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Ethnobotanical Medicinal Plants Used as Chewing Sticks among the Kenyan Communities

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Background: Dental infections are among the most pursued global oral health problems. They are caused by plaque forming bacteria such as *Myces, Actinobacillus, Streptococcus* and *Candida* species which reside in the oral cavity. Chewing sticks have remained a common and acceptable teeth cleaning agent in different parts of the world especially in developing countries despite the widespread use of tooth brushes and tooth pastes. These are secondary forest products used by many communities in Kenya. They are used to treat wide range of oral infections and some have been reported by the herbalist to possess pharmacological properties. Despite their wide usage, not much has been investigated about the species mentioned for their importance according to local communities.
Aim: In view of this, the purpose of this research was to undertake an ethnobotanical study and evaluation of phytochemicals of the locally used medicinal plants as chewing sticks among western communities in Kenya.
Place and Duration: Research was carried out at University of Kabianga from January to May 2016.
Methodology: Secondary literature search and structured interviews among local informants in 5 Counties, Western Kenya was used to collect data. They were requested to list the species used as chewing sticks and to rank them by priority. To evaluate the pharmacological importance, phytochemical screening was done on organic extracts (leaves and stems) of the three species listed as priority according to local perceptions.

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Results: In our findings, fifteen plant species belonging to different families were documented. It was observed that plants used by the locals are carefully selected for properties such as hardness, or bitterness and certain species were more popular than others among the users. Some of these species had medicinal properties and were used for the treatment of malaria, stomach upsets, cough, diarrhea, dysentery, and tuberculosis. The oral health status of the users, especially the youths and the middle aged were suggestions of the possible dental recipe, contained in some of these plant species especially the frequently used. Phytochemical screening of the extracts from the three species ranked as priority revealed the presence of alkaloids, tannins, flavonoids, saponins, terpenoids and carotenoids. Therefore the extracts contains compounds (phytochemicals) that have been reported to have an effect on oral pathogens and other ailments and thus prevent tooth decay and gum diseases.

Conclusion: Thus, the study ascertains the value of medicinal plants used in the Western Kenya and Kenya as a whole, which could be of considerable interest to the development of new drugs and production of new antibiotic. Use of these plants as chewing sticks can also be commercialized and be a source of income for many poor Kenyans upon scientific validation of their toxicity.

Keywords: Ethnobotanical; phytochemicals; medicinal plants; chewing stick.

ABBREVIATIONS

WHO : World Health Organization
DCM : Dichloromethane

1. INTRODUCTION

The World Health Organization (WHO) ranks oral disease among the top five causes of health burden in the world [1]. The most common oral infection are periodontal diseases that are mainly caused by poor oral hygiene. Periodontal diseases can be regarded or defined as any pathological processes disturbing the periodontal tissues which include the gums, bone and the ligaments holding the teeth to the bone. It is commonly caused by bacterial plaque accumulation around the neck of the teeth. This infections affects all humans without regard for race or gender or better still the origin of a person or his/her nationality. Bacterial plaque and their products, especially enzymes and endotoxins initiate the inflammatory process of the diseases. Thus oral health care is part of total health and essential to quality of life of an individual. This is to say that an unhealthy condition of the mouth and teeth can affect all parts of the body producing much ill health. Bone [2] pointed out that, systematic health maybe more affected by oral hygiene than previously recognized. In this review, he discussed possible etiological associations between periodontitis and cardiovascular disease in general, and endocarditis specifically, as well as rheumatoid arthritis, pneumonia, pre-term birth and low birth weight. Periodontal inflammation, which facilitates the entrance of bacteria into the blood stream especially after chewing food or cleaning the teeth, (either by direct effect from the bacteria or from the inflammation which their presence may trigger) could lead to thrombus formation and/or the development of atherosclerotic lesions. These bacteria have been reported to be insusceptibility to antimicrobial agents compared with cultures grown in suspension [3]. The ineffectiveness of traditional and modern preventive methods in reducing such oral health diseases has led to a greater awareness of the importance of social causes. The awareness is aimed at sensitizing people on the importance of maintaining oral health. People are encouraged to rinse their mouth after brushing, chew sugar free gum after every meal or visit local dentist for a checkup. The Kenya National Oral Health Conference in June, 2003 also recognized the fact that the dental care needs of the majority of Kenyans remains largely unmet because there are a few professionals offering care, as a result services are often too costly, scarce or totally absent especially in rural areas [4]. They recommended the use of natural chewing sticks. This is due to the fact that chewing sticks and plant derived antimicrobials have a long history of providing the much needed therapeutics [4]. Many studies on various chewing sticks have reported that chewing sticks have medicinal properties associated with gum healing, analgesia and antimicrobial and plaque inhibiting effect [5-9]. The earliest chewing sticks were discovered in Babylonia in 3500 BC [9]. They were twigs with a frayed end used to brush against the teeth, while the other end was used as a toothpick [10]. They are prepared as a pencil-sized stick from the twigs, stems or roots

