

The effect of garlic consumption on *Helicobacter pylori* treatment using urea breath test: a randomized clinical trial

Azita Hekmatdoost^a, Marzieh Ghobeh^a, Rahebeh Shaker-Hosseini^a,
Dariush MirSattari^b, Reza Rastmanesh^a, Bahram Rashidkhani^c, Lida Navai^{*a}

^a Department of Clinical Nutrition, Faculty of Nutrition and Food Technology, Shahid Beheshti University of Medical Sciences, National Nutrition and Food Sciences Technology Research Institute, Tehran, Iran

^b Shahid Beheshti University of Medical Sciences, Taleghani Hospital, Tehran, Iran

^c Department of Community Nutrition, Faculty of Nutrition and Food Technology, Shahid Beheshti University of Medical Sciences, National Nutrition and Food Sciences Technology Research Institute, Tehran, Iran

ABSTRACT

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Background: There have been a number of reports indicating that garlic can inhibit *Helicobacter pylori* (*H. pylori*) *in vitro*; however, there is few clinical trials evaluating its effect in human infection. The aim of this study was to assess the effect of garlic consumption on urea breath test (UBT) results in patients with *H. pylori* infection.

Methods: We performed a randomized case-controlled design on 36 outpatients diagnosed with *H. pylori* infection. In order to confirm the presence of *H. pylori* infection, the UBT was performed and in order to examine the presence of inflammation and/or ulcer in stomach, esophagus and duodenum, upper endoscopy was performed at the beginning and the end of the study. The patients in the case group took four grams of garlic powder daily (two tablets each containing two grams of garlic powder) whereas the patients in the control group took two placebo tablets (each containing two grams of white flour) for 8 weeks.

Results: The average age was 40.87 ± 16.45 in case groups and 35.40 ± 11.26 in the control group. In the control group, 47% were men and 53% women, 80% married and the rest were single. At the beginning of the study, all the patients had positive UBT. At the end of this study, the results of UBT showed that the *H. pylori* infection was negative in 87% of cases and 73% of control group showing eradication of *H. pylori* infection; however the eradication in case group was not significantly more than control group.

Conclusion: This study did not support a role for garlic in the treatment of *H. pylori* infection.

Introduction

It has been about a hundred years ago that

the presence of microbes in the stomach was recognized. It was first in 1983 when Warren and Marshall discovered a spiral urease-producing organism in the human stomach, and later classified it as *H. pylori*. *H. pylori* is one of the most common bacterial pathogens in human stomach [1]. *H. pylori* infection is now recognized as a

Corresponding author:

Dr Lida Navai, PhD.

Address: Department of Clinical Nutrition, Faculty of Nutrition and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Email: l_navai@yahoo.com

worldwide problem. The prevalence of *H. pylori* is 50% in industrial countries and 90% in developing countries [2]. Also, a high percentage of *H. pylori* infection is reported in different provinces in Iran. In Shiraz, the percentage of *H. pylori* infection is 98% among infants, 87% among 10 year old children and 57% among adults. The prevalence in Tehran is reported as 96% [3].

H. pylori has been shown to be strongly associated with peptic ulcer disease [4,5], gastric carcinoma [6], gastric lymphoma [5,7] coroner disease [8-11], metabolic syndrome, type 1 diabetes, and insulin resistance [12,13]. The results of various studies show that *H. pylori* infection is a risk factor to cause atherosclerosis through inflammation and change in the level of serum lipids and lipoproteins [14,15].

In order to eradicate *H. pylori*, numerous therapies has been applied and it has been shown that no treatment alone is effective on this microbe [16]. One of the used treatments in eradicating *H. pylori* infection is called “triple therapy”, consisting of the combined use of two antibiotics and a proton pump inhibitor, which gives a high eradication rate and is now applied for clinical treatment of *H. pylori*-associated gastroduodenal disease [17]. However, eradication by the triple therapy is not always successful and there have been reported harmful side effects of these drugs such as metal taste in mouth, increased sensitivity to light, constipation, diarrhea and dark feces [17].

Another treatment is called “quadrille therapy”, which includes using omeprazole, Bismuth and 2 types of antibiotics (metronidazole and tetracycline] for two weeks [18]. This type of therapy is very expensive and besides the already mentioned side effects causes convulsion and itching. Moreover, the *H. pylori* resistance to antibiotics including clarithromycin and metronidazole has also become a serious problem that may lower treatment efficacy in the future [19].

Since many people all over the world are infected with *H. pylori*, it is necessary to

search for non-antibiotic effective and safe substances in terms of gastrointestinal protection from *H. pylori*-associated diseases. Epidemiological studies have shown that stomach cancer incidence may be reduced with high consumption of allium vegetables and different plant strains [20-24]. Moreover, a number of experimental studies have demonstrated that garlic and its constituents including diallyl sulfide can suppress *H. pylori* infection [25-27]. However, some other studies have denied this effect [28-30]. Thus, this study was designed to examine the effect of garlic consumption on *H. pylori* eradication.

