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Full Length Research Paper

Diversity of plants used in the treatment of *Helicobacter pylori* associated morbidities in the Nkonkobe municipality of the Eastern Cape Province of South Africa

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Helicobacter pylori **is a major cause of gastro-duodenal pathologies. Expenses associated with combination therapy and the adverse effects of the treatment regimens have led to increased usage of ethnomedicines in the management of infections. Despite the usage of plants in the management of infections in the Nkonkobe municipality, empirical studies to document the specific plant species used by traditional doctors are lacking. This study was conducted to document the various plant families and species used in the management of *H. pylori* associated morbidities in the Nkonkobe municipality. A semi-structured questionnaire was used to interview the local dwellers including traditional doctors, herbalists and hawkers in traditional medicine. The plant parts used, preparation, mode of administration and dosages were recorded. Seventeen plant species belonging to 13 genera and 11 families were collected and identified by their vernacular and scientific names. The Asphodelaceae was the most represented family (4 species), followed by Apocynaceae (3 species) and Loganiaceae (2 species). The plant parts most frequently used were the roots (35.3%), followed by the leaves and stem barks (23.5% each). Further research is needed to scientifically correlate treatment claims with folkloric uses and to isolate the plants active components, determine their *in-vivo* potencies and toxicity.**

Key words: *Helicobacter pylori*, stomach morbidities, ethnomedicines, Nkonkobe municipality, South Africa.

INTRODUCTION

Helicobacter pylori, a Gram negative microaerophilic helical bacillus has been implicated in the pathogenesis of a number of digestive tract disorders such as chronic active gastritis, peptic ulcer, gastric cancer and mucosa associated lymphoid tissue (MALT) lymphoma (Ndip et al., 2008; Manyi-Loh et al., 2010). The organisms are found to be suspended in the stomach mucosa or attached to epithelial cells of the stomach which happens to be the only known reservoir of infection (Atherton, 2006; Correa and Piazuelo, 2008).

Half of the world's population is infected by this organism and a high prevalence of up to 90% has been reported in the developing countries (Adrienne et al., 2007), as opposed to 20 to 50% in the developed nations (Castillo-juarez et al., 2009). A high prevalence of infection has been found almost always to correlate with low socio-economic status and poor sanitary conditions (Ndip et al., 2004; Kusters et al., 2006).

Infections are treated with potent combination therapies, a proton pump inhibitor (PPI) or bismuth in combination with two antibiotics most commonly metronidazole, clarithromycin, amoxicillin and tetracycline with an expected success rate of 80 to 90% (Njume et al.,

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2009). However, eradication of *H. pylori* is still a difficult problem as treatment failure rate remains at 10 to 40% (Lai et al., 2006). Equally important is the increasing prevalence of antimicrobial resistant strains in South Africa which jeopardize the success of therapeutic regimens aimed at eradication of infections (Njume et al., 2010; Tanih et al., 2010).

In the Nkonkobe municipality just like many areas of the developing world, the use of medicinal plants in the treatment of stomach related morbidities is an old custom that has co-existed with the people for many years (Wintola and Afolayan, 2010). This municipality is located within the Eastern Cape Province, home to 15.5% (6.3 million) of South Africa's total population and incorporates two of the former 'homelands' of the apartheid period (that is, Ciskei and Transkei), where many aspects of traditional culture are still part of everyday life (Dold and Cocks, 2002). Consequently, the people of the Eastern Cape tend to be more traditional and rural than those in other parts of South Africa.

The use of medicinal plants in the treatment of diseases has occupied a pivotal position in the socio-cultural and spiritual lives of rural and tribal families in this municipality (Oyedemi et al., 2009). This region abounds in its ethnic diversity, in which many aboriginal cultures have retained traditional knowledge concerning the medicinal utility of the native flora.

