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Combine Antimicrobial Effect of Ginger and Honey on Some Human Pathogens

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Abstract: The aim of this study is to determine the antibacterial effects of different honey samples on clinically isolated bacteria species. Ginger (*Zingiber officinales)* and honey are one of the nature gifts to mankind and have been used to prevent and control disease conditions. The crude extracts of the plant materials were used with pure honey collected from various parts of Kogi State. The Agar diffusion method was used to determine the antimicrobial activity of the plant extracts, honey and combination of both against *Salmonella typhi, Shigella dysenteriae, Escherichia coli and Candida albican.* The growth of all test organisms were inhibited though to varying degrees by the plant extract and honey and with greater effect when combined thus justifying their use in traditional medicines in treating enteric infection and other diseases across Africa.

Keywords: Antimicrobial, enteric infections, ginger, honey, medicinal use, plant extract

INTRODUCTION

Ginger (*Zingiber officinale*) is a native plant in the Southeast Asia but is grown in many tropical regions of the world. The plants are commonly used as spice for flavoring and herbal medicine and the treatment of gastrointestinal infections (Radwan, 1984). The plant is reported to have antibacterial, anti-oxidant, anti-protozoa, anti-fungal, anti-emetic, anti-rhinoviral, anti-inflammatory, anti-insecticidal activity (Ficker *et al*., 2003). Reported pharmacological activities of ginger include antipyretic, analgesic, ant tissues in addition to hypersensitive effects (Thompson *et al*., 2002). It is also used commonly as digestive and circulatory medicine and also helps to lower blood pressure and fever (Carr *et al*., 1987). It is also reported to sooth indigestion relieve motion sickness (Lien *et al*., 2003). Ko (1999) state that it may be beneficial for nausea and vomiting from pregnancy. Its efficacy is believed to come from its aromatic, carminative and absorbent properties (Portoi *et al*., 2003). Honey is a rich food product that is widely consumed throughout the world and an ancient remedy for the treatment of various infections. Antimicrobial activities of honey against a number of Gram positive and Gram negative bacteria have been reported by Hazir and Kestin (2002). The antimicrobial activity of honey has been attributed to its high osmotic effect (pH 3.2-4.5), hydrogen peroxide and its photochemical nature. High osmolarity has been considered a valuable tool in the treatment of infections, because it prevents the growth of bacteria and encourage healing (Archer *et al*., 1990). The use of sugar to enhance wound healing has been reported for several hundred patients (Knutson *et al*., 1981). Efem *et al*. (1992) reported that undiluted honey stop the growth of *Candida sp, Salmonella, Escherichia coli, Aspergillus niger* and *Penicillium chrysogenium.* Honey prevents the growth of isolates and inhibits their growth when honey is added to growing culture. The therapeutic period and recovery growth of isolates necessitate adjustment of honey doses according to type of isolate and grade of growth. A sugar solution resembling honey in its high sugar content was made and the antimicrobial properties when compared with that of honey on 21 types of bacteria and 2 types of fungi, indicates the presence of antimicrobial substance(s) in honey and that the age of honey sample nor whether they have been processed was associated with lower antimicrobial activities of honey but flora sources in the antimicrobial activity was highly significant (Stewart *et al*., 1991). It has been reported that the antimicrobial substances in honey can withstand refrigeration temperatures for six months and are heat stable at 100ºC. Joerg and Sontag (1993) attributed the anti bacterial effect of honey to its phenolic content. Several studies have been done testing the antimicrobial effect of honey and propolis. Methicillin-Resistant *Staphylococcus Aureus (*MRSA), a deadly and antibiotic resistant infection, was cured using honey in seven consecutive patients (Blaser *et al*., 2007).

Since honey is used extensively in Nigeria, it is desirable to determine the antimicrobial activities of the honey in common use. The increasing failure of chemotherapeutics antibiotics resistance exhibited by many pathogenic infectious agents has led to the

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screening of several medicinal plants for their potential antimicrobial activity. Plants with possible antimicrobial activity should be tested against appropriate microorganisms to confirm their activity and ascertain other parameter associated with it.

The study was design to access the antimicrobial potentials of a few commercially sold honeys and ginger plant in Kogi East, Nigeria. The investigation is expected to determine the antibacterial effects of different honey samples on clinically isolated bacteria species.

MATERIALS AND METHODS

Sample collection: Local honey samples were collected from the comb during dry seasons (December-April) from different parts of Kogi East Senatorial District of Nigeria and stored in air tight bottles at temperature in dark. Samples were used within 1 to 2 days of collections in the Department of Science Laboratory, Federal Polytechnic, Idah, Kogi State, Nigeria. The plant used in this study was bought from Egar market in Idah, kogi State, Nigeria, where they are sold in commercial quantities.

