Bacteria Commonly Associated with Bakery Equipments in Selected Areas Around Olabisi Onabanjo University Environ, Ago – Iwoye, Nigeria.

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ABSTRACT

Research was carried out to identify the bacteria associated with equipments used in bread bakeries. Sterile swabs sticks were used to take a total of 78 samples from pre-baking and post-baking equipments surfaces viz., cutting machine (1), millers (5), mixers (5), scales (3), tables (5) and baking pans (20) from five selected bread bakeries across Ago – Iwoye, a town densely populated with tertiary institution students and examined for bacterial contamination. Cultural characteristics and biochemical tests were carried out on pure cultures of isolates for identification purposes. Three genera of bacteria were identified, viz., one gram positive cocci and two gram positive bacilli. They were *Staphylococcus aureus*, *Bacillus subtilis* and *B. cereus*. 66.7% of the equipments were contaminated with *S. aureus*, 14.1% with *B. subtilis*, 7.7% with *B. cereus* and 11.5% had no bacterial growth. Strict hygienic practice should be observed when handling these equipments to guard against food poisoning.

Key words: bread, bakery equipments, *S. aureus*, *B. subtilis*, *B. cereus*

Introduction

Bread is a staple food consumed by most people in Nigeria. Locally made bread prepared in Ago - Iwoye town, Ogun State, Nigeria is consumed mostly by tertiary students residing in the town. The locally made bread is prepared by cooking a dough of flour and water, salt, fat and leavening agents such as yeast and baking soda.

The surface of a freshly baked loaf of bread is practically free of viable microorganism but is subject to contamination by mold spores from the air during cooling and before wrapping. During slicing, contamination may take place from microorganisms in the air, on the knives, or on the wrapper. Spores of bacteria able to cause ropiness in bread will survive the baking process [9].

The occurrence of pathogenic microorganisms has always been attributed to several factors, which include contamination through water, soil, food processing equipments, food contact surfaces and most importantly food handlers [1,11]. Improper handling of food is responsible for most cases of food borne diseases and intoxication, including improper use of preparation and storage temperature, cross contamination and poor personal hygiene [10]. When food handlers do not practice proper personal hygiene or correct food preparation, they may become vehicles for microorganisms, through their hands, mouth, skin among others [6,18]. There are a number of important sources of microbiological contamination in any food manufacturing operation, but most microbiologists would probably rank people, raw materials and processing water as their top three [15].

All types of flour, especially wheat flour, are contaminated with *Bacillus* spores as a result of soil contamination [14,15], cultivation and processing methods [8,24]. Other origins of the *Bacillus* contamination have been reported to be raw materials and bakery equipment [3,16]. *Staphylococcus* species are found in a broad range of commercial foods, including meat and meat products, poultry and egg products, salads, bakery products, sandwich fillings, milk and dairy products. Food products that require considerable handling during preparation or are kept at slightly elevated temperatures after preparation are frequently involved in staphylococcal food poisoning [4]. Most species of staphylococci can produce some form of enterotoxin, the causative agent of staphylococcal enteritis.
The aims of this research work are to isolate and identify bacterial from selected bakery equipments.

Materials and Methods

Collection of Samples:

Samples were collected from five different bakeries. Sterile swab sticks were used to collect samples from the surfaces of several pre-baking and post-baking equipment surfaces viz., cutting machine, miller, table, mixer, scale and different baking pans. The samples were transported to the laboratory immediately after collection. The bakeries were coded BA1 - BA5.

In bakery BA1; 18 samples were collected from pre-baking and post-baking equipments which include 4 baking pans each. In bakery BA2; 14 samples were collected from pre-baking and post-baking equipments which include 4 baking pans each. In bakery BA3; 16 samples were collected from pre-baking and post-baking equipments which include 4 baking pans each. In bakery BA4; 16 samples were collected from pre-baking and post-baking equipments which include 4 baking pans each. In bakery BA5; 14 samples were collected from pre-baking and post-baking equipments which include 4 baking pans each.