Herbal remedies are commonly used in this municipality to treat gastritis, peptic ulcer, stomach cancer and other *H. pylori* associated pathologies, as a means to evade the high cost and adverse effects associated with Western drugs. Contrary to these drugs, most of the herbal remedies used are readily available with almost no resistance reported (Wintola and Afolayan, 2010). Ethno botanical studies to identify potential sources of new drugs have become very necessary considering the ever evolving nature of *H. pylori* resistance to current antimicrobial agents (Njume et al., 2009). Equally important is the potential of such studies to bring to lime light numerous plants having significant medicinal properties hitherto unknown to the scientific world.

More than 80% of rural African people depend on plant based remedies for primary health care (Afolayan and Lewu, 2009). In order to preserve valuable plant information and prevent lost of traditional values, it is imperative for studies covering the folkloric use of these plants to be assembled into regional or provincial pharmacopoeias. This becomes very important considering that 25% of prescription drugs issued in the USA and Canada today contain bioactive compounds that are derived from or modelled after plant natural products (Singh and Lal, 2008). This study was carried out as a means to preserve the enormous wisdom and traditional knowledge associated with treatment of infections symptomatic of *H. pylori* in the Nkonkobe municipality. This becomes imperative considering that most of the traditional doctors are old and may die with their libraries of knowledge.

MATERIALS AND METHODS

Study area

Nkonkobe Municipality, Eastern Cape province of South Africa is located within 32° 47' 0" South, 26° 50' 0" East (Wintola and Afolayan, 2010). The area is bounded by the sea in the east and drier Karroo in the west (Erasto et al., 2005) with an altitude of approximately 1300 m above sea level and vegetation veld type 7 (Masika and Afolayan, 2003). It is inhabited by the Xhosa speaking people with farming as their main source of income. A great majority of these people use plants either alone or as supplements to western therapies in the treatment of numerous gastro-duodenal infections.

Collection of information

A reconnaissance survey was carried out in Fort Beaufort, Alice, King William's town, Dimbaza, Middledrift and Keiskammahoek to identify possible traders or dealers in traditional medicine in April 2009. Field trips were made between May and July 2009 and participation of the locals was voluntary.

Ethno botanical information was collected using the method of Jovel et al. (1996), consisting of general conversation and questionnaires. General questions on the local names of the plants, the parts used, methods of preparation, mode of administration, dosage, other medicinal values of the plants and the perceived efficacy of the remedies on stomach complains were mostly asked directly and the responses filled on the questionnaires. One of our research group members, a Xhosa lady, did the translation from Xhosa to English and vice versa during our interactions with the locals. The respondents were traditional healers, herbalists, farm owners, hawkers of traditional medicines and owners of "amayeza yesiXhosa" (Xhosa medicine) stores in Alice, King William's town, Middledrift, Dimbaza and Keiskammahoek. Villagers who had practical knowledge on medicinal plants used to treat stomach related morbidities were also recruited in the study.

The participants were motivated by giving them financial incentive to provide samples of the plant specimens used in the treatment of stomach complaints but when this was not possible, they optionally accepted to walk the researchers into the bushes where the samples were harvested. Samples were also purchased from the street vendors, "amayeza yesiXhosa" stores and traditional medicine markets in Alice and King William's town. Plant specimens were initially identified by their vernacular names. Authentication of plant material was done by the Giffen herbarium, School of Biological Sciences, University of Fort Hare where voucher specimens were deposited.

Intellectual property agreement

Prior to the interviews the healers and traditional doctors were given information about the project, the participants in the survey and the objectives. The conversations with the locals were built on trust with the common goal of increasing the knowledge on medicinal plants used in the treatment of stomach problems in the municipality. Ethical approval was obtained from the Govan Mbeki Research and Development Centre, University of Fort Hare.

RESULTS

A total of 52 informants participated in the study. The

Table 1. Summary of questionnaire on people interviewed.