Methods

The study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences and informed consent was obtained from all patients. This study was performed as a randomized clinical trial on the outpatients infected with *H. pylori*. First, patients who were intending to participate filled out a testimonial. Then, all the patients were interviewed and filled out a questionnaire including general, demographic and personal information. In this study, 36 patients (18 in each group) were selected. All patients' weight, height, and waist and hip circumferences were measured. Body mass index (BMI) was calculated by dividing the weight in kilogram by the height in meters squared at the beginning and on week eighth. At the end of the study, 3 patients from each group were excluded because of unwillingness to continue and the data for 30 patients was analyzed.

In order to distinguish the *H. pylori* infection, urea breath test (UBT) was performed for all patients. The person was considered infected, if the test result was positive. After that, to examine the condition of esophagus, stomach and duodenum with respect to inflammation or stomach ulcer, endoscopy was performed on all patients. While doing endoscopy, a biopsy sample was taken from the antrum to do a urease test and as a confirmation for *H. pylori*

existence. All patients with positive UBT and with no gastrointestinal disorder were included in this study. Patients were randomly divided into two groups. The therapy prescribed for both groups were the same and included omeprazole 500mg, amoxicillin 1 gr, Bismuth 1.5 gr and metronidazole 500mg for two weeks.

Patients in the intervention group received 4gr/day garlic powder in two capsules and patients in the control group received 2gr/d placebo (white floor) for 8 weeks. The consumption of antibiotics was stopped after 2 weeks and the consumption of garlic powder capsules and placebo were continued for six more weeks. Packages of these capsules were given to the patients monthly. At the end of the study, UBT and endoscopy were obtained again in order to investigate the presence of *H. pylori* and inflammation status. At the beginning of this study all patients were required not to change their prescribed medicines and food diets.

Statistical analysis

All statistical analysis was performed using SPSS version 11.5 and unpaired, two tailed, *t*-test, paired *t*-test and chi square test. P values greater than 0.05 were considered not to be significant.

Results

The average age was 40.87 ± 16.45 in case group and 35.40 ± 11.26 in the control group. In the case group, 67% were men and 33% women, 27% were single and the rest were married. In the control group, 47% were men, 53% women, 80% were married and the rest were single. There were no differences between the two groups considering gender, marital status, educational level, smoking status and the time average of symptoms appearance (Table 1).

At the beginning and the end of study, the average of weight and BMI were not significantly different between the two groups and in this regard no significant changes were observed during the study (Table 2).

UBT Results

At the beginning all patients were UBT positive, showing they were all infected with *H. pylori*. At the end of study, of 30 patients 13 (87%) of case group and 11 (73%) of control group were UBT negative and the rest were still infected (Table 3). At the end, eradication of *H. pylori* was more satisfactory in case group but there was no statistical significant difference between these two groups ($p = 0.36$).

Table 1. Patients' general characteristics¹

Variables	Mean±SD	Case Number (%)	Control Number (%)
Gender	Female	10(67%)	7(47%)
	Male	5 (33%)	8(53%)
Marital Status	Single	4(26%)	3(20%)
	Married	11(73%)	12(80)
Educational Level	Primary	2(13%)	5(33%)
	Diploma	10(67%)	6(40%)
	Bachelor or higher	3(20%)	4(27%)
Smoking Status	Yes	2(13%)	3(20%)
	No	13(86%)	12(80%)
Symptoms Manifestation	Less than a month	11(73%)	10(66%)
	More than a month	4(27%)	5(33%)
Age		40.87 ± 16.45	35.40 ± 11.26

¹ Value are shown as numbers (percent)

Table 2. Initial and final values of weight and BMI in case and control groups¹

Variables	Group	Number	Week One	Week Eight	p-value
Weight (kg)	Case	15	65.73 ± 14.5	65.47±14.50	0.86
	Control	15	66.53±10.32	66.40±10.32	0.84
BMI (kg/m ²)	Case	15	23.38±3.38	23.28±3.30	0.18
	Control	15	23.43±2.15	23.41±2.12	0.21

¹ Values are shown as Mean±SD**Table 3.** Urea Breath Test (UBT) results in each group before and after intervention¹

Group	Number	Beginning UBT (positive)	Ending UBT		p-value
			positive	negative	
Case	15	15(100%)	2(13%)	13(87%)	0.36
Control	15	15(100%)	4(26%)	11(73%)	

¹ Value are shown as number (percent)

Discussion

The results of this study showed that improvement in *H. pylori* infection symptoms in intervention group was more satisfactory but was not significantly different from the placebo group. Moreover, the result of UBT was more desirable in intervention group and after the eight week consumption of garlic powder when compared to the control group; however, this was not significantly different between the two groups.

