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Identification and Isolation of the Bacterial Content in Stored Pap (Ogi/Akamu) in Masaka Market Nasarawa State of Nigeria

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Abstract **Original Research Article**

The sole aim of this study was to determine, identify and isolate the bacterial content in stored Pap (Ogi/Akamu).This study was conducted in Masaka a conurbation of towns under Karu Local Government Area of Nasarawa State. Sterilization of glass wares with a disinfectant before and after use. Sample collection, media preparation, inoculation, incubation, isolation of pure culture were all aseptically carried out: For further identification, each typical colony was further sub cultured on MacConkey agar, peptone water agar, triple sugar iron agar, relevant biochemicals and Gram staining done for final confirmation . Analysis of the stored pap (*ogi)* from the four sellers at Masaka market as cultured on the nutrient agar and MacConkey agar showed the different bacteria and their percentages of occurrence as follows; *Escherichia coli* (12%), *Staphylococcus aureus* (34%), *Pseudomonas spp*(12%), *Klebsiella spp*(8%), *Shigella*(6%), *Providensia nisera*(8%), *Staphylococcus capitis*(14%) and *Salmonella spp*(6%). These distributions were not significant at 95% confidence limits. (P>0.05). In conclusion the present study showed that the quality of pap sold at Masaka community was poor. This was proven by the high bacteria count. It is suggested that means of collection and preparation of pap and the effect of unsterile containers for storage to be critically examined and improved upon.

Keywords: Microbial Load, Storage, Stored Pap, Ogi.

BACKGROUND OF THE STUDY

Ogi (*Akamu*) is a product of fermented maize (*Zea mays*) widely eaten in Africa [1, 2]. Similar maize preparations in Ghana are referred to as "*Akana*" or "*Kenkey*". *Ogi* is often marketed as a semi solid, raw, unprocessed and fermented mass of corn, millet or guinea corn, formerly wrapped in leaves but presently in transparent polythene bags. Gelatinized *Ogi* (a porridge) called "Pap" is mainly used as a breakfast meal for adults and weaning food by low income earners who cannot afford the more expensive imported weaning foods [3, 2].

In most parts of Africa especially in Nigeria, children are fed with mashed adult foods. These foods are bulky and this therefore reduces food intake by a child, often resulting in malnutrition. The development of nutritionally balanced calorie dense, low bulk and easily digestible weaning food becomes mandatory. This involves the use of simple but time consuming traditional technology called fermentation [4]. The traditional fermentation method employed in *Ogi* production is a wild process and microorganisms are not controlled. Microbiological analyses have shown the presence of several genera of bacteria, moulds and yeasts in the fermented maize product – Ogi [5, 6].

Ogi is fairly acidic (pH 4.8), which tends to inhibit the growth of some bacteria. Its spoilage however, is enhanced by some extrinsic factors amongst which are storage temperature. Extension of the shelf life of *Ogi* is carried out using various techniques, which include refrigeration, freezing and drying (dehydration) to reduce the microbial load and consequently spoilage [2].

HYPOTHESIS OF THE STUDY

[Ho]: Microbial load and type in stored pap (*Ogi*) has no significant consumption health hazard on human population.

[Ha]: Microbial load and type in stored pap (*Ogi*) has significant consumption health hazard on Masaka human population.

STUDY BACKGROUND

History of Pap

In the sub-Saharan Africa, most of the breakfast meals for both adults and young kids are prepared using cereals, legumes roots, cassava and potatoes. Pap is one of the popular porridges that are widely used in the West Africa nations. It is one of the cheap and popular weaning foods in most of the countries in West Africa. There are a variety of methods that is used to prepare *Ogi. Ogi* is primarily prepared from maize, sorghum or millet. Cereals form a big proportion of the food taken. Cereals have approximately 12-14% water, 65-75% carbohydrates, 2% lipids and a protein content of about 7-12%. Cereals in their natural forms have several other nutrients such as vitamins and minerals but these are not biologically available. Their constant use may cause anemia, malnutrition and other dietary diseases. Gelatinized *Ogi* is commonly referred to as pap and in mostly used as the weaning food for infants and also as adult breakfast meal. There are different traditional names given to these semi solid foods such as *Eko, Agidi, Akamu* among others. Semi solid food made from sorghum, corn, guinea corn is usually referred to as *Ogi*-baba. The viscosity of the final semi solid food produced depends upon the water volume that was used during the preparations process. *Ogi* is one of the staple foods for infants in African countries such as Nigeria [7]. In Nigeria and other parts of Africa 90% of the infants are introduced to complementary foods to supplement the mother milk after the age of 6 months [8]. In addition to infant weaning, *Ogi* is also consumed by adults and also used by an infant mother to stimulate the production of milk. The use of semi-solid food such as *Ogi* for nursing the sick has been encouraged by the doctors as it is light in the stomach and easily digested. Children are mostly feed with mashed adult food which is bulky and absorbs a lot of water. These foods are also bulky and they inhibit a child's ability to feed on more nutritive food contents. There is therefore the need to develop nutritionally balanced diet that has enough calories, is less bulky and can be digested by the infants. During the stage where the infant is feed with complimentary foods, the kid is vulnerable to malnutrition and he must be provided with semi solid foods that provide the requisite nutrients for the fast growing infant. Complimentary food must be prepared so that they are drinkable, are less bulky and free from bacterial contamination [9]. The food must also be of the right quantity to satisfy the infant at one feeding. *Ogi* is mostly prepared using traditional fermenting and malting technologies which are simple but do not guarantee quality and lack of contaminations as well as lack the appropriate nutritive value [10]. It is one of the first complimentary foods that are used during the weaning process. The main reasons for fermenting these grains are to convert starch contents in the cereals such that it does not require dilution. The fermenting process also removes the pathogens. According to [11], *Ogi* provides about 20-26 Kcal/ kg per day to an infant who has an average density of 0.26 Kcal/ kg.