Locality	Traditional doctors	Herbalist	Traditional medicine sellers	Villagers	Total
Fort Beaufort	0	0	2	0	02
Alice	3	3	2	1	09
Middle drift	0	0	1	2	03
Keiskammahoek	1	1	0	3	05
Dimbaza	0	0	3	2	05
King William's town	0	0	28	0	28
Total	04	04	36	08	52
Percentage	7.7	7.7	69.2	15.4	100

majority of them were traditional medicine sellers, 36/52 (69.2%) and villagers, 8/52 (15.4%) who had practical knowledge on medicinal plants used to treat gastritis and other stomach problems. Very few traditional doctors, 4/52 (7.7%) and herbalist, 4/52 (7.7%) accepted to participate in the study (Table 1).

Types of plants sampled

A total of 17 plant species belonging to 13 genera and 11 families were sampled (Table 2). The Asphodelaceae was the most represented family (4 species), followed by Apocynaceae (3 species) and Loganiaceae (2 species). The roots were the most commonly used plant parts, constituting 35.3% of all medicinal preparations. This was followed by the stem bark and leaves (23.5% each), rhizome, tuber and whole plants each having a percentage representation of 5.9% (Figure 1). Stomach pain was the most frequent manifestation that was treated with most of the plants. Except for one plant, treatment was given orally for all stomach related illnesses (Table 2).

DISCUSSION

The folkloric use of plants in the treatment of *H. pylori* associated diseases is becoming more and more popular due to expenses associated with antimicrobial chemotherapy as well as the many adverse effects which reduce the quality of life and discourage patients from observing medication protocols (Bohr and Malfertheiner, 2009). Numerous plants, 17 of which are enlisted herein are used in the treatment of stomach related morbidities in the Nkonkobe municipality of South Africa and other parts of the developing world (Ndip et al., 2007, 2009). However, this study is the first to document plant species used in the treatment of infections symptomatic of *H. pylori* in this municipality.

The results of this study indicate that three species; *Aloe arborescence*, *Aloe tenuior*, *Aloe ferox* from the Asphodelaceae family are commonly used in the treatment of stomach problems in our study area. Our results are consistent with the findings of Wintola and Afolayan (2010) who also reported the use of these species in the treatment of constipation in this municipality. It is worth mentioning that the Aloes are widely distributed in Africa and have been reported to be useful medicinal plants with antibacterial properties (Mbanga et al., 2010). However, little is known about their anti-*H. pylori* activities.

Thong-Ngam and Chatsuwan (2007) evaluated the antimicrobial activity of *A. vera* on *H. pylori* and found no activity. However, aloe-emodin, a compound that is found in some *Aloe* species has been shown to elicit a dose dependent growth inhibition of *H. pylori* cultures (Wang et al., 1998). *A. arborescence* was also recently reported to exhibit strong antimicrobial activities against a wide variety of organisms including *Staphylococcus aureus*, *Bacillus substilis*, *Escherichia coli*, *Salmonella typhimurium*, *Salmonella gallinarum*, *Klebsiella* species, *Proteus* species and *Candida albicans* in Zimbabwe (Mbanga et al., 2010). The antimicrobial activity of plant extracts may vary across different regions and may depend on the age of the plants as well as the parts used (Ndip et al., 2007). More studies to evaluate the antimicrobial activities of these plants against *H. pylori* would shed light on their potential usefulness as possible sources of novel therapies against this notorious pathogen.

Information from literature indicates that almost all of these plants have been used in the treatment of other illnesses in humans or animals in the Eastern Cape province of South Africa and other countries in Africa (Dold and Cocks, 2002; Cocks and Dold 2006). Five of the plants studied herein have been recently reported in our study area as remedies for the treatment of constipation. They include; *Strychnos henningsii*, *A. arborescence*, *A. tenuior*, *A. ferox* and *Alepidea amatymbica* (Wintola and Afolayan, 2010). Two of these; *S. henningsii* and *A. ferox* are also used for treating diabetes mellitus (Oyedemi et al., 2009), while *A. amatymbica* is used in the treatment of diarrhoea (Afolayan and Lewu, 2009).

This is not surprising considering that a single plant species may contain several chemical compounds that may be active against a wide variety of diseases. Plant cells fundamentally are chemical factories and many

Table 2. Plants used in the treatment of *Helicobacter pylori* related morbidities in the Nkonkobe municipality of the Eastern Cape province of South Africa.

