

# 1 Exploring Medicinal Plants for Anti-Helicobacter Pylori Activity

2 Mohammed Ibrahim<sup>1</sup>

3 1

4 Received: 2 March 2012 Accepted: 24 March 2012 Published: 8 April 2012

5

---

## 6 **Abstract**

7 Helicobacter pylori is a class 1 carcinogen that requires targeted therapeutic strategy. A  
8 number of drugs including proton pump inhibitors, antibiotics and antiprotozoals are available  
9 for the treatment of Helicobacter pylori infections like chronic gastric irritation, gastro  
10 duodenal ulcers and low grade gastric mucosa associated lymphoid tissue lymphoma. Clinical  
11 evaluation of these drugs has shown the incidence of relapses, side effects and drug  
12 interactions. Multi drug resistance to Helicobacter pylori has been the main reason for  
13 treatment failure. This has been the rationale for the development of new anti- Helicobacter  
14 pylori drugs and search for novel molecules has been extended to medicinal herbs that offer  
15 better protection, decreased relapse and undevelopment of resistance towards bacteria. The  
16 present article reviews the medicinal herbs from global perspective for their anti- Helicobacter  
17 pylori activity and active compounds from the plants responsible for this activity. We have  
18 highlighted some of the important plants and their active constituents reported for their anti-  
19 Helicobacter pylori activity. Ancient system of medicine (Ayurvedic and Unani) supported by  
20 modern science is necessary to isolate, characterize and standardize the active constituents  
21 from herbal sources for anti-Helicobacter pylori activity.

22

---

23 *Index terms—*

## 24 **1 Exploring Medicinal Plants for Anti-Helicobacter Pylori Ac- 25 tivity**

26 Abstract -Helicobacter pylori is a class 1 carcinogen that requires targeted therapeutic strategy. A number  
27 of drugs including proton pump inhibitors, antibiotics and antiprotozoals are available for the treatment of  
28 Helicobacter pylori infections like chronic gastric irritation, gastro duodenal ulcers and low grade gastric mucosa  
29 associated lymphoid tissue lymphoma. Clinical evaluation of these drugs has shown the incidence of relapses,  
30 side effects and drug interactions. Multi drug resistance to Helicobacter pylori has been the main reason for  
31 treatment failure. This has been the rationale for the development of new anti-Helicobacter pylori drugs and  
32 search for novel molecules has been extended to medicinal herbs that offer better protection, decreased relapse  
33 and undevelopment of resistance towards bacteria. The present article reviews the medicinal herbs from global  
34 perspective for their anti-Helicobacter pylori activity and active compounds from the plants responsible for this  
35 activity. We have highlighted some of the important plants and their active constituents reported for their anti-  
36 Helicobacter pylori activity. Ancient system of medicine (Ayurvedic and Unani) supported by modern science is  
37 necessary to isolate, characterize and standardize the active constituents from herbal sources for anti-Helicobacter  
38 pylori activity.

39 Health Organization has categorized H. pylori as a class 1 carcinogen. 5 Eradication of the organism has been  
40 shown to result in ulcer healing, prevention of peptic ulcer reoccurrence and may also reduce the prevalence of  
41 gastric cancer in high-risk populations. 6 Many clinical trials involving patients with gastric and duodenal ulcers  
42 show that curing the infection is associated with a significant reduction in ulcer reoccurrence rates. [7][8] Since  
43 1984 physicians prescribing triple therapy to treat H. pylori infections which includes three options.