of variety of plant species. Chewing stick is a common and acceptable teeth cleaning agent in different parts of the world, especially in developing countries [11]. They are chewed on one end to frayed brush like end, before being used for teeth cleaning in a manner similar to the use of a toothbrush. When properly used, they can be efficient in removing dental plaque due to the combined effect of mechanical cleaning, antimicrobial activity and enhanced salivation [12]. The use of toothbrush and chewing sticks for teeth cleaning are common in most communities in Kenya with chewing stick use appearing to be high in the northern part of Kenya where it is highly used by the Muslims [13]. This is because natural products are known to play an important role in both drug discovery and chemical biology. In fact, many of the current drugs either mimic naturally occurring molecules or have structures that are fully or in part derived from natural motifs. In view of this the current research was aimed at evaluating an ethnobotanical study and evaluation of phytochemicals present in chewing sticks used my many communities in Kenya.

2. MATERIALS AND METHODS

2.1 Study Area

The research was carried out in the month of January 2016. The study was carried out in Counties of Vihiga, Kakamega, Bungoma, Busia and Transnzoia in Western Kenya. In each County a few rural communities were selected by random sampling based on availability of famous identifiable local herbalists and their geographical distribution. Direct interaction with local respondents (users) was adopted to get information about the variety of species used as chewing sticks and for treatment of other common infections. Some specimens of plant species described were identified by a taxonomist, collected, processed and dried for farther investigations. Ethnobotanical information was collected using direct interviews and discussions with local people. The informants (respondents) were purposefully selected to represent both male and female, youth and middle aged. Respondents were asked to make a free listing of species used as chewing sticks and rank them by priority based on their usage amongst local users. Provision sites were also recorded for each listed species. Initially, the respondents listed all the species used as chewing sticks. Then, it was requested from each person interviewed to mention the five main species used from the most important to the less important. We selected the three most important and used species. Fifty respondents were considered for the prioritization and listing exercise considering that many of them (essentially urbans) do not know enough species and could not identify the species name (local or scientific). The assigning of local names to the plants species was used to establish some sort of relationship between people and plants and to show if people are quite familiar with them. Scientific names were frequently referred to as the regions hosts different communities, thus the local names of plants may vary from one community to another, in some cases more than one name could refer to a particular plant. The plants that was found to be having traditional knowledge of utilization among the people of many communities were selected as reference specimens and was checked from other sites visited. These plants were considered as the priority plants.

2.2 Extracts Preparation

The dried, ground samples (leaves and stems) of the three plants species were weighed and about 1100 g was soaked in 1200 mL hexane in a 2500 mL bottle for 2 days at room temperature with frequent shaking. The solvent-containing extracts was then decanted and filtered in a 500 mL beaker through cotton wool to remove course particles and lastly through filter paper (Whatmann No.1) to obtain crude hexane extract. This was followed by serial extraction using dichloromethane (1500 mL), followed by ethyl acetate (1200 mL) and lastly methanol (1200 mL) in the order of increasing polarity of the solvents for three days each with frequent shaking. It was filtered to obtain the crude extracts in each step. The crude extract solutions were then concentrated under a reduced pressure to a minimum volume using a Rotavapor (Büchi Labortechnik AG, Switzerland) at 70℃ to distill off hexane, at 40℃ to distill o ff dichloromethane, at 77℃ to distill off ethyl acetate and at 78.5℃ to distill of methanol from each extract, respectively. The concentrated crude extracts were allowed to dry to constant weight at room temperature.