Assay of antibacterial activity: Clinically isolated bacteria species of *Escherichia coli, Salmonella typhi, Shigella dysenteriae* and *Candida albican* were obtained from the Microbiology Laboratory, Federal Polytechnic, Idah, Kogi State. The antibacterial activities of the honey samples were carried out using the Agar well diffusion method (Hazir and Keskin, 2002). Bacteria were cultured in liquid Tryptic soyar broth (Difco 30g/l) and the measurements of the bacterial growth were calculated using Mc Farland 0.5 method (Jeddar *et al*., 1985). About 1ml of bacteria isolates samples were diluted 100x with sterile nutrient agar medium (Difco 28g/l), mixed thoroughly and poured into the Petri dishes. Six wells on the growth medium with diameters of 6 mm were made and filled up with honey, extract from Ginger and mixture of honey and extract of Ginger samples in equal proportions before dilutions (30-100%). One of the 6 wells was filled with undiluted honey samples. The plates were incubated at 37ºC for 24-30 h (Hazir and Keskin, 2002). Antibacterial activity was assumed if there is zone of clearance. Control plates were also prepared for the antibacterial activity tests.

RESULTS

The results showed that the ginger extract had activity on all the test organisms at varying degree. The highest ginger activity was recorded on *Candida albican* at concentrations of 50% and above, followed by *E.coli* and *Salmonella typhi* at 60% and above. *S. typhi* was more sensitive to honey at 50% and above while *E.coli* showed least sensitivity (Table 1 and 2).

Table 1: The result of the combined effect of Gin ger on the test organisms

	Zones of inhibition (mm)/%					
Organisms	30%	50%	60%	70%	80%	100%
E.coli	7.5	9.5	9.0	7.5	11	7.0
Salmonella typhi	6.5	7.0	8.0	7.0	9.0	7.0
Shigella dysenteriae	7.0	7.0	7.0	7.0	7.0	10.0
Candida albican	7.0	14.0	10	8.0	10.0	11.0

Table 2: The result of the combined effect of honey on the test organisms

	Zones of inhibition (mm)/%					
Organisms	30%	50%	60%	70%	80%	100%
E.coli	6.0	6.0	7.0	7.5	7.0	11.0
Salmonella typhi	8.0	19.0	13.0	12.0	12.0	14.0
Shigella dysenteriae	7.0	8.0	11.0	7.0	9.0	19.0
Candida albican	12.0	10.0	10.0	8.0	10.0	12.0

Table 3: The result of the combined effect of Ginger and honey on the test organisms

	Zones of inhibition (mm)					
Organisms	30%	50%	60%	70%	80%	100%
E.coli	14.	16.5	9.0	12.0	10.0	7.0
Salmonella typhi	15	15.0	12.0	15.0	10.0	9.0
Shigella dysenteriae	9.0	12.0	6.5	9.0	6.0	14.0
Candida albican	10.0	14.0	14.0	12.5	13.0	11.0

All the test organisms were sensitive to the combine effect of ginger and honey at all concentrations tested (30% and above). The zones of inhibitions increased tremendously to the synergistic effect (Table 3).

DISCUSSION

The study revealed the microbial effect of ginger and honey on the target organisms tested. The highest zone of inhibitions by ginger extracts were obtained with *E. coli* while that of honey was on *S. typhi. S. dysenteriae* showed the least sensitivity to ginger and E.coli showed least sensitivity to honey.

The difference in the zones of inhibitions may be directly related to the susceptibility of *E. coli, S. typhi, C. albican* to the ginger extract and honey. The factors responsible for the high susceptibility of the test organism to ginger are not exactly known but may be attributed the secondary metabolite (inhibins) and phytochemicals (gingerol and shagelol, flavonods) (Stewart *et al*., 1991). The results obtained in this study agrees with that of Ficker *et al*. (2003), Grange and Davey (1990) and Zahra *et al*. (2009).

All the commercial samples of honey showed antibacterial activity on clinical bacterial isolates. The property exhibited may be possibly due to redox

potential of ascorbic acids present in the honey (Rahmanian *et al*., 1970). The results which also showed that honey can stop the growth of bacteria at 50% dilution confirmed the observations of Jeddar *et al*. (1985). However, the results did not agree completely with those of other authors because some honey samples tested were found not to have anti bacteria activity at 40% dilutions. The ability of honey to kill microorganisms has been attributed to its higher content of tetracycline derivatives, peroxidases, fatty acids, phenols, ascorbic acids and amylases (Jeddar *et al*., 1985; Nzeako and Hamdi, 2000).

The anti microbial substances in the ginger and honey samples were not estimated in this study, however, the fact remains that the samples tested all showed a high degree of activity on the tested microbes. It can be concluded that this plants and the honey when combined show much promise in the development of phytomedicines with great antimicrobial properties.

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