### 3 INTRODUCTION

---

44 First option includes the combination of proton pump inhibitor (PPI), clarithromycin and ampicillin.  
45 Second option includes PPI, clarithromycin and metronidazole. Third option includes bismuth subsalicylate,  
46 metronidazole and tetracycline, but the cure rate from standard triple therapy has been low as 50%. 9-10  
47 However, eradication by the triple therapy is not always successful and acquisition by *H. pylori* resistance to  
48 antibiotics could present a serious problem that may reduce treatment efficiency. 11 Quadruple therapy, where  
49 three antibiotics are taken alongside the PPI, has also been used in cases where triple therapy has not been  
50 successful. But the success rate was only 67%. 12 Many strains of *H. pylori* are now developing resistance  
51 to commonly used antibiotics. *H. pylori* acquires resistance by mutations to all the antibiotics used in the  
52 treatment regimens. The mechanism of resistance involves point mutations which are transmitted vertically,  
53 however transformation may be possible if two strains are present simultaneously in the stomach. Drug efflux  
54 proteins also can contribute to natural insensitivity to antibiotics and to emerging antibiotic resistance. Efflux  
55 pump gene *hef A* of *H. pylori* play an important role in multidrug resistance. Global resistance of *H. pylori*  
56 to metronidazole, clarithromycin, amoxicillin and tetracycline was also reported. One person may have more  
57 than one strain of *H. pylori*. Here the antibiotics may kill one strain, but not the other. [13][14] Furthermore,  
58 undesirable side effects of the drugs and the significant cost of combination therapy require the

## 59 2 Global Journal of Medical Research Volume XII Issue IV 60 Version I

61 *elicobacter pylori* (*H. pylori*), a Gram -negative 1984 by Marshall et al, is one of the most common chronic  
62 bacterial pathogens in humans. 1 Approximately 50% of people in the world are infected with it, and its  
63 prevalence is significantly higher in developing countries than in developed countries. 2 Once a person is infected,  
64 the organism can live in the stomach indefinitely and may not cause clinical illness. It is still not clear how  
65 *H. pylori* are transmitted or why some people infected with bacteria become sick and others do not. 3 *H. pylori*  
66 infection is an important etiologic impetus usually leading to chronic gastritis, gastroduodenal ulcer and low  
67 grade gastric mucosa associated lymphoid tissue lymphoma.

68 Epidemiological data shows that a high *H. pylori* infection rate is related to the high incidence of gastric cancer  
69 and gastric adenocarcinoma. 4 World *H* spiral bacterium which was first detected in I.

## 70 3 Introduction

### 71 II.

72 Current Treatment Regimens As phytomedicine has proved to be an untapped treasure for the discovery of  
73 lead compounds to cure gastrointestinal disorders. Hence several studies have been aimed to evaluate the anti-  
74 *elicobacter pylori* activity of medicinal herbs. 15 To the best of our knowledge, there is no extensive global view  
75 on exploring medicinal plants for anti-*elicobacter pylori* activity. List of medicinal herbs with anti-*Helicobacter*  
76 *pylori* activity including their source and active extracts are given in table ??.

77 The insolubility of non-polar extracts makes it very difficult for the investigators to be used in an aqueous  
78 medium during the study of anti-*Helicobacter pylori* activity. 26 Water or alcohol (methanol/ethanol) are used  
79 mainly for a large number of crude extract preparations. 27 The type of solvent used may have an effect on the  
80 nature of the compounds extracted and the resulting bioactivity of the extract. 28 To estimate the value of each  
81 extract therefore, several factors, including the rate of extraction, the quantity extracted (yield), the diversity  
82 of compounds extracted, the diversity of inhibitory compounds extracted, the ease of subsequent handling of  
83 the extracts, toxicity of the solvent in the bioassays and the potential health hazards of the extractants have to  
84 be evaluated. In many research works, methanol/ethanol is used for alkaloid extraction; acetone for flavonoids  
85 and steroids; hexane, diethyl ether and chloroform for fat soluble oils, wax, lipids and esters. Dichloromethane  
86 for terpenoids, ethylacetate for esters, ethanol may be used for sterols, poly phenols, tannins and water for  
87 water soluble components like glycosides, polysaccharides, polypeptides and lectins. 29 Hundreds of plants with  
88 antimicrobial compounds have been reported. However, very few of these studies have reported the *in vivo* anti-  
89 *Helicobacter pylori* activity of these compounds. It is very important to know whether these compounds will still  
90 maintain their maximum activity in the gastric mucus niche of *H. pylori*. Anti-*Helicobacter pylori* compounds  
91 from plants and their mechanism of action are given in table 2.