WHAT IS CEREAL

Cereal is a kind of grain used for making human and animal food. All are forms of edible grasses grown around the world in a variety of climates and soils. The term cereal comes from the Roman Goddess Ceres, who was the god of harvest and agriculture and aligned with the yearly harvest. These grains are processed into a wide variety of products including breads, cakes, desserts, and other meals. All cereals are wholegrain and are divided into large-seed cereals, grown in fields or in water paddies, and small-grain millets. Whole grains include maize/corn, wheat, barley, and oats. These grains are divided into three parts. The first part is the bran, which is an outer layer that contains fiber and vitamins. The second layer is the starch-filled center, the endosperm, and the final layer is the small germ, which is filled with vitamin E, phosphorus, and magnesium. Cereal grains are grown in greater quantities and provide more food energy worldwide than any other type of crop; they are therefore staple crops. Some plants often referred to as cereals, like buckwheat and quinoa, are considered instead pseudo cereals, since they are not grasses.

In their natural form (as in *whole grain*), they are a rich source of vitamins, minerals, carbohydrates, fats, oils, and protein. When refined by the removal of the bran and germ, the remaining endosperm is mostly carbohydrate. In some developing nations, grain in the form of rice, wheat, millet, or maize constitutes a majority of daily sustenance. In developed nations, cereal consumption is moderate and varied but still substantial [11].

Farming of cereal

While each individual species has its own peculiarities, the cultivation of all cereal crops is similar. Most are annual plants; consequently one planting yields one harvest. Wheat, rye, triticale, oats, barley, and spelt are the "cool-season" cereals [12]. These are hardy plants that grow well in moderate weather and cease to grow in hot weather (approximately 30 °C, but this varies by species and variety). The "warm-season" cereals are tender and prefer hot weather. Barley and rye are the hardiest cereals, able to overwinter in the subarctic and Siberia. Many cool-season cereals are grown in the tropics. However, some are only grown in cooler highlands, where it may be possible to grow multiple crops in a year.

For a few decades, there has also been increasing interest in perennial grain plants. This interest developed due to advantages in erosion control, reduced need of fertilizer, and potential lowered costs to the farmer. Though research is still in early stages, The Land Institute in Salina, Kansas has been able to create a few cultivars that produce a fairly good crop yield [13].

Planting of Cereal

The warm-season cereals are grown in tropical lowlands year-round and in temperate climates during the frost-free season. Rice is commonly grown in flooded fields, though some strains are grown on dry land. Other warm climate cereals, such as sorghum, are adapted to arid conditions.

Cool-season cereals are well-adapted to temperate climates. Most varieties of a particular species are either winter or spring types. Winter varieties are sown in the autumn, germinate and grow vegetative, then become dormant during winter. They resume growing in the springtime and mature in late spring or early summer. This cultivation system makes optimal use of water and frees the land for another crop early in the growing season.

Winter varieties do not flower until springtime because they require vernalization: exposure to low temperatures for a genetically determined length of time. Where winters are too warm for vernalization or exceed the hardiness of the crop (which varies by species and variety), farmers grow spring varieties. Spring cereals are planted in early springtime and mature later that same summer, without vernalization. Spring cereals typically require more irrigation and yield less than winter cereals [13].

Period of cereal Growth

Once the cereal plants have grown their seeds, they have completed their life cycle. The plants die and become brown and dry. As soon as the parent plants and their seed kernels are reasonably dry, harvest can begin.

In developed countries, cereal crops are universally machine-harvested, typically using a combine harvester, which cuts, threshes, and winnows the grain during a single pass across the field. In developing countries, a variety of harvesting methods are in use, depending on the cost of labor, from combines to hand tools such as the scythe or cradle [13].

If a crop is harvested during wet weather, the grain may not dry adequately in the field to prevent spoilage during its storage. In this case, the grain is sent to a dehydrating facility, where artificial heat dries it.

In North America, farmers commonly deliver their newly harvested grain to a grain elevator, a large storage facility that consolidates the crops of many farmers. The farmer may sell the grain at the time of delivery or maintain ownership of a share of grain in the pool for later sale. Storage facilities should be protected from small grain pests, rodents and birds [13].

