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EFFECT OF EXTRACT OF GARLIC AND GINGER ON BACTERIA ISOLATED FROM OGI

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Abstract

Ogi is a cereal-based traditional lactic acid-fermented weaning food. Ogi deteriorates after long keeping. Therefore, the need to develop methods of extending the shelf life of ogi without altering the flavor as used in this study, using garlic and ginger as the preservatives. This study also revealed that microbial load is lower in ogi with concentration of 100% of garlic and ginger and higher in ogi without garlic and ginger. Also the ogi with 10.0ml of garlic and ginger has acceptability in terms of taste, odour, texture and colour and ogi with 6.0ml of garlic and ginger/sample c was found to have higher level of acceptability than ogi with other concentration of garlic and ginger and Ogi without garlic and ginger. The bacteria isolated from ogi include Staphylococcus sp., Escherichia coli, Bacillus sp., Streptococcus sp. The total heterotrophic plate count ranges from $2.0x10^{-3}$ to $9.6x10^{-1}$.This study shows that garlic and ginger have little effect on the microbial load of Ogi.

Key words: *Garlic, Ginger, Extract, Bacteria, Ogi*

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INTRODUCTION:

Ogi is made from cereals and are more widely utilized as foods in African countries than in the development world. In fact cereals account for as much as 77% of total caloric consumption in the African countries [1].

Allium sativum, commonly known as garlic is a species in the onion family *Alliaceace*. Its close relatives include the onion, shallot, leek, chiverakkyo. Garlic has been used throughout history for both culinary and medicinal purposes. The garlic plant's bulb is the most commonly used part of the plant, with the exception of the single cloves type, the bulb is divided into numerous fleshy sections called cloves [2]. The cloves are used for cloning, consumption (raw or cooked) or for medicinal purposes and have a characteristic pungent, spicy flavor that mellows and sweets also edible and being milder in flavor than the bulbs, they are most often consumed while immature and still tender. Additionally, the immature flower stalks (scapes) of the hard neck and elephant types are sometimes marketed for uses similar to asparagus in stir-fries [3].

Papery, protective layers of "skin" over various parts of the plant are generally discarded during preparation for most culinary uses, though in Korea, immature whole heads are sometimes prepared with the tender skins intact. The root cluster attached to the basal plate of the bulb is the only part not typically considered palatable in any form. The sticky juice within the bulb cloves is used as an adhesive in mending glass and china [7].

Ginger and her cousin Tumeric is proud member of the *Zingiberaceae* family and grow in sub-tropical, volcanic soils in the southern hemisphere. The plant is thought to have originated in tropical Asia and widely cultivated in the Caribbean and Africa. All cultures report similar uses of this plant. It has been used as a favorite "diffusive" circulatory stimulant and healthy agent, calming nausea removing phlegm or catarrh in a wet cough. It has also been used to support a healthy inflammatory response. Ginger is also widely used for motion sickness. Ginger is one of the most widely consumed aromatic spices on the plant. Ginger is a tuber that is consumed whole as a delicacy, medicine, or spice. It is the rhizome of the plant *Zingiber officinale*. It leads its name to its genus and family (*Zingiberaceae*). Other notable members of this plant family are turmeric, cardamom, and galangal. Ginger cultivation began in south Asia and has since spread to East Africa and the Carribean. It is sometimes called root ginger to distinguish it from other things that share the name ginger[1].

Microbiological and nutritional studies by Odunfa and Teniola, (2001)[3] showed that the lactic acid bacterium "*Lactobacillus plantarium*" the aerobic bacteria "*Corynebacterium*" and *Aerobacter*", the yeast *Candida mycoderma, Saccharomyces cerevisiae* and *Rhodotorula* and molds *Cephalosporium, Fusarium, Aspergillus,* and *Penicillium* are the major organism responsible for the fermentation and nutritional improvement of ogi. [3], determine that *Bactobacillus plantarium* was the predominant organism in the fermentation responsible for lactic acid production. *Corynebacterium* hydrolyzed corn starch to organic acids while *Saccharomyces cereviseae* and *Candida mycoderma* contributed to flavor development.