Previous studies indicated the anti-helicobacter activity of different plants extract [31]. Malekzadeh et al. reported that cardamoms extract with the concentration of 125 mg/l is effective on *H. pylori* activity reduction [32]. Ramezani et al. declared that pistachio extract with the concentration of 1.5 mg/ml is effective on the activity reduction of 12 species of *H. pylori* [33], and Sayyah et al. reported the anti-helicobacter activity of cinnamon [34]. In this study and for the first time in Iran, the effect of garlic powder on *H. pylori* infection was examined. The results of UBT indicated that *H. pylori* infection was eradicated in 87% of patients who had consumed garlic powder, however; this result was not significantly different when compared with control group. There are different opinions reported on garlic mechanism in *H. pylori* infection [35,36].

Latest studies have shown that allicin is one of the active principles of crushed garlic, which has a variety of antimicrobial

activities. Allicin in its pure form was found to exhibit antibacterial activity against a wide range of gram-negative and gram-positive bacteria in a way that separation or prevention of the activity of allicin decays the antibacterial activity of garlic [37,38]. Allicin is not naturally present in garlic cloves but after hydrolysis and oxidation produces a compound called alliin. Alliin was found to be the stable precursor that is converted to allicin by the action of an enzyme termed alliinase which is also present in the cloves [39].

Recent studies have shown that garlic and its sulfur-containing compounds deactivated nuclear factor kappa B (NF-κB) induced by various receptor agonists including lipopolysaccharide (LPS) (40-42). The sulfur compounds have specific sulfur chemotypes which can react with the thiol groups to reduce the oxidative stress disturbing the integrity of DNA [43]. Allicin, containing thiosulfinate chemotypes, can react with cysteine which is an abundant constitution of TLR4 [44]. Thus, allicin inhibits the LPS-induced dimerization of TLR4, leading to deactivation of NF-κB and reduction in cyclooxygenase 2 and inducible nitric oxide synthetase expression [44]. It demonstrates that a garlic extract can directly inhibit the TLRs-mediated signaling pathway at the receptor level suggesting this inhibition to be one of the mechanisms for the anti-inflammatory activity of garlic [45].

Also, previous studies show that *H. pylori* produces some antigenic products such as

heat shock proteins, urease and lipopolysaccharides, which are absorbed to the stomach epithelial cells, pass through the mucous and synthesize inflammation factors such as TNF- α , IL-8 and CRP [46]. However, thiosulphinate compounds present in garlic and its constituents have this ability to react with the SH group in the inflammation factors and prevent their activity and finally reduce their reproduction [47].

Correa et al, in 1992 stated that *H. pylori* infection increases stomach pH which in turn increases nitrate level in the stomach and subsequently nitrite level increases which is a risk factor in causing cancer [48]. While, allicin can block the production of nitrate and other free radicals and therefore reduces *H. pylori* infection and cancers [48].

In our study, there was no significant relation observed between the consumption of garlic powder and the rate of *H. pylori* eradication. Ernest et al. in 1998, in a case-control study on 30 patients infected with *H. pylori* showed that the consumption of 900 mg garlic powder alone per day for 8 weeks was not effective on *H. pylori* eradication [29].

In a study by Aydin in 2000 there was found no significant relation between the consumption of garlic and the *H. pylori* eradication [28], which is similar to our study results.

Previous studies have shown that cutting garlic and changing its form from raw to powder reduces its allicin antibiotic property [50]. Also, the storage of garlic powder for a long period of time reduces allicin antibiotic property because allicin decomposes to other sulfur compounds when stored for a long period of time [51]. However, these compounds have their own remedial property, but they do not have allicin's antibiotic potential property on *H. pylori* [51]. In addition, there is a need for more studies with a larger sample size and higher doses and a longer time for supplement consumption to observe a possible relation between garlic powder consumption and the rate of *H. pylori* eradication.

In our study, the therapy failure rate was 13% in the case group and 26% in the control group. Numerous studies have shown that during the first *H. pylori* therapy period, therapy failure would be expected with an average of 5-12%. The reason is that *H. pylori* become resistant to antibiotics quickly. For example, Mohammadi et al. reported 17% resistant to clarithromycin [52]. Moreover, Rafeey showed *H. pylori* resistance to amoxicillin is 59% [53].

However, Chowdhury has shown that *H. pylori* becomes resistant to antibiotics 1000 times easier than becoming resistant to allicin [54]. Previous studies have shown that not only *H. pylori* does not become resistant to allicin but garlic consumption with antibiotics can have a double effect on *H. pylori* eradication [20,55-57].

Conclusion

The present study is the first one in Iran that shows the garlic consumption effect on *H. pylori* eradication. This study did not support a role for garlic in the treatment of *H. pylori* infection.

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