Isolation of Bacteria:

The streak plate method was used for isolation. The sterile swab sticks were dipped in saline water and then used to streak the surface of already solidified agar. The media used for isolation were Nutrient agar (Oxoid, UK CM0003B) and Blood agar. Blood Agar was prepared by allowing sterilized nutrient agar cool to 45°C and 5% sterile defibrinated sheep blood was aseptically added, mixed and poured into Petri dishes to set.

Bacterial characterization:

Representative colonies of isolates resulting from the isolation were sub cultured and preserved on nutrient agar slant. Cultural characteristics of the isolates on the plates were noted. The organisms were identified based on Bergey’s manual of determinative bacteriology (Buchanan and Gibbons, 1974).

Results:

Biochemical characterization:

Three species of bacteria were isolated and these are Staphylococcus aureus, Bacillus subtilis and Bacillus cereus.

Incidence of bacteria in bakery equipment:

The single cutting machine, mixers, tables in bakeries BA1 and BA2 and scales from bakeries BA1 and BA3 analyzed were contaminated with S. aureus. No bacteria were isolated from the scales in bakery BA4. Thirteen baking pans were contaminated with S. aureus, 3 with B. subtilis, 3 with B. cereus and no growth in 1 before (pre) baking; 16 with S. aureus and 4 with B. subtilis after baking (post baking). In bakery BA5 all the baking pans were contaminated with B. subtilis after (post) baking (Tables 1 and 2).

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\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Equipment} & \text{No sampled} & \text{S. aureus} & \text{B. cereus} & \text{B. subtilis} & \text{No growth} \\
\hline
\text{Cutting machine} & 1 & 2.6\% (1) & - & - & - \\
\text{Mixer} & 5 & 7.7\% (3) & 2.6\% (1) & 2.6\% (1) & - \\
\text{Miller} & 5 & 7.7\% (3) & - & 2.6\% (1) & 2.6\% (1) \\
\text{Table} & 5 & 5.1\% (2) & 2.6\% (1) & - & 5.1\% (2) \\
\text{Scale} & 3 & 5.1\% (2) & - & - & 2.6\% (1) \\
\text{Baking pan} & 20 & 33.3\% (13) & 7.7\% (3) & 7.7\% (3) & 2.6\% (1) \\
\hline
\text{Total} & 39 & 61.5\% & 12.9\% & 12.9\% & 12.9\% \\
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\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Equipment} & \text{No sampled} & \text{S. aureus} & \text{B. cereus} & \text{B. subtilis} & \text{No growth} \\
\hline
\text{Cutting machine} & 1 & 2.6\% (1) & - & - & - \\
\text{Mixer} & 5 & 7.7\% (3) & 2.6\% (1) & 2.6\% (1) & - \\
\text{Miller} & 5 & 7.7\% (3) & - & 2.6\% (1) & 2.6\% (1) \\
\text{Table} & 5 & 7.7\% (3) & - & - & 5.1\% (2) \\
\text{Scale} & 3 & 5.1\% (2) & - & - & 2.6\% (1) \\
\text{Baking pan} & 20 & 41.0\% (16) & - & 10.3\% (4) & - \\
\hline
\text{Total} & 39 & 71.8\% & 2.6\% & 15.5\% & 12.9\% \\
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Incidence of bacteria in bakery equipments before and after baking:

Figure 1 show there was an increase in contamination by S. aureus and B. subtilis after baking. There was drastic reduction in B. cereus contamination after baking.

Incidence of bacteria in each bakery:

Figure 2 shows the rate of occurrence of bacteria isolates in each bakery. All the bakeries are
contaminated with at least two species of bacteria except bakery BA4 that was contaminated with S. aureus only. All the bakeries are contaminated with S. aureus with BA1 having the highest value.

Fig. 1: Incidence of bacteria in bakery equipments before and after baking.

Fig. 2: Incidence of bacteria in each bakery.