Scientific name/Family	Vernacular/Local name(s)	Herbarium vouchers	Parts used /State	Type of stomach illness	Preparation	Mode of administration and dosage
Hypoxis hemerocallidea (Hypoxidaceae)	Inongwe (African potato)	CNUFH07	Tuber (Fresh)	Gastritis	Crushed in warm water and sieved	Taken orally, three glasses a day
Rubia petiolaris (Rubiaceae)	Ubulawu	CNUFH08	Roots (Fresh)	Severe stomach and chest pains	Infusion	Taken orally until symptoms subside
Strychnos henningsii (Loganiaceae)	Umnonono	CNUFH04	Stem bark (Dry)	Stomach pains	Infusion	Taken orally
Strychnos decussata (Loganiaceae)	Umnonono	CNUFH06	Stem bark (Dry)	Stomach pains	Infusion	Taken orally
Aloe arborescence (Asphodelaceae)	Unomawenii	CNUFH09	Leaves (Fresh)	Stomach pains	Decoction	Taken orally
Aloe ferox (Asphodelaceae)	Ikhalaah	CNUFH10	Leaves (Fresh)	Stomach pains	Decoction	Taken orally
Aloe tenuior (Asphodelaceae)	Intelezi	CNUFH11	Leaves (Fresh)	Stomach pains	Decoction	Taken orally
Alepidea amatymbica (Apiaceae)	Iqwili	CNUFH03	Rhizome/Roots (Fresh or dry)	Chest pain, belching	Boiled , infusion	Steam inhaled until symptoms subside
Hydnora africana (Hydnoraceae)	Umavumbuka	CNUFH12	Whole plant (dry)	Gastritis, stomach cramps, ulcers	Infusion	Taken orally
Pachycarpus concolor (Apocynaceae)	Itshongwe	CNUFH13	Roots (Dry)	Stomach ache, gastritis	Infusion	Taken orally
Xysmalobium orbiculare (Apocynaceae)	Itshongwe	CNUFH14	Roots (Dry)	Stomach ache, gastritis	Infusion	Taken orally
Xysmalobium undulatum (Apocynaceae)	Itshongwe	CNUFH15	Roots (Dry)	Stomach ache, gastritis	Infusion	Taken orally
Elephantorrhiza elephantine (Fabaceae)	Intolwane	CNUFH16	Roots (Fresh)	Stomach pains	Boiled	Taken orally, three glasses daily
Ilex mitis (Aquifoliaceae)	Isidumo	CNUFH17	Stem bark (Dry)	Bloated painful stomach	Infusion	Taken orally
Cissampelos capensis (Menispermaceae)	Umayisake	CNUFH18	Leaves (Fresh and dry)	Stomach pains	Crushed in hot water	Taken orally
Bulbine abyssinica (Asphodelaceae)	Uyakayakana	CNUFH19	Roots (Fresh)	Stomach pains	Infusion	Taken orally
Trichilia dregeana (Meliaceae)	Umkhuhlu	CNUFH20	Stem bark (Fresh and dry)	Pains and stability of the stomach	Infusion	Taken orally

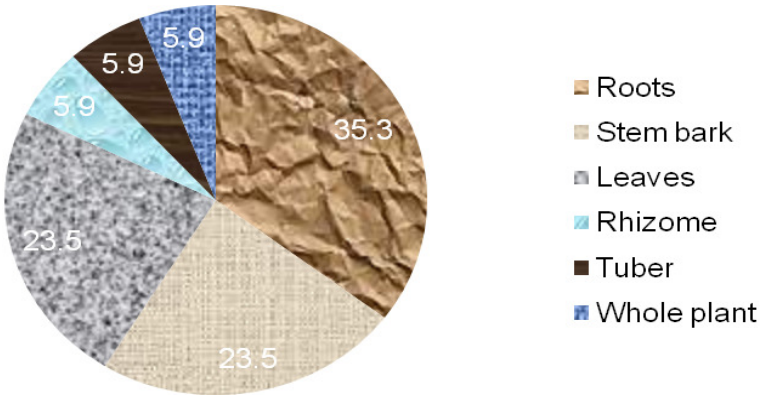

Figure 1. Percentage of plant parts used in the treatment of Helicobacter pylori-associated morbidities in the Nkonkobe municipality.

