*Biosciences, Biotechnology Research Asia* Vol. **5**(1), 89-92 (2008)

# Microbial population of processed Tomato puree

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(Received: January 20, 2008; Accepted: March 21, 2008)

## ABSTRACT

This study was conducted to investigate the microbial load of fresh and boiled Roma VF and Cherry (round) tomato purees stored at 27°C for 9 months. Bacterial load was high in fresh samples ranging between $1.42 \times 10^2$ Cfu/mL and $2.42 \times 10^2$ Cfu/mL. The boiled sample had no microbial growth from 0 to 42 days of storage. However, the boiled samples stored for 9 months showed insignificant growth of microbes; $2.0 \times 10^5$ Cfu/mL for bacteria and $6.0 \times 10^5$ Sfu/mL for fungi. This result showed that tomato processed into puree and preservation by thermal treatment can reduce the spoilage and wastage of tomato as constraints facing tomato *(Lycopersicum esculentum)* production in Nigeria. This study proposes a sustainable method of thermal preservation that can be carried out by an average literate housewife, on excess tomatoes available in the market during harvest.

**Key words:** Microbial population, tomato puree.

## INTRODUCTION

*Lycopersicum esculentum*, the wild cherry tomato which grows spontaneously in tropical and sub-tropical areas of the world, is an important food condiment in Nigeria. The remarkable progress made in tomato production in Nigeria through mechanization, makes tomatoes to be very cheap and surplus during harvest. The crop deteriorates easily and cannot be stored for a long time at room temperature because it contains a lot of water which supports the growth of microbes. It thus requires special care to preserve. Losses occur at all stages of handling the tomatoes, from harvesting through storage, processing and marketing to final delivery to the consumers. The result of losses adversely affects the farmers, the traders and consumers. Estimate of production losses from mishandling, transportation, spoilage and pest infestation of tomatoes in Nigeria is difficult to quantify; but some authorities put losses to be as high as 50% or half of what is grown[1].

Deliberate efforts are being made in increasing food production but commensurate efforts are not made to stem post-harvest losses through the establishment of appropriate processing and storage structures. The Federal Government of Nigeria, warned by this trend of production losses, approved a comprehensive food security programme in 1987 that emphasized food processing and storage[2]. The food security programme assigned roles to the private sectors and various tiers of government in reducing production losses yearly in grain crops; and other special attention is highly required in reducing losses encountered yearly in tomato production[2]. When the growing population is considered, food preservation will play important role in reducing these losses.

Food preservation is a method of treating food to prolong the length of time at which the commercial acceptable attributes or qualities such as colour, texture, flavour or aroma are retained[3]. Pasteur demonstrated that ferments, moldiness and some forms of putrefaction were caused by the presence of microorganisms widely distributed in the environment. He reported that since these microorganisms are the main cause of food spoilage, food preservation is based on rendering conditions unfavourable for the growth of these microbes[4]. Food preservation is therefore the science which deals with the process of preventing decay or spoilage of food, thus allowing it to be stored in a fit condition for future use[3]. The history of food preservation goes back to the primitive man and the need to survive for many years. Man has been researching into ways in which fresh and perishable commodities can be preserved. The earliest known methods of preservation involved sun drying of food under appropriate climatic conditions, heating, refrigeration and the use of chemicals and other preservatives[5]. The demand for preserved food is now on the increase as the urban centre population has grown. Prepared ready-to-eat foods and farm produce are increasingly commercially available during the past twenty years. This happens particularly in highly industrialized countries where women go out to work and do not have time for extensive food preparation. The simple operation of reheating processed foods or short-time preparation of food is what time allows.