1.9.4 Nutritional Facts of Cereal

Some grains are deficient in the essential amino acid lysine. That is why many vegetarian cultures, in order to get a balanced diet, combine their diet of grains with legumes. Many legumes, on the other hand, are deficient in the essential amino acid methionine, which grains contain. Thus, a combination of legumes with grains forms a well-balanced diet for vegetarians. Common examples of such combinations are dal (lentils) with rice by South Indians and Bengalis, dal with wheat in Pakistan and North India, and beans with corn tortillas, tofu with rice, and peanut butter with wheat bread (as sandwiches) in several other cultures, including Americans. The amount of crude protein found in grain is measured as the grain crude protein concentration [14].

Preparation Effects on the Physical, Chemical and Microbial Nature of *Ogi*

The methods of preparations vary from community to community. Various researchers have also come up with different methods of preparing *Ogi*. One of the methods entails soaking the cereals in water for a period of 3- 5 days. This water is changed every day until froth forms on top and an alcoholic smell is produced. These methods have been shown to produce Brevi bacterial spp. There is also another method which involves the use of hot water and soaking the grains for a period of 24 hours. The other method entails cooking for 10 minutes and then steeping at ambient temperature. Researcher have found out that the actual processing of grains to produce *Ogi* results to the loss of about 40% of the total proteins but the digestibility of the proteins is increased by 20% and while about 50% of the macro and micro nutrients are lost [15].

The production process results to serious alterations in the physical, biological and chemical process of the resulting pap. The final viscosity of the *Ogi* is greatly affected by the temperature and the egression of polysaccharides. Prolonged steeping always results to carbohydrates loss and spoilage. The processing conditions may also introduce a vast number of bacterial. The use of hot water increases the softening rate and also the effects of Aflatoxins but this *Ogi* will not raise while be cooked.

Sorghum has high nutritional value and fermentation process alters this value. However, there are some benefits of the fermenting process. The fermentation process results to the breaking down of complex substance to digestible nutrients [16]. Various researchers have found out that there are many microbiological and nutritional changes during the fermentations process. The researcher shows this process results to production of lactic acid bacterium

lactobacillus plantarum, aerobic bacteria *Corynebacterium* and *Aerobacter*. There is also the production of yeasts such as: *Candida mycoderma*, *Rhodotorula* and *Sacchyaro-myces cervisiae*. During the rocess, Molds such as *Penicillium*, *Aspergillus*, *Fusarium* and *Cephalo- sporuim* are also present in the fermentation process. *Lactobacillus plantarum* is the most predominant microorganism and is responsible for the fermentation process and lactic acid production. Other microorganisms such as *Corynebacterium* and *Candida mycoderma* affect the flavor of the *Ogi* [17].

Microbial fermentation has some profound advantages and hence its preference in the production of *Ogi*. It is used in food preservation, reduction in volume of food materials, taste and appearance improvements, reductions in cooking and food preparations period, production of safe foods and increase in some nutrients [18].

Microbial Properties of Ogi

The microbial content of *Ogi* has also been found to be affected by the preparations methods and the ingredients used. The preparation of *Ogi* requires the use of substance such as water and other ingredients which may be contaminated. Poor sanitary conditions have been found to affect the food and water where *Ogi* production is prevalent. The main organism that has been isolated from *Ogi* preparations substance and equipment are *Aspergillus flavus*, *Fusarium oxysporium*, *Candida Albicans*, *Saccharomyces Cerevisiae*, *and Escherichia Coli*. *Lactobacillus plantarum*. *Pseudomonas Aeruginosa*. And *Staphylococcus aureus*. Researchers have found out that the non-enteric bacteria were found in all the study samples that were screened while the enteric bacterial developed at the later stages of the fermentations process. The researcher also showed that poor handling of the fermented *Ogi* also re-contaminated with the enteric bacteria. It has been found out the main contamination sites were water, medium for soaking, the grinding mill and the contamination that results during storage and transportation. Studies done by (Shephard, *et al.*, 2002) established that there are toxins associated with cancer such as mycotoxins. High levels of Fumonism have been reported due to use of supernatant from *Ogi* as the solvent for removing active ingredients from the traditional herbal plants. There is also the development of Aflatoxins during the storage process and this can cause problems to the young kids. Poor hygiene during the preparation of *Ogi* also results to contamination and infections by diseases such as cholera. During the storage of *Ogi*, fungi contaminations often occurs and moulds grow and produce Mycotoxins and certain yeast produce infections and allergies [19]. Studies carried out to show the interrelationship between micro-organism found in *Ogi* and the nutrition reveal that some of the micro-organism used in fermentations result in addition of the nutritive value of *Ogi*. Studies show that there is an increase in the lysine content during fermentation [20]

Physical properties of *Ogi*

The textural quality of *Ogi* depends upon the cereal type, milling technique, fermentations process, the size of the grains, and the steeping method used. The particle size in *Ogi* is of paramount importance as it influences: mixing, the starch consistency, heating rate, mass transfer and rheology. The acceptable particle size is <125 µm is ideal. Other tests carried out document the textural qualities of sorghum porridges and *Ogi* as well as the rheological properties. Studies have also shown that the swelling of *Ogi* is greatly influence by the fermentation property. During the processing of sorghum to *Ogi*, there is a considerable reduction in the viscosity of the fermentation samples. The stability and gelling tendency of *Ogi* are greatly affected by the fermentation process. Increase in the fermenting period to over four days result to poor stability, gelling tendency among other problems [21].