92 Curcumin, biologically active poly phenolic from *Curcuma longa* has recently been shown to arrest *H. pylori*  
93 growth. The anti-*Helicobacter pylori* activity of curcumin against 65 clinical isolates of *H. pylori* *in vitro* was  
94 examined. Minimum inhibitory concentration ranging from 5-50  $\mu$ g/ml, showing its effectiveness against *H. pylori*  
95 growth *in vitro* irrespective of genetic makeup of strains. Curcumin showed immense therapeutic potential against  
96 *H. pylori* infection as it was highly effective in eradication of *H. pylori* from infected mice as well as restoration of  
97 *H. pylori* induced gastric damage.

98 *Curcuma longa* extract was the most efficient in killing the seven strains of *H. pylori* within 15 minutes followed  
99 by chilli and ginger. [46][47][48] *Mallotus phillipinesis* is (Lam) Muell. Exhibited the most potent bactericidal  
100 activity against *H. pylori* which completely killed the bacteria at the concentration of 15.6-31.2  $\mu$ g/ml. 16 There  
101 is no evidence of *in vivo* effectiveness of this plant. Antibacterial activity of *Allium sativum* L(garlic) against  
102 *H. pylori* is well documented (40  $\mu$ g/ml) and resistance has not been reported. The synergistic action of garlic and  
103 omeprazole against *H. pylori* was also reported.

104 Thiosulfinates play an important role in the antibiotic activity of garlic. Further clinical evaluation seems  
105 warranted. [49][50][51] A mixture of tannic acid and n-propyl gallate can limit the gastric mucosa deterioration  
106 induced by *H.pylori* infection and vac A administration, suggest that vac A inhibition plays a role in this protective  
107 activity. So, polyphenols from plant sources may contribute to limit the pathological outcomes of *H.pylori*  
108 infection. 52 Successive extracts of *Sapindus mukorossi* and *Rheum emodi* inhibited the growth of 30 resistant  
109 clinical isolates of *H.pylori* in vitro and in vivo studies and there was no acquired resistance against these  
110 herbal extracts even after ten consecutive passages. 53 The evidence summarized above tentatively suggests  
111 possible benefits from some herbal sources with anti-*Helicobacter pylori* activity. Herbal science, Ayurvedic  
112 knowledge supported by modern science is required to standardize the plant extracts and to isolate, characterize  
113 and standardize the active constituents from plant sources for anti-*Helicobacter pylori* activity.

114 Extensive investigations and large scale well designed clinical trials are required to provide more conclusive  
115 proof to explore medicinal herbs for anti-*Helicobacter pylori* activity.

116 Table1 : Medicinal herbs having anti-*Helicobacter pylori* activity (global perspective).

117 **4 Global Journal of**



Figure 1: hydroxy- 4

118 1 2 3

<sup>1</sup>© 2012 Global Journals Inc. (US)

<sup>2</sup>© 2012 Global Journals Inc. (US) © 2012 Global Journals Inc. (US)