Preservation provides the opportunity to diversifying the processing of the excess produce to some other forms of food or new food that gives greater profitability to growers e.g. tomato juice, tomato sauce, ketchup, tomato puree etc. It reduces losses and gives rise to commercialization of preserved home produce[7]. Preservation provides a year round availability of farm produce in different food forms. This will reduce and substitute importation and give stronger market position for plant growers. It will also improve the nation's economy by reducing price fluctuation of commodity and provide a degree of price stability. Preservation of food maintains emergency supplies of food. Recently, there is a gradual change of life-style that has created great demand for preservation of food. Ready – prepared convenient preserved foods are in high demand to fresh produce. To preserve food, processing directed at inactivating or controlling microorganisms and enzymatic activities is necessary. There is no method of preservation that will improve the quality of the products, but it can only preserve it[3].

Tomatoes are living respiring objects when harvested and contain 65-95% (w/w) water. They continue the living processes after harvest until their food and water reserves are exhausted after which the produce dies and decays. Decaying involves spoilage. The principal causes of food spoilage are growth of microorganisms and biochemical processes[4]. Microorganisms are active spoilage agents of fresh and they render produce poisonous by their activities. They are affected by temperature, moisture, oxygen concentration, available nutrients, degree of contamination with spoilage organisms and the presence or absence of growth inhibitors[8]. Fresh tomatoes can become infected through injuries caused by careless handling during harvesting and by disease causing insect, or other animal damage.

Excellent quality of foods supply to consumers should be an important concern to all. In the food processing control, safety and wholesomeness are the most important attributes of food quality. The lack of quality as it relates to safety and wholesomeness can result in food poisoning. A group of activities designed to ensure a standard of excellence in food (food quality control programme) is controlled by Federal and State Agencies. Failure to meet the degree of excellence defined by the regulations, policies or standards of identity is considered to be an illegality[9]. In order to ensure good supply of tomato to consumers all the year round and prevent waste of excess tomato in markets, this study aimed to determine the microbial load of fresh and pureed tomatoes over a storage period of 9 months. Effect of boiling on the microbial population was also investigated.

## MATERIAL AND METHODS

All glasswares and material used for processing of the tomatoes were washed with disinfectant and sterilized in an autoclave at 121°C for 15 minutes. Preparation of media used was carried out according to manufacturer's instructions. Nutrient agar (NA) was used for cultivation of bacteria while malt extract agar (MEA) was used for fungal growth. Roma VF and round types of cherry tomato were purchased from the main market in Akure, Ondo State, Nigeria. The tomatoes were fully ripe, free from damages and diseases. Sorting of the tomatoes was done manually to select good quality tomatoes to prepare the tomato puree. The sorted tomatoes were washed with clean tap water to remove the left over stems, dirts and soil on the tomatoes.

The tomatoes were ground into a paste in an electric plastic blender under an hygienic condition. Plastic blender was used instead of metallic type to prevent the release of metallic materials and microorganisms into the paste. The tomato paste (puree) was heated quickly in a large pot with continuous stirring to prevent burning. When the temperature reached 100°C, sterile bottles were filled immediately with hot tomato puree leaving ½ inch head space. The bottled tomato puree was thereafter put into a stainless steel pot for more boiling. The water was heated to boiling point (100°C) and it was kept constant for 20 minutes, after which the bottles were removed with the aid of a long steel strainer. This completed the thermal preservation of the tomato puree. Contact of bottles with wet or damp materials was avoided to prevent bottles from cracking. The tomato puree was stored in a cool, dry and dark place for 9 months at room temperature of 27°C. Care was taken not to expose the puree to light as it could affect the colour of the puree.