The process of *Ogi* fortification influences the rheological properties of *Ogi*. The addition, some materials may increase the viscosity or decrease it. Okra seeds added to the *Ogi* show a minimization of starch stability values while *Ogi* blended with roasted okra seed resulted in high viscosities. Fortified *Ogi* has a low sensory texture as compared to the unfortified one. The texture and viscosities have an imperative role as this determines its acceptance among the local community. For example, the textural value of *Agindi* which is made from *Ogi* greatly influences its acceptance among the local communities. The textural values are usually described as firm, consistent and smooth gritty appearance. The fermentation processes play an important role in the textural properties of *Ogi*[21].

Nutritional and chemical properties of *Ogi*

During the processing of sorghum to make *Ogi*, there is a great loss in the nutritive value. There are some vitamins such as pathogenic acids, folic acid, riboflavin, niacin and thiamine. Other lost elements are fiber, proteins, calcium, iron and phosphorous. Processing steps such as steeping, milling and sieving result to great reduction in nutrient content [22]. Most of the nutrients found in the test and germ of the seed are lost during processing as these are removed. Processing of *Ogi* using sorghum reduces the protein utilizations and other biological values. One of the common practices during the making of *Ogi* is the discarding of steeping water during processing. This reduces the minerals and other nutrients found in *Ogi*. It is recommended less water should be used during serving so as to minimize loses. The processing techniques have a great impact on the components of *Ogi*. Traditional processing has been shown to lose more nutrients as opposed to the modern experimental milling methods. During the dehydration of the *Ogi* using a drum or tray drying, most of the heat sensitive nutrients such as lysine are lost. The key drawback in the use of *Ogi* for infant and adult staple food is the low nutritive value [23]. There are a lot of attempts to fortify *Ogi* with nutritive additives such as

proteins [24] this has resulted in the blending of *Ogi* with soya and maize so as to improve the lysine content. *Ogi* has also been prepared to incorporate therapeutic properties so as to control diarrhea among the infants. According to Sanni *et al*. (2001) [25], most of the traditional infant meals need fortifications and blending with other food so as to improve their nutritive values. The process of fortifications may also be done to improve tastes. Some of the added components are fried beans, sugar, milk, fruits and berry seeds to make it sour and on a laboratory scale, vanilla can be added. This ingredient sweetens the porridge as well as increase the nutritive value of this porridge. Most of the researchers link the high rate of kwashiorkor occurrence in young infants to the consumption of *Ogi* [26]. This researcher proposes the addition of fortification ingredients such as melon, cowpea, soy bean and other animal sources [27]. A comparative research has also shown that *Ogi* made from maize's more nutritious as compared to that made from sorghum.

Production of Pap

Pap is a Nigerian corn or sorghum meal made from wet corn starch or wet sorghum starch. It has a distinctive taste that makes people crave for it.

It is processed by using dry corn or sorghum. After processing it, we get the raw pap which is then prepared with hot water before serving as meal.

Tools Chiffon cloth**,** Blender**,** Muslin bag; A tight woven cotton, calico or canvass material whose weaves do not shift is great for this. Big and small bowls.**,** Dry corn

Directions for Processing Pap

1. Wash the dry corn thoroughly and soak in a generous quantity of cold water for 3 to 4 days. Do not refrigerate it because it is important that some kind of fermentation takes place.
2. Wash the corn and change water daily.
3. On the third day or 4th day wash and blend till smooth. Bite into it to check, if not soak for one more day. Add a generous quantity to help your blender.
4. Drape the chiffon cloth over a big bowl and tie it up. The bowl should be big enough to accommodate the pap and the water you'll use to rinse it.
5. Sieve the blend rinsing as necessary till you are left with only the chaff. It is advisable to rinse small quantities of the corn blend at a time so that you will not be overwhelmed.
6. When you have rinsed all the corn blend, blend the chaff and rinse again if you think you can get more *Akamu* from it. This may be the case if you used a kitchen blender. This won't be necessary if you used the heavy duty grinders in Nigerian markets.
7. When done, take off the chiffon cloth and set the mixture of water and *akamu* aside to settle for at least 3 hours.
8. After about 3 hours or when you notice that the water is clear, decant the clear water and pour the rest of the mixture into the muslin bag.
9. Tie the bag and keep it in such a way as to let the water drain from the *ogi*.
10. When you notice that the water has drained off, tie the bag tighter and leave to continue draining the water. Repeat the process as the water drains till no more water drains off.
11. Tie the bag for the last time and place some weights on it to squeeze out the last trace of water.
12. Leave it like this overnight so that the *Akamu* will have the classic sour taste. Again, do not refrigerate it.
13. The next day, bring out the *Akamu* from the bag, cut it up into single-use chunks, place in containers (bowls or plastic bags) and put in your freezer till you are ready to use it [27].