This present study focuses on the isolation of bacteria present in ogi and the determination of the effect of extracts of ginger and garlic to extend the shelf life of ogi.

METHODOLOGY

Collection of Samples

Samples of Ogi were obtained from Udu market in Warri and were taken to the microbiology laboratory in a sterile container for microbial analysis.

Fresh ginger and garlic cloves were also bought from Udu market in Warri, Delta State.

Microbiological Analysis of Samples

Isolation of Organisms

Serial Dilution

500g of Ogi was mixed with 200ml of distilled water. Four test tubes containing 9.0ml of sterile distilled water to obtain 10^{-1} dilution of the ogi sample making 10^{-2}, 10^{-3}, 10^{-4}. The tubes were then covered with aluminum foil.

1.0ml of the supernatant solution of the Ogi samples was added to 9.0ml of sterile distilled water in a test tube to obtain 10^{-1} dilution of the samples, 1.0ml of 10^{-1}dilution was added to another 9.0ml of sterile water to get 10mls of 10^{-2} dilution of the same sample.

These processes were reported to get 10^{-2} and 10^{-4}. All the four samples were serially diluted for inoculation of total viable microbial count and isolation of different types of micro-organism present in them.

Total Viable Count

This was done by pouring a little of the prepared nutrient agar at about 45^{o}C into a petri-dish and swirled gently and allowed to set. Then using a sterile wire loop inserted into the Ogi sample dilution.

Several number of streaking was made on the plate containing the agar and after which it was incubated for 24hours at 37°C.
The plate was examined after incubation and the number of colonies present in the plate was counted and recorded.

Isolation of Types of Microorganism Present in Ogi Samples
1.0ml from 10^{-2} and 10^{-3} dilution of each sample were aseptically transferred into different sterile Petri dishes. About 10.0ml of appropriate media were poured into the plates. Good spread inoculum was achieved by combination of swirling and radical motion of the plates on the bench. The plates were allowed to set and incubated at 37°C for 24hours.

Culture Preparation
Distinct colonies of organism were picked with sterile wire loop from the mixed culture and sub-culture by streaking onto a fresh solidified media. This was due to obtain a pure culture. Pure cultures of organisms obtained on the plates were then inoculated on the appropriate agar slants for biochemical test.

Sensory Evaluation
Quality attributes such as taste, colour, texture, and odour were evaluated for level of acceptability of fresh prepared samples into gruel using a five point hedonic scale (1-5) a ten member panel was used to assess the various quality attributes for overall acceptability.

Zone of Inhibition with Garlic and Ginger
The pure culture of the organisms was grown on the appropriate agar slant. About 10ml of the appropriate media were poured into the plates; good spread of inoculum was achieved by combination of swirling to radical motion of the plates on the bench. The plates were allowed to set the microorganisms were then streaked on the plates containing the medium of nutrient agar.
The garlic and ginger was diluted as follows
1ml of ginger - - - -- -100% concentration (1st test tube)
1ml of ginger + 1ml of sterile distilled water - 50% conc. (2ndtest tube)
1ml of ginger + 2ml of sterile distilled water - 33.3% conc. (3rd test tube)
1ml of ginger + 3ml of sterile distilled water - 25% conc. (4thtest tube)

Dilution for Garlic
1ml of garlic - - - - - -- 100% conc. (1sttest tube)
1ml of garlic + 1ml of sterile distilled water -- 50% conc. (2ndtest tube)
1ml of garlic + 2ml of sterile distilled water - 33.3% conc. (3rd test tube)
1ml of garlic + 3ml of sterile distilled water -- 25% conc. (4thtest tube)

1ml of garlic and ginger from different concentration was pipette and introduced into the plates. The medium was then incubated for 24hours at 37°C. Zones of growth inhibition indicate sensitivity of the organism to the extracts of garlic and ginger while those without zone indicates resistances.