Discussion:

Isolation of Staphylococcus aureus, Bacillus subtilis and Bacillus cereus from bakery equipments conforms to the work of (Viljoen and Von Holy, 1997) that isolated Bacillus species from equipment surfaces, air, raw materials, and hands of workers, and (Nasir and Islam, 2007) who isolated Bacillus and Staphylococcus from bakery foods in Bangladesh. Bacillus species was also isolated from flour and ropy bread as the main species involved in bread spoilage (Sorokoluva et al., 2003) and reported the source of contamination to be from raw materials and bakery equipment. Toxigenic B. cereus has been isolated from Nigeria flour based foods (Yusuf et al., 1992).

S. aureus was isolated from most of the equipments with 66.7% occurrence, followed by B. subtilis with 14.1%, B. cereus 7.7% while 11.5% had no growth. From the work of (13) Bacillus has 84.62% while Staphylococcus has 76.92%. This shows that Bacillus and Staphylococcus are the bacteria frequently encountered in bakery products and equipments.

There was high increase in S. aureus and a little increase in B. subtilis contamination after baking. According to Bremer et al. (2004), the presence of S. aureus on the surfaces of equipment after production could be as a result of recontamination by food handlers. Food handlers are usually the main source of food contamination. However, the surfaces of equipment can also be a source of S. aureus contamination. Staphylococci exist in air, dust, sewage, water, milk, and food or on food equipment, environmental surfaces, humans, and animals. Humans and animals are the primary reservoirs. Staphylococci are present in the nasal passages and throats and on the hair and skin of 50% or more of healthy individuals. Although food handlers are usually the main source of food contamination in food poisoning outbreaks, equipment and environmental surfaces can also be sources of contamination with S. aureus.

It was observed during sampling that the bakeries were not carrying out proper hygiene practices, their equipments were rarely covered (often exposed) and prior to the baking process, equipment are not properly cleaned; a knife used as cutter is also used to scrape off the residue of dough. The bakery environments were dusty and unkempt:
an evidence of lack of regular and proper cleaning. This fact could explain the high rate of *Staphylococcus aureus* found in these bakeries. However, bakery BA3 showed a high number of *Bacillus subtilis*, which could have been from the raw material. The ability of *Bacillus* species to resist dessication allows their survival on dried products such as cereal and flours. *B. cereus* is widely distributed in the environment and can be isolated from soil, water and vegetation [2]. *B. subtilis* is a notable food spooter, causing ropiness in bread and related food. Ropy bread or rope is a bacterial spoilage condition of bread [23,12]. A major source of *Bacillus* contamination is from raw ingredients [23] so ideally it would thus be profitable for bakeries to use only ingredients with low levels of contamination.

In conclusion, vegetative bacteria, as well as, moulds and viruses, are readily destroyed during dessication allows their survival on dried products such as cereal and flours. *B. cereus* is widely distributed in the environment and can be isolated from soil, water and vegetation [2]. *B. subtilis* is a notable food spooter, causing ropiness in bread and related food. Ropy bread or rope is a bacterial spoilage condition of bread [23,12]. A major source of *Bacillus* contamination is from raw ingredients [23] so ideally it would thus be profitable for bakeries to use only ingredients with low levels of contamination.

In conclusion, vegetative bacteria, as well as, moulds and viruses, are readily destroyed during baking, but post-baking contamination from air, equipment and handlers can occur [7]. Due to the high incidence of *S. aureus* carriage by humans, prevention of staphylococcal food poisoning relies on good hygienic practices to reduce the incidence of contamination of food by food handlers. It can thus be concluded from this study that the high occurrence of *Staphylococcus aureus* as related to bakery equipment contamination is as a result of food handlers which are usually the main source of food contamination. Surfaces of equipment can also be a source of *S. aureus*.

*Staphylococcus aureus* and *Bacillus* species, the bacteria found in or on the bakery equipments can be eliminated by proper hygienic practices and abiding by rules and regulations as laid down by the legislative bodies.

References