How to prepare pap

1. Put some lumps of *akamu/ogi*/pap into a sizeable bowl. *Akamu* rises during preparation so you should use a bowl big enough to contain the meal in its risen state. If in doubt, use a very big bowl, with time, you will learn which quantity can comfortably fit is which bowl size.
2. Use a tablespoon to crush the lumps of *ogi* into very small pieces.
3. Add cold water in small quantities and mix till you have a medium consistency with no lumps.
4. Put a kettle of water to boil. Make sure the water will be enough. It is better to boil too much water than not have enough water when making *akamu*.
5. Just before the water boils, stir the mix very well because some of the *ogi* may have settled at the bottom of the bowl. If not stirred well, this is the major cause of lumps when you start making it.
6. Once the water boils, pour it slowly but steadily in a circular motion into the bowl of *akamu* and stir at the same time. Pouring the hot water slowly and stirring at the same is very important because this prevents lumps.
7. Once you see the mixture setting, stop stirring and reduce the flow of water you are pouring till the *akamu* has completely set.
8. Set the kettle aside and stir the pap very well. If it is too thick for you, you can add more hot water. But be careful else it will become watery. Remember that you will still add liquid evaporated milk.
9. Add evaporated milk and some sugar to taste and stir everything to the way you like it [27].

Benefits of Pap

Corn is used as a source of nourishment in various forms like whole corn, corn flour, cornstarch, corn syrup, cornmeal, corn oil, popcorn, cornflakes, and especially, corn is made into paste form called *OGI* with the addition of just pure drinking water. *OGI* is a good source of vitamins, minerals, and dietary fiber.

Health Benefits of Adding OGI to Your Daily Meals

1. *OGI* is very rich in Dietary Fiber. The fiber content makes it suitable for diets that are made to lose weight and those made with the aim of lowering cholesterol levels.
2. *OGI* is also very rich in Carbohydrates. It contains starch that will slowly release energy into the blood stream thereby providing you the needed energy all day long.
3. Maize facilitates the removal of toxic food substances and also accelerates the passage of feces through the intestine.
4. Maize combats the symptoms of certain cancers — According to recent studies, the use of maize helps to combat the effects of certain cancers, as it reduces the development of cancer.
5. reduces the risk of diabetes and heart diseases — the fiber in whole grains helps to prevent the risk of heart diseases and diabetes, and all its nutrients boost the immune system.
6. Corn pap is 100% natural. It has no additives or artificial content whatsoever.
7. It has no sodium and contains potassium (lowers B.P). This means that it helps to maintain a normal blood pressure effortlessly, which makes it a perfect food for people who are hypertensive and those who do not want to develop high blood pressure.
8. Pap has a high water content and helps to supply the daily requirement of water. It is as a result of this that it is used by nursing mothers to help the easy flow of breast milk (lactation) after delivery.
9. The texture of corn pap makes it very easy to digest and a perfect food for convalescencing individuals who are recovering from illness. The texture also makes it an ideal breakfast food because it exerts very little stress on the digestive system when instant energy is required after overnight sleep.
10. Corn has an adequate protein score i.e. the protein in it is more than the 8% required in food.
11. The fermented water from soaked milled corn is very nutritious and has a lot of use traditionally. In Yoruba language, it is called *omidun* which literarily translates to “sweet water”[27].

METHOD

Area of study: This study was conducted in Masaka a conurbation of towns under Karu Local Government Area of Nasarawa State, which has a mixture of both Rural and an emerging urban life due to the presence of a university and government workers.

Sterilization of glass wares; All glass wares used in the course of this work such as Petri dishes, pipette, test tube and conical flasks were thoroughly washed and sterilized in a hot air oven at 160-200^{o}C. The wire loops used were flamed red hot and allowed to cool before use, the work bench surfaces were also cleaned with a disinfectant before and after use. Sample collection; *Ogi* samples were purchased from local sellers from Masaka market and were transported to the laboratory where analyses were carried out.

Media preparation; All media used were prepared according to the manufacturer’s instruction. The media used are Nutrient agar, MacConkey agar, Triple Sugar Iron agar, CItrase agar and peptone water agar which were all sterilized by autoclaving at 121c for 15minutes before use. Inoculation and Incubation THE different samples of pap were collected and with the use of the inoculation stick the samples were inoculated in the Nutrient, TSI (Tripple Sugar Iron), Citrase and MacConkey agar and placed into the incubator for 24 hours and checked for growth.

Isolation of pure culture: For further identification, each typical colony will be further sub cultured on MacConkey agar, peptone water agar and triple sugar iron agar.

Gram staining The Gram staining reaction is used to help identify pathogens in specimens and cultures by their gram reaction (Gram positive or Gram negative).