RESULTS:
Table 1 Shows the morphological and biochemical characteristics of bacteria isolated from Ogi
Table 2 Shows the total bacterial count (cfu/g) of Ogi it was recorded that the bacterial count in sample A has the highest microbial range of (9.6) $96x10^{-1}$(cfu/g).
Table 3 Shows the bacteria isolated from Ogi. It found that *Staphylococcus aureus, Lactobacillus sp., Streptococcus sp, Escherichia coli,* were common during isolation of Ogi without garlic and ginger.
Table 4 Shows those bacteria isolated from Ogi with garlic and ginger. It was found that *Bacillus sp, Staphylococcus aureus, Streptococcus sp*, were common isolate during isolation of Ogi with garlic and ginger.
Table 5 Shows the result for sensory evaluation carried out on the acceptability and preference of the "Ogi" in terms of taste, colour, texture and odour. Sample C (Ogi 6.0ml of garlic and ginger) was found to have the highest rating followed by sample A: (Ogi with 2.0ml of garlic and ginger), while Sample D: (Ogi without garlic and ginger) has the least value of acceptability, based on the studies carried out.
Table 6 Shows the result of zone of inhibition of ginger extract at different concentration on nutrient Agar.
Table 7 Shows the result of zone of inhibition of ginger extract at different concentration on nutrient agar.
Table 8 Shows the result for comparison of zones of inhibition of nutrient agar at 100% concentration.

Table 1: Cultural, Morphological and Biochemical Characteristics of the Bacteria Isolates from Ogi

Cultural	Morphological		Biochemical			Suspected organism
Growth features	**Gram stain**	**Motility**	**Citrate**	**Coagulase**	**Oxidase**	
Yellow, entire elevated, small, smooth, colonies	+ coccl in pairs and in clusters	Non-motile	-	+	-	*Staphylococcus aureus*
White, entire, elevated, small, translucent, colonies	+ coccl in pairs	Non-motile	-	-	-	*Staphylococcus epidimidis*
Small, ovoid, cream, raised, dull colonies	+ coccl in pairs	Non-motile	-	-	-	*Staphylococcus feacalis*
Small, ovoid, white, raised, glistering colonies	+ coccl in pairs	Non-motile	-	-	-	*Staphylococcus lactis*
Circular, opaque, convex, cream, rough, colonies	- rod in chain	Non-motile	-	-	-	*Escherichia coli*
Irregular, dull, flat, cream, rough colonies	+ rod in clusters	Motile	-	-	+	*Bacillus Spp.*

Table 2: Total Viable Bacterial Count of Ogi

Ogi samples	Bacterial counts (cfu/g)
A	**$9.6x10^{-1}$**
B	**$5.9x10^{-1}$**
C	**$3.8x10^{-2}$**
D	**$2.0x10^{-3}$**

Table 3: Bacteria Isolated from Ogi

Ogi samples	Bacterial counts (cfu/g)
A	*Streptococcus sp, Staphylococcus aureus, Bacillus sp. Escherichia coli*
B	*Escherichia coli, Staphylococcus aureus, Streptococcus sp*
C	*Staphylococcus aureus, Escherichia coli Bacillus sp.*
D	*Staphylococcus aureus, and Escherichia coli.*

Table 4: Bacteria Present in Ogi with Garlic and Ginger

Samples	Isolated bacteria
A	*Streptococcus sp, Staphylococcus aureus, Bacillus sp., Escherichia coli.*
B	*Escherichia coli, Staphylococcus aureus, Streptococcus sp.*
C	*Staphylococcus aureus, Escherichia coli and Bacillus sp.*
D	*Staphylococcus aureus, and Escherichia coli.*

Table 5: Sensory Evaluation of Ogi Samples

Evaluation parameters	Sample A	Sample B	Sample C	Sample D
Taste	37	37	37	39
Texture	42	40	41	39
Colour	43	42	43	35
Odour	38	37	40	36
Total	160	156	161	149

Key:
Sample A: Ogi with 2.0ml of Garlic and Ginger.
Sample B: Ogi with 4.0ml of Garlic and Ginger.
Sample C: Ogi with 6.0ml of Garlic and Ginger.
Sample D: Ogi without Garlic and Ginger.

Table 6: The Zone of Inhibition (Millimeter) of Garlic Extract at Different Concentration on Nutrient Agar.

