake and body weight in humans: a review. *Obes Rev.* 2007;8(1):21-34.

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