Gram staining is a common technique used to differentiate two large groups of bacteria based on their different cell wall constituents. The gram stain procedure distinguishes between gram positive and gram negative groups by coloring thee cells red or purple due to the presence of thick peptidoglycan in their cell walls [27].

2.6.1 Gram positive Bacteria

Stains dark purple with crystal violet (or methyl violet) and are not decolorized by acetone or ethanol. Examples include species of *Staphylococcus, Streptococcus, Clostridium, and Corynebacterium.*

2.6.2 Gram negative Bacteria

Stains red because after being stained with crystal violet they are decolorized b acetone or ethanol and take up red counter stain (e.g neutral red, sarafin) examples include species of *Neisseria klebsiella, Haemophilis brucella, Shigella coliforms.*

Relevant Biochemical test such as: Catalase Test, Coagulase Test and Citrase test, Tripple sugar iron agar test were carried out: This test carried out to differentiate between coliforms such as Enterobacter aero genes + and Escherichia coli.

HYPOTHESIS OF THE STUDY

[Ho]: Microbial load and type in stored pap (*Ogi*) has no significant consumption health hazard on human population.

[Ha]: Microbial load and type in stored pap (*Ogi*) has significant consumption health hazard on Masaka human population.

RESULTS

The result gotten from the analysis of pap (*ogi)* from four sellers at Masaka market are shown below. Table 1.0 to Table 16.0 shows the occurrence of bacteria grown on the nutrient agar and the MacConkey agar. While Table 17.0 shows the bacteria and the percentages of each bacteria occurring as follows; *Escherichia coli* (12%), *Staphylococcus aureus* (34%), *Pseudomonas spp*(12%), *Klebsiella spp*(8%), *Shigella*(6%), *Providensia nisera*(8%), *Staphylococcus capitis*(14%) and *Salmonella spp*(6%).

Table-1.1: Sample 1 of Pap with changed water on Nutrient agar

Serial Number	Samples	Colony Characteristics	Biochemical Tests			Organisms isolated
			Catalase Test	Coagulase Test	Oxidase Test	
1	Corn	Tiny dry colonies seen in small quantities	+	+	-	*Staphylococcus aureus*
2	Guinea Corn	Mixed growth. Dry shinny colonies in large number	+	+	-	*Staphylococcus aureus*
		Mucoid mountain like growth seen	-	-	+	*Pseudomonas*
3	Millet	Tiny shiny, yellow golden colonies seen	+	+	-	*Staphylococcus aureus*

Table-1.2: Sample 1 of Pap with changed water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies	+	+	+	+	-	-	-	+	-Cocci	-	*Klebsiella spp*
2	Guinea Corn	Pink mucoid Mountain like colonies seen	+	+	+	+	-	+	-	-	-rod	+	*Escherichia coli*
3	Millet	Large pink mucoid like colonies seen	+	+	+	-	-	-	-	-	-rod	-	*Shigella spp*

Table-1.3: Sample 2 of Pap with changed water on Nutrient agar

Serial Number	Samples	Colony Characteristics	Biochemical Tests			Organisms isolated
			Catalase Test	Coagulase Test	Oxidase Test	
1	Corn	Dry colonies seen in small quantities	+	+	-	*Staphylococcus aureus*
2	Guinea Corn	Dry shinny colonies in large number	+	+	-	*Staphylococcus aureus*
		Yellow mucoid mountain like growth seen	-	-	+	*Providensia niseria*
3	Millet	Tiny shiny, colonies seen	+	+	-	*Staphylococcus aureus*

Table-1.4: Sample 2 of Pap with changed water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies Pink mucoid	+	+	+	+	-	+	-	-	-rod	+	*Escherichia coli*
2	Guinea Corn	Mountain like colonies seen	+	-	+	+	+	+	+	+	-rod	+	*Pseudomonas spp*
3	Millet	Large pink mucoid like colonies seen	+	-	+	+	+	+	+	+	-rod	+	*Pseudomonas spp*

Table-1.5: Sample 1 of Pap with Unchanged water on Nutrient Agar

Serial number	Sample	Colony Characteristics	Biochemical Test					Organisms Isolated
			Catalase test	Coagulase Test	Oxidase Test	Gram staining	Motility Test	
1	Corn	Tiny dry shinny colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
2	Guinea Corn	Shinny spoty milky colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
3	Millet	Spoty tiny golden colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*

Table-1.6: Sample 1 of Pap with unchanged water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies Pink mucoid	+	+	+	+	-	+	+	-	-rod	+	*Pseudomonas spp*
2	Guinea Corn	Mountain like colonies seen	+	-	+	+	-	+	-	-	-cocci	-	*Salmonella spp*
3	Millet	Yellowish pink mountain like mucoid	+	+	+	-	-	+	+	-	-rod	+	*Pseudomonas spp*

Table-1.7: Sample 2 of Pap with Unchanged water on Nutrient Agar

Serial number	Sample	Colony Characteristics	Biochemical Test					Organisms Isolated
			Catalase test	Coagulase Test	Oxidase Test	Gram staining	Motility Test	
1	Corn	Tiny dry shinny colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
2	Guinea Corn	Shinny spotty milky colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
3	Millet	Spotty tiny golden colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*