2.3 Phytochemical Screening

Plant crude extracts were evaluated for phytochemical screening for flavonoids, tannins, saponins, alkaloids, reducing sugars, Anthraquinone and phenolics compounds.

2.4 Test for Alkaloids

About 0.4 gram were warmed with 2% of H2SO4 for two minutes, it was filtered and few drops of Dragendoff's reagent were added. Orange red precipitate indicate the present of Alkaloids [14].

2.5 Test for Tannins

One milliliter of the filtrate was mixed with 3 mL of FeC1, A dark green color indicated a positive test for the tannins.

2.6 Test for Saponins

One milliliter of the plant filtrate were diluted with 4 mL of distilled water; the mixture were vigorously shaken and left to stand for 10 min during which time, the development of foam on the surface of the mixture lasting for more than 10 mm, indicates the presence of saponins.

2.7 Test for Anthraquinones

One milliliter of the plant filtrate were shaken in about 10 mL of benzene; the mixture was then filtered and about 5 ml of 10% (v/v) ammonia were added, then shaken and observations made. A pinkish solution indicates a positive test.

2.8 Test for Phenolic Flavonoids

One milliliter of plant filtrate were mixed with about 3 mL of 10% lead acetate; a brownish precipitate indicated a positive test for the phenolic flavonoids.

2.9 Test for Flavonoids

Approximately I mL of the plant filtrate were mixed with 3 mL of dilute NaOH; a golden yellow color indicated the presence of flavonoids.

2.10 Test for Reducing Sugars

About one milliliter of the plant filtrate was mixed with Fehling A and Fehling B separately; a brown color with Fehling B and a green color with Fehling A indicate the presence of reducing sugars.

3. RESULTS AND DISCUSSION

3.1 Results

Fifteen plants were reported as sources of chewing-sticks in this study (Table 1). Most of the reported plants as chewing sticks were harvested as leaves or stems. Bark and roots of the plants were the least used. The main purpose for using the stems was attributed to its mechanical scrubbing of the teeth while leaves were chewed since they enhanced salivation which is important in sweeping down the bacteria in the mouth. They were also recommended as they did not harm the plant even after harvesting especially the leaves. Common ailments like tuberculosis and fever were also the main reasons why leaves were chewed by many users. The most priority plants used as chewing sticks amongst most communities in this area were *Olea africana, Psidium guajava* and *Diaspyros lycioides*. This plants were found to be common in most homestead and this could be the reason why they were commonly used as chew sticks. They were also known for their mineral rich fruits especially *Psidium guajava* which also explains why many homestead planted them. Beautification of homestead was also suggested as a reason why they were planted in homestead. Many informers noted that, though they were not sure of the chemical component responsible for the healing abilities of these plants, they appreciated their usage as passed onto them by their forefathers.

The phytochemicals screening revealed the presence of alkaloids, saponins, tannins, flavonoids, Anthraquinone, reducing sugars and phenolic flavonoids in both leaves and stems extracts of the three plants species mentioned as priority plants (Tables 2, 3 and 4). The phytochemical tested were highly presence in leaves than stems extracts. Sugars were also tested which confirms why the leaves and stems were commonly chewed by many users. These plants were adored amongst many communities in these area, this is because despite their continuous usage there were no signs of depletion and many were being cultivated and protected. Other households used their concoctions for healing open wounds, stomachache, diarrhea, gum diseases and fever. *Alstonia boonei, Vernonia amygdaline*, *Paullinia pinnata* and *Vitex doniana* were notably used for stomachache, tuberculosis and diarrhea among children. This could be the reasons why they also featured among the top five priority plants used by these communities.