<sup>3</sup>Exploring Medicinal Plants for Anti-*Helicobacter pylori* Activity

Exploring Medicinal Plants for Anti-Helicobacter Pylori Activity					
Botanical name	Source	Part used	Extract	Reference	
South Asian Herbs					
<i>Mallotus phillipinesis</i>	Pakistan	covering fruit	Aqueous ethanol (70%)	16,17,18	
<i>Curcuma amada Roxb.</i>	Pakistan	rhizome			
<i>Myristica fragrans Houtt.</i>	Pakistan	seed			
<i>Psoralea corylifolia</i>	Pakistan	seed			
<i>Glycyrrhiza glabra L</i>	India, Srilanka	root			
<i>Terminalia chebula</i>	Pakistan	fruit			
<i>Curcuma longa L</i>	India	rhizome			
<i>Cuminum cyminum</i>	Srilanka	seed			
<i>Coccinia grandis</i>	India	leaves	Ethanol		
<i>Terminalia arjuna</i>	India	bark	Methanol		
East Asian Herbs					
<i>Rhizoma coptidis</i>	China	rhizome	Aqueous	19,20	
<i>Radix scutellariae</i>	China	root			
<i>Radix isatidis Asasorum sieboldi</i>	China Korea	root root	Methanol		
<i>Lindera strychnifolia</i>	Korea	root			
<i>Angelica tenuissima</i>	Korea	root			
<i>Alpinia oxyphylla</i>	Korea	fruit			
American Herbs					
<i>Zingiber officinale</i>	USA	rhizome	Methanol	21	
<i>Rosmarinus officinalis</i>	USA	rosemary leaf			
<i>Foeniculum vulgare</i>	USA	seed			
<i>Nigella sativa</i>	USA	seed			
African Herbs					
<i>Terminalia spinosa</i>	East Africa	young branches	Aqueous	22	
<i>Harrisonia abyssinica</i>	East Africa	root			
<i>Ximenia caffra</i>	East Africa	root			
<i>Azadirachta indica</i>	East Africa	leaves, stem bark			
<i>Combretum molle</i>	South Africa	stem bark	Acetone	23	
<i>Sclerocarya birrea</i>	South Africa	stem bark			
<i>Carica papaya</i>	Nigeria	leaf	Aqueous	24	
<i>Morinda lucida</i>	Nigeria	leaf	ethanol		
<i>Octimum gratissimum</i>	Nigeria	leaf			
<i>Phyllanthus amarus</i>	Nigeria	leaf			
Brazilian Herbs					
<i>Bixa orellana L</i>	Brazil	seed	Aqueous ethanol (96%)	25	
<i>Chamomilla recutita L</i>	Brazil	inflorescence			
<i>Ilex paraguariensis A</i>	Brazil	green leaves			
<i>Malva sylvestris L</i>	Brazil	inflorescence & leaves			

Figure 2:

---

**2**

Compound name	Examples	Mechanism reference of action
Quinones	Quinones, idebenone, duroquinone, menadione, juglone, coenzyme Q 1	
Flavones, flavonoids and flavonols	Quercetin, catechins, myristin, rutin	
Phenolics and polyphenols	and Catechol, pyrogallol, curcumin	
Tannins		Polymeric phenols, hydrolysable tannins
Coumarins		7-hydroxy-4-methyl coumarin,
Terpenoids and essential oils	and	
Alkaloids		
Lectins and poly peptides		

Figure 3: Table 2 :



119 [ Hoffman JS Pharmacological therapy] , Hoffman JS Pharmacological therapy

120 [Zhang and Lewis ()] , Y Zhang , K F Lewis . *New antimicrobial plant peptides FEMS Microbiol Lett* 1997. 149  
121 p. .

122 [ Helicobacter pylori: a global overview Acta Gastro-Ent Belg ()] , *Helicobacter pylori: a global overview Acta*  
123 *Gastro-Ent Belg* 1998. 61 p. .

124 [ Microbiol Immunol ()] , *Microbiol Immunol* 2000. 44 p. .

125 [Sapulveda et al. ()] , A R Sapulveda , Lgv Coelho , Helicobacter pylori . *Helicobacter* 2002. 7 (1) p. .

126 [ Anticancer Res ()] , *Anticancer Res* 2002. 22 p. .

127 [ Antimicrobial Agents Chemother ()] , *Antimicrobial Agents Chemother* 2005. 49 p. .

128 [ Helicobacter ()] , *Helicobacter* 2007. 12 p. .

129 [Torres et al. ()] 'A comprehensive review of the natural history of Helicobacter pylori infection in children' J  
130 Torres , G Perez-Perez , K J Goodman , J C Atherton , B D Gold , P R Harris , Ia Garza , A M Guaner , J  
131 Munoz , O . *Arch Med Res* 2000. 31 p. .

132 [Lee and Lee ()] 'Ahn YJ Antibacterial activity of oriental medicinal plants extracts toward Helicobacter pylori?'  
133 H B Lee , H K Lee . *Agri Chem Biotechnol* 2003. 46 (3) p. .

134 [Hughes and Lawson ()] 'Allium ampeloprasum (elephant garlic) and Allium cepa (onion), garlic compounds  
135 and commercial garlic supplement products' B G Hughes , L D Lawson . *Phytotherapy Res* 1991. 5 p. .  
136 (Antimicrobial effect of Allium sativum L (garlic))

137 [Fabry and Okemo ()] 'Ansorg R Activity of East African medicinal plants against Helicobacter pylori?' W Fabry  
138 , P Okemo . *Cancer Chemotherapy* 1996. 42 (5) p. .