Table-1.8: Sample 2 of Pap with unchanged water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies Pink mucoid	+	+	+	+	-	+	+	-	+Cocci	+	*Pseudomonas spp*
2	Guinea Corn	Mountain like colonies seen	+	-	+	+	-	+	+	+	-rod	-	*Providensia niseria*
3	Millet	Yellowish pink mountain like mucoid	+	-	+	+	-	+	-	-	-rod	-	*Salmonella spp*

Table-1.9: Sample 3 of Pap with changed water on Nutrient

Serial number	Sample	Colony Characteristics	Biochemical Test					Organisms Isolated
			Catalase test	Coagulase Test	Oxidase Test	Gram staining	Motility Test	
1	Corn	Tiny dry shinny colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
2	Guinea Corn	Shinny spoty milky colonies seen	+	+	-	+Cocci	-	*Staphylococcus aureus*
3	Millet	Spotty tiny golden colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*

Table-1.10: Sample 3 of Pap with changed water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies	+	+	+	+	-	+	-	+	-rod	+	*Escherichia coli*
2	Guinea Corn	Pink mucoid Mountain like colonies seen	+	+	+	+	-	+	-	+	-rod	+	*Escherichia coli*
3	Millet	Yellowish pink mountain like mucoid	+	+	+	+	-	-	+	+	-rod	-	*Klebsiella spp*

Table-1.11: Sample 4 of Pap with changed water on Nutrient

Serial number	Sample	Colony Characteristics	Biochemical Test					Organisms Isolated
			Catalase test	Coagulase Test	Oxidase Test	Gram staining	Motility Test	
1	Corn	Tiny dry shinny colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
2	Guinea Corn	Shinny spoty milky colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*
3	Millet	Spoty tiny golden colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*

Table-1.12: Sample 4 of Pap with changed water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies	+	+	+	+	-	-	-	+	-rod	+	*Klebsiella spp*
2	Guinea Corn	Pink mucoid Mountain like colonies seen	+	+	+	+	-	-	+	+	-rod	-	*Providensia niseria*
3	Millet	Yellowish pink mountain like mucoid	+	+	+	+	-	-	+	+	-rod	-	*Providensia niseria*

Table-1.13 Sample 3 of Pap with unchanged water on Nutrient

Serial number	Sample	Colony Characteristics	Biochemical Test					Organisms Isolated
			Catalase test	Coagulase Test	Oxidase Test	Gram staining	Motility Test	
1	Corn	Tiny dry shinny colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
2	Guinea Corn	Shinny spoty milky colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*
3	Millet	Spoty tiny golden colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*

Table-1.14: Sample 3 of Pap with unchanged water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	corn	Mucoid mountain like colonies	+	+	+	+	-	+	-	+	-rod	-	*Escherichia coli*
2	Guinea Corn	Pink mucoid Mountain like colonies seen	+	-	+	-	-	-	+	+	-rod	-	*Shigella spp*
3	Millet	Yellowish pink mountain like mucoid	+	-	+	-	-	-	+	+	-rod	-	*Shigella Spp*

Table-1.15: Sample 4 of Pap with unchanged water on Nutrient

Serial number	Sample	Colony Characteristics	Biochemical Test					Organisms Isolated
			Catalase test	Coagulase Test	Oxidase Test	Gram staining	Motility Test	
1	Corn	Tiny dry shinny colonies seen	+	+	-	+cocci	-	*Staphylococcus aureus*
2	Guinea Corn	Shinny spotty milky colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*
3	Millet	Spotty tiny golden colonies seen	+	-	-	+Cocci	-	*Staphylococcus capitis*

Table-1.15: Sample 4 of Pap with unchanged water on MacConkey Agar

Serial number	Sample	Colony Characteristics	Biochemical Tests										Organisms isolated
			G	L	S	Gas	H2S	Indole Test	Oxidase Test	Citrase Test	Gram Staining	Motility Test	
1	Corn	Mucoid mountain like colonies	+	+	+	+	-	-	+	+	-rod	-	*Salmonella typhi*
2	Guinea Corn	Pink mucoid Mountain like colonies seen	+	-	+	+	-	-	-	+	-rod	-	*Klebsiella spp*
3	Millet	Yellowish pink mountain like mucoid	+	-	+	+	-	+	-	+	-rod	+	*Escherichia coli*

3.0. Occurrences of microorganism isolated from pap

The microorganisms isolated from the different paps were *Escherichia coli* (12%), *Staphylococcus aureus* (34%), *Pseudomonas spp*(12%), *Klebsiella spp*(8%), *Shigella*(6%), *Providensia nisera*(8%), *Staphylococcus capitis*(14%) and *Salmonella spp*(6%).%