3.2 Discussion

The use of leaves and stems of the mentioned plants could be due to high concentration of phytochemicals in them [15]. Moreover medicinal herbs possess curative properties due to the

presence of various complex chemical substance of different composition, which are found as secondary plant metabolite found in one or more part of the plant [16]. This means that there is continuous and urgent need for discovery of new antimicrobial compounds with diverse chemical structures and novel mechanisms of action because of alarming increase in the incidence of new and re-emerging infectious diseases [15]. Claims supported by scientific studies are that, using chewing sticks affords an extract which contains compounds that have an effect on oral pathogens and other ailments and thus prevent tooth decay and gum diseases [16]. Apart from mechanical effects, chewing sticks from various plant species have been shown to have significant antimicrobial activity against a broad spectrum of microorganisms [7-9,17]. Many of these bioactive compounds extracted from plants have also been incorporated in the preparation of toothpaste [6]. This is mainly because plants contain useful compounds which exhibit antibacterial or anti-inflammatory activity [18]. Furthermore, in a study that compared the effect of chewing stick or toothbrush using on plague removal and dental health, chewing stick resulted in significant reductions in plague [6,18,19]. And another study which compared the levels of 25 oral bacteria in chewing stick and toothbrush users showed that certain bacteria especially several oral streptococci species where lower among the chewing stick users. However, chewing stick was associated with greater gum recession [2]. Other studies on *Olea africana* have shown that quinolone group of alkaloids, cinchonine and cinchonidine were found to be present in the plant ethanol leaves extracts [20]. While studies on stems showed presence of tannins, alkaloids and flavones [19,20]. Many of the known phytochemicals that belong to several chemical classes have also been reported to have inhibitory effect on a wide range of microorganisms [11,21]. They have been used as medicines, flavouring and colouring agents. In the Oleaceae family several phytochemicals have been isolated and identified these includes terpenoids, polyphenols and tannins that have been isolated from *Olea europea*,

Table 1. Medicinal plants used as chewing sticks

SRN.	Scientific name	Part used	Local uses
1.	*Olea africana*	Stems	Chewed for toothache and teeth Cleaning, stomachache, malaria
2.	*Diaspyros lycioides*	Stems, leaves	Chewed for toothache and teeth cleaning
3.	*Allophylus africanus*	Stems, roots	Chewed for teeth cleaning, toothache and diarrhea
4.	*Citrus aurantifolia*	Stems, leaves, roots	Chewed for vomiting, toothache and teeth cleaning
5.	*Citrus sinensis*	Twigs, stems, leaves	Chewed for vomiting, toothache and teeth cleaning
6.	*Glypheae brevis*	Bark, stems	Chewed for diarrhea, fever and teeth cleaning.
7.	*Psidium guajava*	Bark, stems	Chewed for toothache and oral hygiene.
8.	*Zanthoxylum zanthoxyloides*	Roots, bark	Chewed for cough tuberculosis and teeth cleaning
9.	*Alstonia boonei*	Stems	Chewed for cough tuberculosis and teeth cleaning
10.	*Olax subcorpidica*	Stems	Chewed for toothache and oral hygiene
11.	*Vernonia amygdalina*		Chewed for toothache and oral hygiene
12.	*Paullinia pinnata*	Roots	Chewed for diarrhea and teeth cleaning
13.	*Vitex doniana*	Leaves, bark	Chewed for oral hygiene, headache, cough and stomachache
14.	*Sarcorcephalus latiolia*	Stems, leaves	Chewed for diarrhea and teeth cleaning
15.	*Napoleonaea imperialis*	Stems	Chewed for cough and teeth cleaning

Table 2. Phytochemicals present in stems and leaves of *Olea africana*

	Stems extract				Leaves extract			
	Hexane	**DCM**	**EtoAc**	**Methanol**	**Hexane**	**DCM**	**EtoAc**	**Methanol**
Alkaloids	+	+	+	+	+	+	+	+
Anthraquinone	+	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+	+
Phenolic flavonoids	+	+	+	+	+	+	+	+
Flavonoid	+	+	+	+	+	+	+	+
Carotenoids	+	+	+	+	+	+	+	+

Key: + denotes present, EtoAc: Ethyl acetate

Table 3. Phytochemicals present in stems and leaves of *Psidium guajava*

	Stems extract				Leaves extract			
	Hexane	**DCM**	**EtoAc**	**Methanol**	**Hexane**	**DCM**	**EtoAc**	**Methanol**
Alkaloids	+	+	+	+	+	+	+	+
Anthraquinone	+	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+	+
Phenolic flavonoids	+	+	+	+	+	+	+	+
Flavonoid	+	+	+	+	+	+	+	+
Carotenoids	+	+	+	+	+	+	+	+

