RESEARCH ARTICLE

MICROBIOLOGICAL QUALITY CONTROL OF SOYMILK SOLD IN KOGI STATE

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Abstract

There is a growing public health concern about the increase of do-it-yourself soymilk commonly found in every part of our society. The purpose of the present research was to examine the microbiological implications of the soymilk sold in the Kogi state of Nigeria. Samples were collected from vendors in different locations. The analysis was conducted on the samples using established standard procedures. The result found certain microorganisms such as Micrococcus spp, Lactobacillus spp, Streptococcus spp, Enterobacter spp, Klebsiella spp, and other fungi which comprises Aspergillus spp and Saccharomyces. The study concludes that the soymilks sold in Kogi state are mostly contaminated due to the producers' unhygienic practices.
Soy milk is a popular beverage in Nigeria. It is widely sold along the streets and market places. There is currently an upsurge in the production and marketing of soymilk drinks across Nigeria's cities, occasioned by the increasing skill acquisition programs and entrepreneurial intentions. In Kogi state, the product is readily available in every corner. A closer observation of the vendors and environment raises health-related safety. However, there is a growing concern on the regular soymilk's production processes relating to microbiological quality (Fasoyiro et al., 2010). Indeed, soymilk consumption could threaten human health if harmful microorganisms are not adequately guided during the production, storage, and distribution. Thus, contamination is possible following an unhygienic preparation procedure. Therefore, this study intends to examine the microbiological quality control of soymilk sold in Kogi state.

**Materials and Methods:**
Materials and glassware were purchased from a reliable vendor and adequately sterilized and dried. The reagents used in the study include crystal violet, Lugol's iodine, Safranin, Kovac's reagent, Lactophenol cotton blue, Hydrogen peroxide. Soymilk beverages were purchased from local vendors from different locations in Kogi state. They were immediately transported to the microbiology laboratory for analysis. The study followed the standard procedures outlined in Stanley et al. (2014) and Agboke et al. (2012).

**Result:**

**Table 1:** Morphological Characteristics and Gram Reaction of Bacterial Isolate.

| Code no | Morphological characteristics | Gram Reaction                  | Isolates          |
|---------|-------------------------------|--------------------------------|-------------------|
| A       | Creamy round colonies on nutrient agar | Gram-positive coccus in clusters | Micrococcus spp   |
| B       | Creamy and small round shape colonies in nutrient agar | Gram-positive cocci in chain | Streptococcus spp |
| C       | Pale green and convex opaque colonies on cled agar | Gram position cocci in chain | Aerobacter spp    |
| D       | Pale green and creamy colonies on cled agar | Gram-negative cocci in chain | Klebsiella spp    |
| E       | Creamy and round in the shape on Mrs agar | Gram-positive rods in chain | Lactobacillus     |

**Table 2:** Biochemical character of Gram-positive bacteria present.

| Sample code | Gram reaction | Catalase test | Oxidase | Indole | Sucrose | Glucose | Lactose | Motility | Presumptive organism |
|-------------|---------------|---------------|---------|--------|---------|---------|---------|----------|---------------------|
| A           | +             | +             | -       | +      | AG      | A       | AG      | -        | Micrococcus spp      |
| B           | +             | +             | -       | +      | A       | AA      |         | -        | Streptococcus spp    |
| C           | +             | +             | -       | +      | A       | AGAG    |         | -        | Aerobacter spp       |
| D           | -             | +             | -       | +      | AG      | AG      | AG      | -        | Klebsiella spp       |
| D           | +             | +             | -       | +      | AG      | A       | A       | -        | Lactobacillus spp    |

Key: - = Negative, + = Positive, A = Acid, AG = Acid & Gas
Table 3:- The Identification of Fungi Isolates based on their reactions with lactophenol cotton blue.

| Characteristics | Identification |
|-----------------|----------------|
| Presence of septate hyphae long and smooth conidiophores, long unbranded sporoging with large, round head Black and brownish at the edges with dark mycelium spores on the surface | Aspergillus spp |
| Creamy, oval shape budding cell with rounded shape the end resembling barrel shape | Saccharomyces spp |

Table 4:- Percentage Distribution of Each Isolate.

| Isolates            | Numbers of organism | Percentage distribution |
|---------------------|---------------------|-------------------------|
| Micrococcus spp     | 96                  | 36.5                    |
| Streptococcus spp   | 81                  | 30.7                    |
| Aerobacters spp     | 28                  | 10.6                    |
| Klebsiella spp      | 16                  | 6.1                     |
| Lacto bacillus spp  | 24                  | 9.11                    |
| Aspergillums spp    | 10                  | 4.0                     |
| Saccharomyces spp   | 8                   | 3.0                     |
| Total               | 263                 | 100                     |

Discussion:-

The current study was aimed to determine the microbiological quality soymilk beverage on sale in the Kogi state of Nigeria. The analysis conducted on the samples shows the presence of certain microorganisms such as Micrococcus spp, Lactobacillus spp, Streptococcus spp, Aerobacter spp, and Klebsiella spp, as shown in table 2. Table 1 shows the morphological characteristics and Gram reaction of the isolates. The result is consistent with studies that found similar microorganisms in soymilk (Agboke et al., 2012; Akinola et al., 2015; Brooks et al., 2004; Edet & Peter, 2017; Mbayei et al., 2013; Ozoh & Umeaku, 2016). Lactobacillus spp, as observed above, has been associated with soymilk spoilage and an increase in acid production (Stanley et al., 2014). These organisms thrive in fermentable substrates as sugar, which can be reduced by acid. The presence of Streptococcus spp indicates a high level of exposure and carelessness at any production level (Brooks et al., 2004). All the isolated organisms in the study have been associated with health implications. However, evidence has shown that microbial pathogens may find their way into food production, including soymilk processing, due to inadequate hygienic practices and insufficient decontamination and raw materials' mishandling.

Furthermore, table 3 shows Aspergillus spp and Saccharomyces spp as the fungi isolated based on their lactophenol cotton blue reactions. Aspergillus spp is a toxigenic mold with the capability of producing aflatoxin (Brooks et al., 2004). Thus, it is a public health concern. On the other hand, Saccharomyces spp has been shown to cause spoilage at the fermentation stage, probably due to high-sugar levels. However, the role of Saccharomyces spp in the spoilage of soymilk is unclear.

Conclusion:-

The microbiological quality control of soymilk commonly sold in every area in the Kogi state has been contaminated with varying bacteria. The study concludes that microorganisms present in the widely available soymilks in the study parameter are attributed to producers' poor hygiene, unsanitary conditions of processing equipment, and raw materials. Pathogenic bacteria in soymilk can be either infectious or toxin-producing. Although most pathogens that contaminate soymilk grow only slowly or not at all. Perhaps, soymilk provides a safe place for microorganisms to grow. Thus, it is recommended that adequate precaution in production and storage hygiene are critical for controlling the contamination of microorganisms in soymilks. The current study contributes to disease control literature by further affirming the prevalence of consuming contaminated soymilks in Nigeria.
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