	Nutrient agar			
Isolates	100%	50%	33.3%	25%
Bacillus	15	12	7.6	2.5
Staphylococcus aureus	13	10	6.5	3.0
Streptocuccus spp	11	10	7.9	1.5
Escherichia coli	10	7	6.5	1.0

TABLE 7: The Zone of Inhibition (Millimeter) of Ginger Extract at Different Concentration on Nutrient Agar.

	Nutrient agar			
Isolates	100%	50%	33.3%	25%
Bacillus	12	8	5.5	2.0
Staphylococcus aureus	14	10	6.6	1.8
Streptocuccus spp	10	7.9	6.9	1.5
Escherichia coli	8	6.5	6.0	1.2

Table 8: Comparism of the Zones of Inhibition of Garlic and Ginger on Nutrient Agar at 100% Concentration

	Nutrient Agar	
Isolates	Garlic	Ginger
Bacillus cereus	15	12
Staphylococcus aureus	13	14
Streptocuccus spp	11	10
Escherichia coli	10	8

Microbial Load of Ogi
Microbial load of all the samples reduces with the addition of garlic and ginger.
The microbial load was lower in 100% garlic and ginger, AS the concentration of garlic and ginger was reducing the microbial load was increasing.

DISCUSSION:

Result obtained in this study demonstrate the cultural, morphological and biochemical characteristics of the bacteria isolated from OGI, identified by their color, shape, size, motility and other test as shown in (Table I). Through the gram staining, motility and coagulase test bacteria such as *Staphylococcus aureus, Staphylococcus epididimis, Streptococcus feacalis, Bacillus spp* present in Ogi.

Result displayed in table 2 and 3 indicate the total viable bacterial count of ogi and bacteria isolated in Ogi in each serial dilution. This was obtained by a careful examination if the Petri dishes which were inoculated for 24hours.

The total count was recorded and it was noted that, the count sample A (10^{-1}) was the highest and as the dilution concentrated decreases the total bacterial count decreases (Table2). The bacterial isolated were *Staphylococcus sp, Bacillus sp, Escherichia coli and Streptococcus sp*. from sample A to D (Table 2).

Table 4 result shows that the microbial load obtained in culturing "ogi" with garlic and ginger is minimal compared to "ogi" without garlic and ginger. The study shows that garlic and ginger has little effect on the microbial load of ogi i.e. the same bacteria such as *Streptococcus sp, Staphylococcus sp, Bacillus sp and Escherichia coli* were able to grow in ogi with garlic and ginger and in ogi without garlic and ginger at room temperature and this is contradictory to the report on the use of combination of preservative for the stabilization of traditional and novel foods [5] and antimicrobial effect of garlic and ginger (Table 4)

Result displayed in table 5, show the high degree of acceptability recorded in various attributes of color, taste, texture, and odour in garlic and ginger treated sample (sample c) maybe is associated with the use of garlic as flavor enhancer. But the odour was too pungent which makes it to be of low value of acceptability and this support the finding of antimicrobial effectiveness of species and herbs.

The effect of garlic and ginger is higher at concentration of 100%, herb the different dilution of garlic and ginger had different dilution of garlic and ginger had different effect on the size if zone of inhabitation (Table 6 and 7).

The study shows that the garlic and ginger has less effect on ogi in that there was increase in microbial load of bacterial despite the addition of garlic and ginger. The findings support reports on antimicrobial effectiveness of Spices [6].

CONCLUSION:

In conclusion, the result of this study revealed that undesirable bacteria such as *Bacillus sp., Streptococcus sp., Staphylococcus sp.* and *Escherichia coli* were present in "OGI" which could not be totally inhibited by the presence of garlic and ginger but reduced them and application of high amount could prevent spoilage and inhibit other bacteria. However, it was obvious that garlic and ginger alone could not prolong the shelf life of OGI and that garlic and ginger can be used to enhance the flavor of Ogi.

RECOMMENDATIONS

1. Ginger and Garlic should be cultivated in high quantity to improve the shelf life of ogi.
2. Ginger and Garlic should also be used widely on Ogi because it enhances the flavor.

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