## RESULTS AND DISCUSSION

The average bacterial and fungal loads of the fresh blended tomato samples stored at room temperature (27°C) were 1.7 x $10^2$ Cfu/mL and 1.65 x $10^2$ Sfu/mL respectively. There were no microbes in the boiled tomato puree samples stored for 0 to 42 days (Fig. 1). The boiled tomato samples stored for 9 months showed microbial growth of bacteria and fungi (Fig. 1). The high number of micro-organisms in the blended fresh tomato samples was as a result of microorganisms spread in the atmosphere which gained entry into the plant through natural pores on the plant. These pores allow the movement of air, carbon dioxide and water vapour in and out of plants during which microbes are taken into plants[1]. This basis is supported by Bailey and Scott[10] who reported that microorganisms occupy essentially all parts of the earth where life exists, including ocean depths of more than 10,000 metres deep and dust particles in the atmosphere and soil where the plants are grown. It is therefore expected that almost any material or all microorganisms and their metabolic activities can cause spoilage and diseases if they are not eliminated or suppressed in action. Air is the major enemy of fresh and preserved food products because it is one of the hosts of microorganisms. When air is eliminated totally from freshly boiled processed foods, new microorganisms and their growth would be prevented in the foods and they can be stored for long time[1]. The other reason for presence of high number of microorganisms in the fresh tomato samples could be nutrient content of the tomato puree. Tomato is rich in minerals which support the growth of microorganisms and this can lead to deterioration

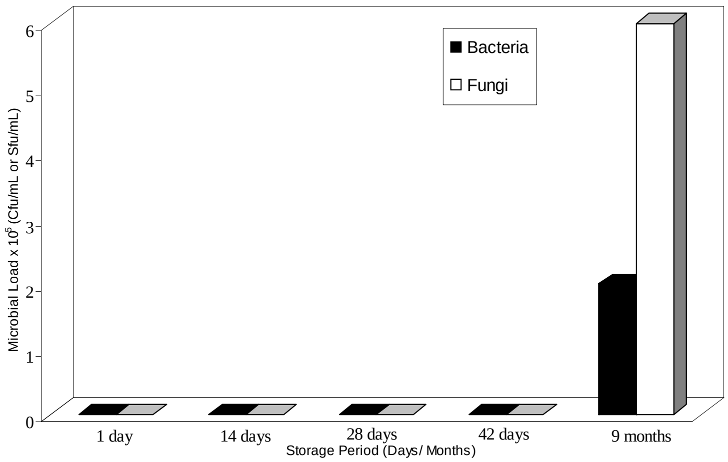


**Fig. 1: Bacterial and fungal counts of boiled tomato puree stored for 9 months**

of the food. The higher the moisture content within the limits of its requirement by microorganisms, the shorter the shelf–life of the product in which they are living[8].

The absence of microorganisms in the boiled tomato puree before and during sample stored for 42 days indicates that boiling killed the bacteria and fungi. It also indicates that the 100°C is sufficient to eliminate those microbes that were in the samples before thermal processing. This then means that temperature is crucial to the growth of living organisms. Hersorn and Hulland[11] (1980) also reported that the rate at which destruction of microbes occurs is a function of time and temperature, which vary with each other besides other factors. In addition, they said the higher the temperature that the cells are exposed, the more rapid is their destruction. This is a confirmation of some findings that spore forming saccharolytic anaerobes of the *Clostridium pasteurianum* type which are responsible for gaseous spoilage in canned fruit and tomatoes are readily controlled by relatively short thermal processes at temperature below 100°C. These organisms were destroyed within 40 minutes at 100°C in phosphate buffer at pH 7.0. In tomato juice at pH 4.5 the destruction time was 20 minutes[1]

## CONCLUSION

This study has shown that the thermal processing has succeeded in eliminating the microbes that could have destroyed the fresh tomato samples if not boiled before storage. The microbial load in all the samples was below the International Microbiological Standard ($10\times10^3$ Cfu/ml)[1]. Based on the findings obtained in this work, it is recommended that tomato puree should not be stored for more than 42 days.

## ACKNOWLEDGEMENTS

The authors are grateful to Olukunle, O. J. and Boboye, B. in the Departments of Agricultural Engineering and Microbiology respectively of the Federal University of Technology, Akure, Nigeria for their useful contribution towards the success of the bench work and processing of the manuscript for publication.

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