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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, enterobacterspp,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.

Introduction:-

Soymilk is a popular health beverage worldwide (Ge et al., 2021). Soymilk is the aqueous extract of whole soybeans, resembling dairy milk in physical appearance and composition (Giri &Mangaraj, 2012). It is used to substitute dairy milk, especially for people suffering from milk intolerance and allergy(Cui et al., 2021; Kundu et al., 2018). Soymilk is becoming famous worldwide due to its nutritional benefits (Peng et al., 2016; Vanga et al., 2020). However, Soymilk is lower in calories than cow's milk (Vagadia et al., 2018). The nutritional value is limited by soybean trypsin inhibitors (Ge et al., 2021).

Soymilk is consumed globally as a healthy protein drink and used as raw material to produce soy gel foods, such as tofu and soy yogurt(Peng et al., 2016).It is an excellent food item with numerous functional substances with antioxidant effects (Yamamoto et al., 2019).Soymilk has recently been applied in the dairy industry as a valuable ingredient to expand the texture, flavor, and nutritional value of various products(Peng et al., 2016). According to Jimoh and Kolapo (2007), soymilk is a traditional oriental foodbeverage growing in popularity in the United States and the world.Soymilk, a watery extract of the whole soybean, is rich in water-soluble protein, carbohydrates, and oil (Adebayo- Tayo et al., 2008).

It is commonly characterized as having a beamy, grassy, or soy flavor, which reportedly can be improved by lactic acid fermentation as in yogurt-like products (Iwe, 2003). The increasing popularity of soymilk as a beverage worldwide is credited to health benefits,e.g., low cholesterol and lactose, its ability to reduce bone loss and menopausal symptoms, prevention, and heart disease reduction, and certain cancers (Akpan et al., 2007). The health benefits of soymilk have been widely studied (Ali et al., 2017; Apostolidis et al., 2007; Fukuda et al., 2017; Itakura et al., 2019; Li et al., 2016; Niyibituronsa et al., 2019; Oboh, 2006; Stojanovska et al., 2016; Vij et al., 2011; Zhu et al., 2020). However, research has suggested that the regular consumption of soy products is associated with an inverse incidence of type 2 diabetes (Camps et al., 2018) endocrine disrupters (Brando et al., 2013).

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Soymilk 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	Micrococcusspp
B	Creamy and small round shape colonies in nutrient agar	Gram-positive cocci in chain	Streptococousespp
C	Pale green and convex opaque colonies on cled agar	Gram position cocci in chain	Aerobacterspp
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	Saccharomycesspp

Table 4:- Percentage Distribution of Each Isolate.

Isolates	Numbers of organism	Percentage distribution
Micrococcus spp	96	36.5
Streptococous	81	30.7
Aerobactorspp	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 inthe 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 Gramreaction 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; Mbaeyi 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 toinadequate hygienic practices and insufficientdecontamination andraw 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 beencontaminated 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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