139 [Funatogawa et al. ()] 'Antibacterial activity of hydrollysable tannins derived from medicinal plants against  
140 Helicobacter pylori' K Funatogawa , H Shunji , S Hirofumi , Y Takashi , H Tsutomu , H Yashikazu .  
141 *Microbiol Immunol* 2004. 48 p. .

142 [De et al. ()] 'Antimicrobial activity of curcumin against Indian Helicobacter pylori and also during mice  
143 infection' Ronita De , P Kundu , S Snehasikta , T Ramamurthy , C Abhijit , Balakrishna Nair , G ,  
144 Ashis Mukhopadhyay . *Antimicrobial agents and Chemotherapy* 2009. 53 (4) p. .

145 [Basile et al. ()] 'Antimicrobial and antioxidant activities of coumarins from the roots of Ferulago campestris  
146 (Apiaceae)' A Basile , S Sorbo , V Spadaro , M Bruno , A Maggio , N Faroano , S Rosselli . *Molecules* 2009.  
147 14 p. .

148 [Zaidi et al. ()] 'Bactericidal activity of medicinal plants, employed for the treatment of gastrointestinal ailments  
149 against Helicobacter pylori' Sfh Zaidi , K Yamada , M Kadokawa , K Usmanghani , T Sugiyama , R O  
150 Mahony , H A Khutheeri , D Weerasekera , N Fernando , D Vaira . *J Ethanopharmacol* 2009. 121 (47)  
151 p. . (W J Gastroenter)

152 [Kivi et al. ()] 'Befrits R Concordance of Helicobacter pylori strains within families' M Kivi , Y Tindberg , M  
153 Sorberg , T H Casswall . *J Clin Microb* 2003. 41 (12) p. .

154 [Bussing A Induction of apoptosis by the mistletoe lectins: A review on the mechanism of cytotoxicity References Références Refe  
155 'Bussing A Induction of apoptosis by the mistletoe lectins: A review on the mechanism of cytotoxicity  
156 References Références Referencias 2012 May mediated by Viscum album' *Apoptosis* 1996. 1 p. .

157 [Mhady et al. ()] 'Chadwich LR Invitro susceptibility of Helicobacter pylori to botanical extracts used tradition-  
158 ally for the treatment of gastrointestinal disorders' G B Mhady , S L Pendland , A Stoia , F A Hamill , D  
159 Fabricant , B M Dietz . *Phytother Res* 2005. 19 (11) p. .

160 [Kawase et al. ()] *Chatterjee SS Structural requirements of hydroxylated coumarins for in vitro anti-Helicobacter*  
161 *pylori activity: In vivo* , M Kawase , T Tanaka , Y Sohara , S Tani , H Sakagami , H Haver . 2003. 17 p. .

162 [Bergonzelli et al. ()] 'Corthesy-Jheulaz IE Essential oils as components of a diet-based approach to management  
163 of Helicobacter pylori' P O Bergonzelli , L O Chikwelu , D Dannicola , N Porta . *Antimicrob Agents Chemoth*  
164 2003. 47 p. .

165 [Cowan MM Plant products as Antimicrobial agents Clin Microbiol Rev ()] 'Cowan MM Plant products as An-  
166 timicrobial agents' *Clin Microbiol Rev* 1999. 12 p. .

167 [Mahandy et al.] *Curcuma longa) and curcumin inhibit the growth of Helicobacter pylori*, G B Mahandy , S L  
168 Pendland , G Yung , Luzz Turmeric . (a group 1 carcinogen)

169 [Usta and Saltik-Temizel ()] 'Derim H Comparison of short and long term treatment protocols and the results  
170 of second-line quadrupole therapy in children with Helicobacter pylori infection' Y Usta , I N Saltik-Temizel  
171 . *J Gastroenterol* 2008. 43 p. .

172 [Eloff JN Which extractant should used for the screening and isolation of antimicrobial components from plants J Ethanopharma  
173 'Eloff JN Which extractant should used for the screening and isolation of antimicrobial components from  
174 plants' *J Ethanopharmacol* 1998b. 60 p. .