Key: + denotes present, EtoAc: Ethyl acetate

Table 4. Phytochemicals present in stems and leaves of *Diaspyros lycioides*

	Stems extracts				Leaves extract			
	Hexane	**DCM**	**EtoAc**	**Methanol**	**Hexane**	**DCM**	**EtoAc**	**Methanol**
Alkaloids	+	+	+	+	+	+	+	+
Anthraquinone	+	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+	+
Phenolic flavonoids	+	+	+	+	+	+	+	+
Flavonoid	+	+	+	+	+	+	+	+
Carotenoids	+	+	+	+	+	+	+	+

Key: + denotes present, EtoAc: Ethyl acetate

this is comparable to the results of this study (*Olea africana*). Other families of plants used as chewing sticks have also been screened for this phytochemicals for instance phytochemical screen tests of *Diaspyros lycioides* of Ebanaceae family and *Alstonia boonei* of the family Apocynaceae revealed the presence of anthraquinones, cardenolides, saponins, tannins, polyphenols and terpenoids in the twigs and roots: [22,23], this comparable to our studies which revealed similar compounds in leaves and stems. Thus the leaves and roots of this plant can also be chewed as a remedy for oral infections. Phytochemical screening of *Jasminum sambac* a sub species of Oleaceae family showed that there was presence of alkaloids, flavonoids, terpenoids, carbohydrates, proteins, phenols, tannins, saponins and phytosterols [24]. Chemical test on the ethanol extracts of *Olea europea* leaves and stems also showed presence of steroids, alkaloids, flavanoids and tannins [25] while previous studies of methanol crude extracts of the same plant showed the presence of alkaloids, tannins and flavanoids and absence of Anthraquinone and glucosides [26]. Thus the plants that were suggested as priority among the users indicate that they are rich in phytochemicals which are potential sources of compounds containing antibacterial activities. In fact extracts from different plants and plant parts have shown the ability to inhibit the formation of dental biofilms by reducing the adhesion of microbial pathogens to the tooth surface, which is a primary event in the formation of dental plaque and the progression to tooth decay and periodontal diseases [27]. Thus this plants are essential and plays a vital role in maintaining the oral health of these communities.

4. CONCLUSION

The study revealed that most people use the leaves and stems of the chewing sticks. This could be attributed to the presence of phytochemicals which tested positive in leaves and stems of the regularly used chewing sticks. The results of this investigation clearly indicate that many plants are used as chewing sticks by many communities in Kenya. Thus, the study to ascertains the value of such medicinal plants as a whole should be undertaken, which could be of considerable interest to the development of new drugs, production of new antibiotic and development of locally made chewing sticks which could be commercially available to the Kenyan population and the rest of the world. This also is an indication that Kenya is blessed with abundant natural resources like the Medicinal plant which should be converted to our dally use.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. World Health Organization (WHO). The World Health Report, 2004, Geneva; 2004.
2. Bone K. Phytotherapy for periodontal disease and improved oral hygiene. Townsend letter for Doctors and Patients; 2005.
3. Sonkos N, Gondson M. Photodynamic therapy in control of biofilms. Periodontology. 2011;55:143-166.
4. World Health Organization (WHO). Commission on social determinants of health-final report. Closing the gap in a generation: Health equity through action on the social determinants of health. Geneva (Switzerland): WHO; 2008.
5. Odongo O, Musisi L, Waako P, Obua C. Chewing-stick practices using plants with anti-streptococcal activity in a Ugandan rural community. Frontiers in Pharmacology. 2011;2:3389-3391.
6. Muhammad S, Lawal T. Oral hygiene and the use of plants. Scientific Research and Essays. 2010;5:1788-1795.
7. Adeniyi A, Odumosu T, Aiyelaagbe O, Kolude B. *In-vitro* antimicrobial activities of methanol extracts of *Zanthoxylum xanthoxyloides* and *Pseudocedrela kotschyi*. African Journal of Biomedical Research. 2010;13:61–68.
8. Cai L, Wei G, van der Bijl P, Wu D. Namibian chewing stick, *Diospyros lycioides*, contains antibacterial compounds against oral pathogens. Journal of Agricultural and Food Chemistry. 2000;48:909-914.
9. Wu D, Darront A, Skaug N. Chewing sticks. Timeless natural toothbrushes for oral cleansing. Journal of Periodontal Resource. 2001;36:275-284.
10. Almas K, Skaug N, Ahmad I. *In vitro* antimicrobial comparison of miswak extract with commercially available non-alcohol mouth rinses. International Journal of Dental Hygiene. 2005;3:18–24.
11. Khan M, Qureshi A, Gillani A, Ullah F. Antimicrobial activity of selected medicinal plants of Margalla Hills, Islamabad, Pakistan. Journal of Medicinal Plants Research. 2011;5:4665-4670.
12. Hassawi D, Kharma A. Antimicrobial activity of some medicinal plants against *Candida albicans*. Journal of Biological Sciences. 2006;6:109-114.
13. Almas K. The antimicrobial effects of seven different types of Asian chewing sticks. Odontostomatol Tropical. 2001;24: 17–20.
14. Trease GE, Evans WC. Pharma cognsy. 11th Edn, Brailliar Tiridel Can. Macmillan Publishers; 1989.
15. Parekh J, Chanda SV. Antibacterial activity of aqueous and alcoholic extracts of 34 Indian medicinal plants against some *Staphylococcus* species. Turk J Biol. 2008; 32:63-71.
16. Akande A, Hayashi Y. Potency of extract contents from selected tropical chewing sticks against *Staphylococcus aureus* and *Staphylococcus auricularis*. World Journal

