Antimicrobial potentials of some spices on beef sold in Gwagwalada market, FCT, Abuja

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Abstract: Studies on the antimicrobial activities of some spices on beef sold in Gwagwalada market, F.C.T, Abuja were carried out. The spices were chopped to sizes and were mixed with the beef sample. The bacterial load count of the beef sample before treatment is 1.9 x 10^7 and after treatment were 1.5 x$10^{3,}$ 1.6x10^3 and 1.0x10^3 cfu/ml for thyme bayleaf, and garlic while the fungal spore count of beef sample before treatment is 1.0x10^2 and x0.5$10^{2,}$ 0.1x 10^2, 0.6x10^2 for the thyme, bayleaf and garlic respectively. The fungal spore count for the beef and sample after treatment with the spices combined is 0.1x10^1cfu/ml. The microbial isolates of beef sample include: *Staphylococcus aureus, Pseudomonas* sp., *Proteus* sp. and *Bacillus* sp. for bacterial isolates and fungal isolates were *Aspergillus niger, Mucor* sp., *Rhizopus* sp. and *Aspergillus flavus* the combined effect of the three spices inhibited the growth of *S. aureus, Bacillus* sp., *Proteus* sp,, *A. flavus* and *Mucor* sp. [Academia Arena, 2010;2(7):15-17] (ISSN 1553-992X).

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INTRODUCTION

Spices are strongly flavoured parts of plants usually rich in essential oils used in fresh or dry forms (Iwu, 1993) .Some spices are reported to have bactericidal or bacteriostatic activities (Onwuliri and Wonang, 2005). The inhibitory effects of spices are mostly due to the volatile oils present in their composition (Arora-Daljit and Kaur, 1997), factors that determine the antimicrobial activity of spices are the concentration and composition of the spices, the amount of spices used, type of microorganisms, composition of the food, P^H value, temperature of the environment and proteins, lipids, salts and phenolic substances present in the food (Sagdic, 2003).

Bayleaf is the dried leaf of *cinnamon jamale.* It is a medium sized tree which grows in many parts of India, more likely in Khasi hills. The leaves are commonly used as a spice for flavouring various kinds of curries, some sweet preparation of vegetables, fruits and in food preservation. Bayleaf is used as medicines (Chandarana *et al.,* 2005).

Thyme (*thyme vulgaries*) belongs to the family laminaceae. The oil of thyme is important and is obtained by distillation of the fresh leaves and flowering tops of *thyme vulgaris*. Its chief constituents are from 20-25% of phenols, thymol and carvacol. They are valuable for medicinal purposes (Juven *et al.,* 1994). Thyme has a partial or complete anti-flatulence, anti-phlegmasia effect in addition to regulating digestion. Thyme is enemy of poison. It is antispasm and pain. It eases blood flow and invokes sexual activities and promotes consciousness and intelligence (Muhammad and Ali, 2006).

Garlic (*Allium sativum*) is a perennial plant of the family of Alliaceae. Garlic is widely used in many forms of cooking for its strong flavour when crushed or finely chopped. It yields allicin - a powerful antibiotic (Prescott *et al.,* 2008), it also contains Allin, Ajoene, enzymes, vitamin B, minerals and flavonoids. Garlic consists of not less than 200 components, these include antioxidants, the volatile oils, (allin, allicin and ajoene) consisting of sulfur, enzymes (allinase, peroxidase and miracynase), carbohydrates (sucrose, glucose), mineral (germanium, selenium, Zinc), amino acids like cysteine, glutamine isoleucine and methionine, bi-flavonoids like quercetin and cyanidin and allistatin I and II,C,E and A vitamins and niacin, B_1,B_2 vitamins and beta carotene (Gulsen and Erol, 2010).

Meat is a highly perishable food items, the high perishability is due to high temperature (Buchanan, 1986). Meat is frequently involved in food- borne illnesses because they provide ideal media for the growth of disease – causing microorganisms (Pearson and Dutson, 1986). Ouattara *et al.,* 1997 stated that essential oils from plant products that contain carvacrol and eugenol have been shown to exhibit the strongest antimicrobial activity (Prescott *et al.,* 2008). This

study therefore aims at isolation and identification of microorganisms associated with meat spoilage and to evaluate the potency and the inhibitory effects of spices as preservative agents.

MATERIALS AND METHODS

Collection of samples

The spices used (garlic, thyme and bayleaf) and beef were purchased from Gwagwalada main market, F.C.T Abuja in sterile containers and conveyed to the laboratory for microbial analysis.