175 [Ustun et al. ()] 'Flavonoids with anti-Helicobacter pylori activity from *Citrus laurifolius* leaves' O Ustun , O  
176 Berrin , A Yakut , A Ufuk , Y Erdem . *J Ethanopharmacol* 2006. 108 p. .

177 [Howden and Hunt ()] 'Guidelines for management of *Helicobacter pylori* infection' C W Howden , R H Hunt .  
178 *Am J Gastroenterology* 1998. 93 p. .

179 [Cogo et al. ()] 'Helicobacter pylori activity of plant extracts traditionally used for the treatment of gastroin-  
180 testinal disorders' L L Cogo , Clb Monteiro , M D Miguel , O G Miguel , M M Cunico , M L Ribeeiro , Anti  
181 . *Brazilian J Microbiol* 2010. 41 p. .

182 [Gaby ()] 'Helicobacter pylori eradication: are there alternatives to antibiotics' A R Gaby . *Altern Med Rev*  
183 2001. 6 (4) p. .

184 [Helicobacter pylori infection Semin Gastrointest Dis ()] 'Helicobacter pylori infection'. *Semin Gastrointest Dis*  
185 1997. 8 p. .

186 [Hamasaki et al.] *Highly selective antibacterial activity of novel alkyl quinolone alkaloid from a chinese herbal*  
187 *medicine against Helicobacter pylori in vitro*, N Hamasaki , E Ishile , K Taniinga , Y Tezuka , J Nagaoka .

188 [Pellecure et al. ()] *Huiles essentielles bactericide et fongicides. Revue del L institute pasteur de lyon*, S Pellecure  
189 , J Allegrini , S Bouchberg . 1976. 9 p. .

190 [IARC working groups on the evaluation of carcinogenic risk to humans. Schistosomes, liver flukes and Helicobacter pylori Lyon ()]  
191 *IARC working groups on the evaluation of carcinogenic risk to humans. Schistosomes, liver flukes and*  
192 *Helicobacter pylori Lyon*, 1994. 61 p. .

193 [Ibrahim et al.] M D Ibrahim , A K Aleem , K T Santosh , M A Habeeb , M N Khaja . *Habibullah CM*  
194 *Antimicrobial activity of *Sapindus mukorossi* and *Rheum emodi* extracts against *H.pylori*: In vitro and In*  
195 *vivo studies*,

196 [Inatsu et al. ()] 'Idebenone acts against growth of *Helicobacter pylori* by inhibiting its respiration' S Inatsu , O  
197 Ayumi , N Kumiko . *Antimicrob Agents Chemother* 2006. 50 p. .

198 [Baldari et al. ()] 'Immune subversion by *Helicobacter pylori*' C T Baldari , A Lanzavecchia , J L Telford . *Trends*  
199 *Immunol* 2005. 26 p. .

200 [Herrling et al. ()] 'Important role of melanin as protector against free radicals in skin' T Herrling , K Jung , J  
201 Fuches . *SOFWJ* 2007. 133 p. .

202 [Masam and Wasserman ()] 'Inactivation of red beet ?-glycon synthase by native and oxidized phenolic com-  
203 pounds' T L Masam , B P Wasserman . *Phytochemistry* 1987. 26 p. .

204 [Mario et al. ()] 'Iori V A Curcumin based 1-week triple therapy for eradication of *Helicobacter pylori* infection:  
205 something to learn from failure' Di Mario , F Cavallaro , L G Nouvenne , A Stefani , N Cavestro , GM .  
206 *Helicobacter* 2007. 12 p. .

207 [Eloff and Katerere ()] 'McGaw LJ The biological activity and chemistry of the Southren African Combretaceae'.  
208 J N Eloff , D R Katerere . *J Ethanopharmacol* 2008. 119 p. .

209 [Njume and Jide ()] 'Ndip RN Aqueous and organic extracts of selected South African medicinal plants possessss  
210 antimicrobial activity against drug resistant strains of *Helicobacter pylori* inhibition and bactericidal  
211 potential' C Njume , A L Jide . *Int J Mol Sci* 2011. 12 (9) p. .