of Microbiology and Biotechnology. 1998; 14:235-238.

17. More G, Tshikalangea E, Lall N, Botha F, Meyer M. Antimicrobial activity of medicinal plants against oral microorganisms. Journal of Ethno-pharmacology. 2008; 119:473-477.
18. David M, Famurewa O, Olawale K. *In vitro* assessment of aqueous and ethanoic extracts of some Nigerian chewing sticks on bacteria associated with dental infections. African Journal of Microbiology Research. 2010;4:1949-1953.
19. Geissmann A, Dauter D, Victor S. Anthocyanins, flavones and related water soluble plants pigments. Modern methods of plants analyses. Paech K, Tracey MV, (Editors). Springer Verley Gottingen. 2005;3.
20. Hansen K, Kompany R, Kamazawa P. Isolation of an angiotensin converting enzyme (ACE) inhibitor from *Olea europaea* and *Olea lancea*. Phytomedicne. 2006;2:319-325.
21. Talukdar D, Choudhury D, Chakraborty M, Dutta K. Phytochemical screening and TLC profiling of plant extracts of *Cyathea gigantea* (Wall. Ex. Hook) Haltt and *Cyathea brunoniana*. Wall ex. Hook. (Cl and Bak.). Assam University Journal of Science and Technology: Biological and Environmental Sciences. 2010;5:70-74.
22. Wallnofer B. The biology and systematics of *Ebenaceae*. Journal of Natural Products. 2001;10:485-512.
23. Sushant, Prasad. Evaluation of antimicrobial activity of *Jasminum* species using solvent extracts against clinical pathogens. World Journal of Pharmacy and Phaermaceutical Science. 2015;4: 1247-1256.
24. Francis O, Frougt H, Osei A. Antimicrobial and phytochemical properties of *Alstonia* and *Boonei* extarcts. Journal of Organic Chemistry. 2015;4:14-15.
25. Rahman M, Khatum A, Akter A, Kawser. Phytopharmacological evaluation of leaves of olive. Journal of Pharmacology. 2015;1: 45-49.
26. Olila D, Cheruyot K, Katenge D. *In-vitro* antibacterial activity of selected medicinal plants from Longisa region in Bomet district, Kenya. Journal of African Health. 2015;9:25-26.
27. Palombo A. Traditional medicinal plant extracts and natural products with activity against oral bacteria: Potential application in the prevention and treatment of oral diseases. Hindawi Publishing Corporation. 2009;2011:254-264.

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