Determination of antimicrobial activity

The spices were not grinded or blended mechanically according to the standard method of the American Spices Trade Association (ASTA, 1997) to avoid contamination of samples. The beef sample was divided into two halves, one half was analyzed for associated microflora and the other half was analyzed combined with the spices. About 0.2g of each spice was mixed with 1.8g of beef in sterile beakers while three spices (0.2g each) were combined with the beef (1.8g) in another beaker sealed and left for 15 minutes. The resultant stock was thereafter pipetted and used for the microbial analyses. All preparations were carried out under aseptic condition. The plates were incubated for 24-48hours for bacterial isolates and 72 hours for fungal isolates. The colonies were counted with the aid of colony counter. MacConkey and Nutrient agar were used for bacterial isolates and Sabrauds Dextrose Agar (SDA) for the fungal isolates. The number of isolates were expressed as colony forming unit per ml. The morphological, microscopical and biochemical characterization of isolates were determined.

RESULTS AND DISCUSSIONS

The bacterial load count (cfu/g) of beef sample before treatment is $1.9x10^7$and after treatment were $1.0x10^3$, $1.5x10^3$,$1.6x10^3$ for garlic, thyme and bayleaf respectively (table 1).

Table 1: The Bacterial load count of beef sample (cfu/g)

	Garlic with beef	Thyme with beef	Bayleaf with beef
Before treatment	$1.9x10^7$	$1.9x10^7$	$1.9x10^7$
After treatment	$1.0x10^3$	$1.6x10^3$	$1.6x10^3$

The fungal spore count of beef sample before treatment was $1.0x10^2$ and after treatment were $0.5x10^2$, $0.1x10^2$ and $0.6x10^2$ for thyme, bayleaf and garlic respectively (table 2). The fungal spore count for the beef sample after treatment with the spices combined was $0.1x10^1$.

The microbial isolates of beef sample include:- *Staphylococcus aureus*, *Pseudomonas* spp, *Proteus* spp, and *Bacillus* spp for bacterial isolates and the fungal isolate were *Aspergllus niger*, *Mucor* spp, *Rhizopus* spp and *Aspergillus flavus*/

Garlic inhibited the growth of *Bacillus* spp, *A. flavus*, *S. aureus*, *proteus* spp and *Rhizopus* spp in the beef sample (table 3). This was not in agreement with the report of Yin and Tsao, 1999 who reported the non availability of antifungal effect of garlic extracts on *A. niger and A.flavus*, but in this study garlic inhibited *A. flavus* but not *A. nigerBacillus* spp, *Proteus* spp and *Rhizopus* spp and thyme inhibited the growth of *S. aureus*, *Bacillus* spp, *Proteus* spp, *Rhizopus* spp, *Mucor* spp and *A. niger*. (table 3)

Table 2: The fungal spore count of beef sample (cfu/g).

	Garlic with beef	Thyme with beef	Bayleaf with beef
Before treatment	$1.0x10^2$	$1.0x10^2$	$1.0x10^2$
After treatment	$0.5x10^2$	$0.1x10^2$	$0.6x10^2$

This result was in agreement with the work of Muhammad and Ali, (2006) who reported the antimicrobial activity of thyme on *S. aureus*, *Salmonella* spp, *Escherichia coli*, *Shigella sp* and *Helicobacter pylori* that has been implicated to course gastric ulcer.

Bayleaf inhibited the growth of *Bacillus* spp, *Pseudomonas* spp, *A. niger*, *A. flavus* and *Rhizopus* spp (table 3).

Table 3: Inhibition of Microorganisms by Spices

Treatment	Organisms inhibited
Beef treated with garlic	*Bacillus* spp, *A.flavus*, *S.aureus*, *Proteus*,*Rhizopus* spp
Beef treated with thyme	*S.aureus*, *Bacillus* spp,*Proteus* spp, *Rhizopus* spp, *Mucor* spp, *A. niger*
Beef treated Bayleaf	*Bacillus* spp, *Pseudomonas* spp, *A.niger*, *A. flavus*, *Rhizopus* spp,
Beef treated with the three spices combined	*S.aureus*, *Bacillus* spp, *Proteus* spp, *A. flavus*, *Mucor* spp

The synergic effect of the three spices inhibited the growth of *S. aureus*, *Bacillus* spp, *Proteus* spp, *A. flavus* and *Mucor* spp.

The combined the effect of the spices was not as effective as would have been expected. This could be as a result of the interactions of the biochemical compounds of these spices.