possess a rich supply of therapeutically useful constituents (Akinpelu et al., 2009). Some of these constituents; tannins, catechins, alkaloids, steroids, triterpenoids, essential oils and polyphenolic acids have antibacterial properties and health promoting abilities with therapeutic effects on multiple disease conditions (Cowan, 1999; Iwalewa et al., 2007; Adeboye et al., 2008).

Our results show that traditional naming of plants in the Nkonkobe municipality is a little controversial considering that different plants may be given the same names. For example, *Strychnos henningsii* and *Strychnos decussata* are both referred to as 'Umnonono' while 'Itshongwe' can be used to mean *Pachycarpus concolor*, *Xysmalobium orbiculare* or *Xysmalobium undulatum* (Table 2). This phenomenon has been reported in many traditional societies and is probably due to the fact that most of these plants are named after their uses (Bussmann et al., 2006; Focho et al., 2009), which may cut across a number of plants. The results also demonstrate that dosage was dependent most of the time upon the disappearance of symptoms. This may give a false impression of treatment considering that clinical presentations may vary amongst patients and there is also the risk of over dosage.

In this study, the most used plant parts are roots (35.3%), leaves (23.5%) and stem barks (23.5%) (Figure 1). The frequent harvesting of roots and barks may destroy the plants, but they are preferable, probably due to the fact that they contain larger quantities of antibacterial components and they are easier to transport or store for longer periods as previously suggested (Eloff, 2001). It would be much more sustainable if traditional medicine practitioners and dealers in traditional medicine are encouraged to use leaves.

The Apocynaceae was also one of the most represented families in this study (Table 2). A World Wide Web search indicates that none of the three members represented herein; *P. concolor*, *X. orbiculare* and *X. undulatum* has been evaluated against *H. pylori*. This calls for more research on these plants which could be possible sources of new compounds for the eradication of *H. pylori* infections. Equally important is the need to document their toxicological properties and *in vivo* potencies.

Although the use of traditional medicine to manage *H. pylori* associated morbidities is gaining interest in this municipality, information on the effectiveness as well as the toxicological and pharmacological properties of most of these plants are lacking. The locals claim they are efficient and safe because of their natural origin. As a consequence, the inhabitants often use these remedies without medical advice, and in some cases combined with medically prescribed drugs. This constitutes a health risk because some of these plants may contain several constituents which could interact with the prescribed drugs and affect drug metabolic pathways.

The use of medicinal plants in the management of *H. pylori* related morbidities and other infections needs to be regulated considering that some of these plants contain pesticides or heavy metals. Equally important is the fact that a misidentified plant might be used or a different plant than the one originally used for the treatment may be substituted for the same treatment. Not only could plant components affect the efficacy of current *H. pylori* treatment regimens, their interactions could lead to toxicity. However, despite the aforementioned problems, some of these plants are already showing promising results as potential sources of novel anti- *H. pylori* compounds. One of these plants, *Hydnora africana*, studied in our group has been embraced as a potential reservoir that may contain a large repertoire of new anti- *H. pylori* compounds (Unpublished findings).

Conclusion

Ethnobotanical studies of plants used to manage *H. pylori*

associated morbidities can help in identifying cheap sources of new efficient compounds that would be used to better manage the infection. In this study, 17 species belonging to 11 families were identified. More research is needed to scientifically correlate treatment claims with the use of these plants as well as isolate the plants chemical compounds, determine their toxicities and *in vivo* potencies. These aspects are already receiving attention in our group.

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REFERENCES

Adeboye MF, Akinpelu DA, Okoh AI (2008). The bioactive and phytochemical properties of *Garcinia kola* (Heckel) seed extract on some pathogens. Afr. J. Biotechnol., 7: 3934-3938.