212 [NIH consenses conference Helicobacter pylori in peptic ulcer disease Jamaica ()] 'NIH consenses conference He-  
213 licobacter pylori in peptic ulcer disease' *Jamaica* 1994. 272 p. .

214 [Goodwin and Mendall ()] 'Northfield TC Helicobacter pylori infection' C S Goodwin , M M Mendall . *Lancet*  
215 1997. 349 p. .

216 [Smith et al. ()] 'Omonigbehin EA The effect of some Nigerian local herbs on *Helicobacter pylori*' S I Smith , K  
217 S Oyede , B Opere , B A Walokum . *Afri J Clin Exp Microbiol* 2003. 4 (2) p. .

218 [Sivam et al. ()] 'Polter JD *Helicobacter pylori*-in vitro susceptibility to garlic (*Allium sativum*) extracts' G P  
219 Sivam , J W Lampe , B Ulness , S R Swanzly . *Nutr Cancer* 1997. 27 p. .

220 [Ruggiero et al. ()] 'Polyphenols reduce gastritis induced by *Helicobacter pylori* infection or vac A toxin  
221 administration in mice' P Ruggiero , F Tombola , G Rossi , L Pancotto , L Lauretti , Del Giudice , G  
222 Zoratti , M . *Antimicro agents Chemotherapy* 2006. 50 (7) p. .

223 [Poovendran and Kalaigandhi ()] 'Poogunran D In-vitro antimicrobial activity of *Coccinia grandis* on ulcer  
224 producing *Helicobacter pylori*' P Poovendran , V Kalaigandhi . *Euro J App Sci* 2011. 3 (3) p. .

225 [Moore] *Salma NR Mutational analysis metronidazole resistance in Helicobacter pylori*, J M Moore .

226 [Saltik-Temizel Second-Line Helicobacter pylori Therapy Eradication Failure in Children] *Saltik-Temizel*  
227 *Second-Line Helicobacter pylori Therapy Eradication Failure in Children*,

228 [Scalbert A Antimicribial properties of tannins *Phytochemistry* ()] 'Scalbert A Antimicribial properties of tan-  
229 nins' *Phytochemistry* 1991. 30 p. .

---

230 [Wang and Huang ()] 'Screening of anti-helicobacter pylori herbs deriving from Taiwanese folk medicinal plants'  
231 Y C Wang , T L Huang . *FEMS-Immunol Med Microbiol* 2005. 43 p. .

232 [Biradar et al. ()] 'Singhania SS Exploring of antimicrobial activity of Triphala Mashian Ayurvedic formulation'.  
233 Y S Biradar , J Sheetal , K R Khandelwal . *Evid based Complem Alter Med* 2008. 5 p. .

234 [Jonkers et al. ()] 'Stobberingh E Antibacterial effect of garlic and omeprazole on Helicobacter pylori'. D Jonkers  
235 , E V Brork , I Van Dooren , L Thiji , E Dirant , G Hageman . *J Antimicrobial Chemotherapy* 1999. 43 p. .

236 [Hoste et al. ()] 'The effects of tannin rich plants on parasitic nematodes in ruminates'. H Hoste , J Frank , A  
237 Spiridoula , M Stig , Soh Thamsborg . *Trends Parasitol* 2006. 22 p. .

238 [Mabe et al. ()] 'Tsuneo T In-vitro and in vivo activities of Tea catechins against Helicobacter pylori'. K Mabe ,  
239 Y Masami , O Itaro . *Antimicrobia Agents Chemother* 1999. 43 p. .

240 [Marshall and Warren ()] 'Unidentified curved bacilli in the stomach of patients with gastritis and peptic  
241 ulceration'. B J Marshall , J R Warren . *Lancet* 1984. 1 p. .

242 [Ma et al. ()] 'Yang Bai Screening test for anti-Helicobacter pylori activity of traditional Chinese herbal  
243 medicines'. Feng Ma , Ye Chen , Jing Li , He-Ping Qing , Ji-De Wang , Ya-Li Zhang , Bei-Guo Long .  
244 *W J Gastroenter* 2010. 16 (44) p. .