Beef contamination begins immediately after the slaughter of the animal. This is due to poor hygienic procedure adopted in slaughter and cutting of beef when sold which serves as a medium for transfer of microbes. *Bacillus* spp as isolated in this study are capable of producing enterotoxins in food during their growth and multiplication, thus they cause abdominal cramps, nausea, vomiting and diarrhea. *S. aureus* is a well known pathogen and has

been incriminated in many food poisoning cases (Prescott *et al.*, 2008). Garlic inhibited the growth of *Bacillus* spp, *A flavus*, *Proteus* spp and *Rhizopus* spp and this is in agreement with the work of Onwuliri and Wonang, 2005, An *et al.*, 2009, Ayaz and Alpsy, 2007, although they reported on *A.niger* instead of *A.flavus*. Zaika, 1988 reported the antimicrobial activity of thyme and bayleaf and Onwuliri and Wonang, 2005 on garlic which are in agreement with this study.

From this study it being reported for the first time that *A. flavus* was isolated from meat sample. This calls for caution in the handling of meat for human consumption because *A.flavus* has been incriminated as a producer of mycotoxins which have been reported to be carcinogenic.

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REFERENCES

1. An, M, H. Shen, Y. Cao, J.Zhang, Y. Cai, R. Wang and Y. Jiang (2009). Allicin enhances the oxidative damage effect of amphotericin B against *Candida albicans*. *International Journal of Antimicrobial Agents 33* (3); 258-263. PMID: 190 95412 http://www.ncbi. nlm.nih.gov/sites/entrez.
2. Arora-Daljit, S., Kaur, J (1999). Antimicrobial activity of spices *International Journal of Antimicrobial Agents 12*: 257-262
3. American Spice Trade Association (1997). Analytical Methods of the American spice Trade Association. Modified April 30, 2008.
4. Ayaz, E and H.C Alpsoy (2007). Garlic (*Allium sativum*) and Traditional Medicine.*Acta Parasitology Turcica*,*31* (2): 145-149. PMID: 17594659. http://www.ncbi.nlm nih.gov/pubmed.
5. Buchanan, R.L (1986). Processed meat as a microbial environment. *Food Technol; ogy, 14:172*-176
6. Chandarana, S.A., Cakmakai, S Celik, I (2005). *Food Additives* 2nd edition. Atakurk University, Faculty of Agriculture, Erzurum, Turkey.
7. Gulson, G.and Erol, A. (2010). Antimicrobial effect of Garlic (*Allium sativum)* and Traditional Medicine. *Journal of Animal and veterinary Advances 9(1)*:1-4
8. Iwu M.M. (1993). *Handbook of African Medicinal Plants* Bocca Raton CkC Press 435pp.
9. Juven, B.J., Kanner, J.,Shed, F.and Wzeissslowiez (1994). Factors that interact with the Antibacterial of thyme Essential oil and its active constituents, *Journal of Applied Microbiology 76*:626-631
10. Mohammed,A K.Z and Ali, B (2006). An investigation of thyme effect on Helicobacter pylori. *Middle-East Journal of Scientific Research/(1*): 54-57.
11. Onwuliri,F.C and Wonang,D.L.(2005). Studies on the combined Antimicrobial action of Ginger (*Zingiber officinale* L.) and Garlic (*Allium sativum* L) on some Bacteria. *Nigerian Journal of Botany 18*: 224- 228
12. Ouattara B., Simard, R.E., Holley, R.A., Piette, G.J.P., Begin, A.(1997). Antibacterial activity of selected fatty acids and essential oils against six meat spoilage organisms. *International Journal of Food Microbiology. 37*:155-162.
13. Pearson, A.M. and Dustson, T.R.(1986). *Advance in meat research. Meat Poultry Microbiology*, macmillian England, pp 1-11, 49-59.
14. Prescott, I.M., Harley, J.P, and Klein, D.A (2008). *Microbiology* seventh edition. Mc Graw –Hill international edition.
15. Sagdic, O. (2003). Sensitivity of four pathogenic bacteria to Turkish thyme and wild marjoram hydrosols. *Lebensm Wiss Technology 36*,467-473
16. Yin, M.C and S.M. Tsao, (1999). Inhibitory effects of seven *Alluim* plants upon three *Aspergillus* species. *International Journal of food Microbiology, 49*(1-2): 49-56.
17. Zaika, L.L. (1988). Spices and Herbs-their Antimicrobial Activity and its Determination. *Journal of food safety 19*:27-118.

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