Adrienne ZA, Pharm D, Simon I, Emily RM (2007). Update on *Helicobacter pylori* Treatment. Am. Fam. Phy., 75: 329-335

Afolayan AJ, Lewu FB (2009). Antimicrobial activity of *Alepidea amatymbica*. Pharm. Biol., 47: 436-439.

Akinpelu DA, Aiyegoro AO, Okoh AI (2009). Studies on the biocidal and cell membrane disruption potentials of stem bark extracts of *Afzelia africana* (Smith). Biol. Res., 42: 339-349.

Atherton JC (2006). The pathogenesis of *Helicobacter pylori* -induced gastro-duodenal diseases. Ann. Rev. Pathol., 1: 63-96.

Bohr URM, Malfertheiner P (2009). Eradication of *H. pylori* infection: the challenge is on if standard therapy fails. Therap. Adv. Gastroenterol., 2: 59-66.

Bussmann RW, Genevieve GG, Solio J, Lutura M, Lutuluo R, Kunguru K, Wood N, Mathenge S (2006). Plant use of the Maasai of Sekenani Valley, Maasai Mara, Kenya. J. Ethnobiol. Ethnomed., 2: 1-7.

Castillo JI, González V, Aime AH, Martínez G, Linares E, Bye R, Romero I (2009). Anti-*Helicobacter pylori* activity of plants used in Mexican traditional medicine for gastrointestinal disorders. J. Ethnopharmacol., 122: 402-405.

Cocks ML, Dold AP (2006). Cultural significance of biodiversity: The role of medicinal plants in urban African cultural practices in the Eastern Cape, S. Afr. J. Ethnobiol., 26: 60-81.

Correa P, Piazuelo MB (2008). Natural history of *Helicobacter pylori*infections. Digest. Liver Dis., 40: 490-496.

Cowan MM (1999). Plant Products as Antimicrobial Agents. Clin. Microbiol. Rev., 12: 564-582.

Dold AP, Cocks ML (2002). The trade in medicinal plants in the Eastern Cape Province, South Africa. S. Afr. J. Sci., 98: 589-597.

Eloff JN (2001). Antibacterial activity of Murula (*Sclerocarya birrea* (A. rich) Hochst. Subsp. *Caffra* (Sond) Kokwaro) (Anacardiaceae) bark and leaves. J. Ethnopharmacol., 76: 305-308.

Erasto P, Adebola PO, Grierison DS, Afolayan AJ (2005). An ethnobotanical study of plants used for the treatment of diabetes in Eastern Cape Province, South Africa. Afr. J. Biotechnol., 4: 1458-1460.

Focho DA, Nkeng EAP, Fonge BA, Fongod AN, Muh CN, Ndam TW, Afegenui A (2009). Diversity of plants used to treat respiratory diseases in Tubah, North West region, Cameroon. Afr. J. Pharm. Pharmacol., 3: 573-580.

Iwalewa EO, McGaw LJ, Naidoo V, Eloff JN (2007). Inflammation: The foundation of diseases and disorders. A review of Phytomedicines of South African origin used to treat pain and inflammatory conditions. Afr. J. Biotechnol., 6: 2868-2885.

Jovel EM, Cabanillas J, Towers GHN (1996). An ethnobotanical study of the traditional medicine of the Mestize people of Suni Mirano,Loreto, Peru. J. Ethnopharmacol., 53: 149-156.

Kusters JG, Van VAHM, Kuipers EJ (2006). Pathogenesis of *Helicobacter pylori* infection. Clin. Microbiol. Rev., 19: 449-490.

Lai CH, Kuo CH, Chen PY, Poon SK, Chang CS, Wang WC (2006). Association of antibiotic resistance and higher internalization activity in resistant *Helicobacter pylori* isolates. J. Antimicrob. Chemother., 57: 466-471.