Table-1.16: Frequency, percentage of organism Occurance

Serial number	Microorganisms	FrequencY	Percentage (%)	Level of significance in t test value at 95% confidence limits	Extent of hazard	Total Microbial load (cfu/ml)
1	*Escherichia coli*	6	12	P > 0.05 **NO** SIGNIFICANT DIFFERENCE IN THE PERCENTAGE OF DIFFERENT ISOLATES	SEVERE	3.0 X10^5
2	*Staphylococcus aureus*	17	34		SEVERE	9.0 X10^5
3	*Pseudomonas spp*	6	12		SEVERE	3.0 X10^5
4	*Klebsiella spp*	4	8		SEVERE	5.0 X10^5
5	*Shigella*	3	6		SEVERE	1.0 X10^5
6	*Providensia nisera*	4	8		SEVERE	5.0 X10^5
7	*Staphylococcus capitis*	7	14		SEVERE	7.0.0 X10^5
8	*Salmonella spp*	3	6		SEVERE	3.0 X10^5
	TOTAL	50	100%		Significant microbial load in all the isolates at P<0.05	
	t cal < t tab. P> 0.05 at 95% confidence limits hence not significant.					

DISCUSSION

From the result got, it was established that fermentation occurred in all the *Ogi* samples. Fermentation in food processing is the conversion of carbohydrates to alcohols and carbon dioxide or organic acids using yeasts, bacteria, or a combination thereof, under anaerobic conditions. Fermentation usually implies that the action of microorganisms is desirable. It was noticed from this analysis of *Ogi*, that *ogi* stored in water that was not changed had a microbial load of 24 and ogi whose water was changed only after 24hours had a microbial load of 26, making a total of 50 organisms isolated, which may likely lead to food borne disease. These harmful bacteria can seriously affect the health of any one who drinks this pap. The bacteria that were isolated and identified include.

Staphylococcus aureus (or *Staph aureus*) is a type of bacteria that is a facultative anaerobic Gram-positive coccus, it is non-motile and catalase and coagulase positive. 34 % of *Staph aureus* was isolated and identified from both the pap, with 9 load from ogi with changed water and 8 load from ogi with unchanged water and this is in agreement with the work of (Alloysius, *et al*., 1991 and Amakoromo 2011). *Staphylococcus* can cause food poisoning when a food handler contaminates food and then the food is not properly refrigerated. Other sources of food contamination include the equipment and surfaces on which food is prepared. These bacteria multiply quickly at room temperature to produce a toxin that causes illness (Bergdol, 1983).

Escherichia. coli of 12% was isolated from this research work stating that the water with which the pap was stored in was contaminated by *E.coli* which is the name of a type of bacteria that lives in your intestines and in the intestines of animals. Although most types of E. coli are harmless, some types can make you sick. Source of *E.coli* is contaminated water, including drinking untreated water and swimming in contaminated water. (Oyelana and Coker, 2012) is in agreement with this work for the presence of E.coli in water used for Ogi in their work, while Olukay, Ebigwei 1994 in the work "fermented weaning food in Africa" is in disagreement with the presence of isolated *E.coli* in this research.

Shigella spp. Is an infectious organism that causes Shigellosis? 6% of was isolated from the stored Ogi due to the storage method used.6% Salmonella was also isolated from the stored ogi samples. Adebolu, Ihunweze, Onifade, 2012 is in agreement with the percentage of Shigella and Salmonella isolated from this research work as it is similar with their work.

3% of *Salmonella, 7%* of *Staphylococcus capitis*, 4% of *Providensia spp*, *were* isolated from the stored pap both that which water was changed and that which water was not changed. *Klebsiella* is a genus of nonmotile, Gram-negative, oxidase-negative, rod-shaped bacteria with a prominent polysaccharide-based capsule. Klebsiella isolated in this research had a percentage of 8%. Mbakwe and Udemgba (2012) on "Microbiological quality of untreated and salt-treated *ogi* (*akamu*) kept at room temperature" Is in agreement with the count of bacteria in stored Pap as my work has isolated also. These organism were found in their work; *Klebsiella spp*, *Staphylococcus aureus*, *Salmonella spp.*

The presence of these bacteria can cause health hazard when they are consumed by humans. This could expose consumers to high risk of food borne infection. This implies that the samples if not properly preserved can lead to high rate of infection, which is a great

concern in view of healthy implication, an urgent intervention is therefore required.

CONCLUSION

The present study shows that the quality of pap produced from Masaka community is poor. This was proven by the high bacteria count. The poor bacteriological quality observed in the present study requires further investigation in the harvesting and the significance of the means of collection and preparation of pap and the effect of containers for storage to ascertain their contribution on microbial quality. The result of this study also reveals that the pap analyzed was contaminated with bacteria after allowing staying for a week showing that the best method for preservation is not by changing water but refrigerating. The studied products are therefore harmful for direct human consumption when left without proper preservation techniques.

RECOMMENDATIONS

Premised on the results obtained in this study, the following recommendations will significantly improve public health within Masaka community:

1. There is need to increase awareness of the community towards the dangers associated with improper preservation of pap.
2. Health workers from the government should be sent out to evaluate food been sold.
3. Adequate sanitary measures should be taken at each stage from production to consumption.
4. Proper preservation of processed Ogi should be carried employed by individuals.

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