Manyi LCE, Clarke AM, Munzhelele T, Green E, Mnkwetshana NF, Ndip RN (2010). Selected South African honeys and their extracts possess in vitro anti-*Helicobacter pylori* activity. Arch. Med. Res., 41: 324-331.

Masika PJ, Afolayan AJ (2003). An ethnobotanical study of plants used for the treatment of livestock diseases in the Eastern Cape Province, South Africa. Pharm. Biol., 41: 16-21.

Mbanga J, Mangoma N, Saidi B (2010). An Evaluation of the Antimicrobial Activities of *Aloe barbadensis, A. chabaudii* and *A. arborescens* Leaf Extracts Used in Folklore Veterinary Medicine in Zimbabwe. J. Antimicrob. Vert. Adv., 9: 2918-2923.

Ndip RN, Malange AE, Akoachere JFT, Mackay WG, Titanji VPK, Weaver LT (2004). *Helicobacter* antigens in faeces of asymptomatic children in the Buea and Limbe health districts of Cameroon: a pilot study. Trop. Med. Int. Health, 9: 1036-1040.

Ndip RN, Malange TAE, Mbulla SM, Luma HN, Agnes M, Ndip LM, Nyongbela K, Wirmum C, Efange SMN (2007). In *vitro* anti-*Helicobacter pylori* activity of extracts of selected medicinal plants from North West Cameroon. J. Ethnophamacol., 114: 452-457.

Ndip RN, Malange TAE, Ojongokpoko JEA, Luma HN, Malongue A, Akoachere JFK, Ndip LM, MacMillan M, Weaver LT (2008). *Helicobacter pylori* isolates recovered from gastric biopsies of patients with gastro–duodenal pathologies in Cameroon: current status of antibiogram. Trop. Med. Int. Health., 13: 848-854.

Ndip RN, Ajonglefac AN, Wirna T, Luma HN, Wirmum C, Efange SMN (2009). In vitro antimicrobial activity of Ageratum conyzoides (Linn) on clinical isolates of *Helicobacter pylori*. Afr. J. Pharm. Pharmacol., 3: 585-592.

Njume C, Afolayan AJ, Ndip RN (2009). An overview of antimicrobial resistance and the future of medicinal plants in the treatment of *Helicobacter pylori* infections. Afr. J. Pharm. Pharmacol., 3: 685-699.

Njume C, Afolayan AJ, Clarke AM, Ndip RN (2010). Crude ethanolic extracts of *Garcinia kola* seeds Heckel (Guttiferae) prolong the lag phase of *Helicobacter pylori*: inhibitory and bactericidal potential. J. Med. Food. (In press).

Oyedemi SO, Bradley G, Afolayan AJ (2009). Ethnobotanical survey of medicinal plants used for the management of diabetes mellitus in the Nkonkobe municipality of South Africa. J. Med. Plants Res., 3: 1040-1044.

Singh KN, Lal B (2008). Ethnomedicines used against four common ailments by the tribal communities of Lahaul-Spiti in Western Himalaya. J. Ethnopharmacol., 115: 147-159.

Tanih NF, Okeleye BI, Naido N, Clarke AM, Mkweshana N, Green E, Ndip LM, Ndip RN (2010). Marked susceptibility of South African *Helicobacter pylori* strains to ciprofloxacin and amoxicillin: Clinical implication. S. Afr. Med. J., 100: 49-52.

Thong ND, Chatsuwan T (2007). Antibacterial Activity of *Aloe Vera*, Curcumin, Garlic, and Plau-noi Against *Helicobacter pylori*. Thail. J. Gastroenterol., 8: 5-11.

Wang HH, Chung JG, Ho CC, Wu LT, Chang SH (1998). Aloe-emodin effects on arylamine *N*-acetyltransferase activity in the bacterium *Helicobacter pylori*. Planta Med., 64: 176-178.

Wintola AO, Afolayan AJ (2010). Ethnobotanical survey of plants used for the treatment of constipation within Nkonkobe municipality of South Africa. Afr. J. Biotechnol., 9: 7767-7770.