COMPARATIVE ANALYSIS ON THE MICROBIAL QUALITY OF LOCALLY PROCESSED TOMATO PASTE AND TOMATO POWDER

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Abstract
Microbial quality is a common criteria used to determine the acceptability and shelf life of dehydrated plant-based products. The research was conducted to compare the microbial determination tomato paste and tomato powder which was processed from fresh tomatoes sourced from the market. The parameters accessed where microbial load, yeast and mould count, total fungi count. The result carried out on the microbial analysis showed that total microbial load were low in the two samples containing tomato paste and tomato powder ($1.81x\ 10^1$ CFU/g, $1.05x\ 10^1$ CFU/g) respectively when compared to the standard value ($1.5x10^2$CFU/g) after 5 days of storage at room temperature, but the microbial load was significantly higher in the tomato paste when compared to the tomato powder. At day 10 there was total microbial increase in the two samples and the microbial load was significantly higher in tomato paste ($2.06x10^1$ CFU/g), than in tomato powder ($1.36x10^1$ CFU/g). An observed increase in yeast and mould count, fungi count was obtained as the storage period increased, and tomato paste stored for ten days at room temperature recorded the highest number. The samples analyzes were lower than the maximum limit (10CFU/g) which implies good manufacturing practices.
Keywords: Tomatoes, Microorganisms, Lycopene, Microbial analysis

Introduction
Tomato (*Solanum lycopersium*) is a juicy and sweet perishable fruit that is commonly cultivated in tropical and sub-tropical areas of the world, and is an important constituent of the diet of most people worldwide (Agrios, 2005). Tomato is one of the most important food condiment in Nigeria due to its widespread use for the preparation of various food/menu and it comprises about 18% of the average daily consumption of vegetables (Ibitoye et al, 2009). Nigeria is ranked the second largest producer of tomato in Africa and the 13th in the world (Brushlyanova et al, 2013). Due to lack of post harvest enterprise and poor post-harvest storage plans, Nigeria is unable to meet its domestic demands for tomato. According to (Murali et al, 2013) tomatoes are widely used either in their raw forms as food or in various processed forms because of their phytochemical composition, taste, affordability and acceptability. It serves as a major source of antioxidants, lycopene, vitamins, dietary fiber, vitamin A equivalents (in the form of carotenoids), Vitamin C, Vitamin E, folic acid, potassium and other trace elements. Lycopene is a vital anti-oxidant that helps in the fight against cancerous cell formation as well as other kinds of health complications

and diseases. Diets that include tomatoes have been linked with reduced risk of obesity and some neurological diseases including Alzheimer's disease (Adegbola Dauda et al, 2019). It is one of the most important vegetable crops of the solanaceae family, grown all over the world for food and other economic purposes.

Tomato is sensitive to frost and grows well under average monthly temperature of about 21 - 23^0C. It requires moisture of about 60mm and well -drained light loamy soil with a high organic matter content and ph of 5 - 7.5. Inorganic fertilizers can improve crop yields but its use is limited due to scarcity, high cost, nutrient imbalance and soil acidity (Mbah, 2006). Due to its high –water content of 95%, tomatoes are highly perishable and have a short life span and as a result predispose it to spoilage by mainly by pathogenic bacteria. In most developing countries, microbial infestation can occur during the harvesting period, post harvesting, handling, storage, transportation and processing by customers (Yeboah, 2011).

Crude and non-sophisticated methods are applied for storage and transportation of tomato, which have led to large-scale fruit spoilage and reduced productivity. The resulting mechanical injuries (cuts and punctures) lead to fruit decay and reduce the economic value of the crop (Chiejina and Ukeh, 2012). It contains on the average about 6.4% total solids, of which 3.5% is invert sugar, 0.5% citric acid, 0.6% ash, 0.9 protein, 0.53% crude fiber and about 0.05% fat. During the presence of bacteria, yeast and molds, the sugars are rapidly used up and converted into acetic, lactic acid, alcohol and carbon dioxide, the amount of these substances depends on the types of organisms which are most active in a particular sample.

In general preservation and processing of excess food produce reduces losses and gives greater profitability to farmers. Microorganisms the principal cause of food spoilage are active spoilage agents of fresh and preserved produce which render produce poisonous by their activities. They are affected by temperature, moisture, oxygen concentration, available nutrients, presence or absence of growth inhibitors etc. This research was conducted the determine the microbial load, fungi count and yeast and mould count in a sample of locally produced tomato paste and tomato powder stored outside a controlled environment for a duration of 10 days.

Materials and method

Mature fresh tomatoes were purchased from Eke market located in Afikpo, Ebonyi State.

Preparation of Tomato Powder

Fresh and healthy tomatoes were selected and washed with clean water. The clean tomatoes were cut into slices of 7mm thickness and laid on a drying tray, after which was put out under the sun to dry. Sun drying was done between the hours of 10am to 4pm for two (2) days. The dried tomatoes were blended into a powder form. The tomato powder was kept on a rack and was exposed to environmental conditions.

Preparation of Tomato Paste

Fresh and healthy tomatoes were selected and washed with clean water. The tomatoes were ground into a paste in an electric plastic blender under hygienic condition. The homogenous mixture of the paste was heated quickly in a large pot with continuous stirring to prevent burning to reduce its moisture content. The hot tomatoes were then put into bottles and the bottles were immersed

into a very hot water at 100ºc contained in a stainless steel pot. This temperature was kept constant for 20 mins, after which the bottles were removed. The tomatoes were kept on a rack and were exposed to environmental conditions.

Sample Preparation

The tomato paste and tomato powder collected were weighed and macerated, and placed on a sterile aluminum foil. 1 gram of tomato paste and tomato powder was weighed and homogenized with 9ml of sterile distilled water in a 250ml beaker.

Culture Media Preparation

The samples containing tomato paste and tomato powder were analyzed using Ugwu et al method. Nutrient agar was used in preparing the general-purpose culture medium for bacteria. 7g of the medium was dissolved in 250ml of sterile distilled water and it was agitated until completely dissolved. It was dispensed into an infusion bottle and sterilized at 121ºC for 15mins

Preparation of Serial Dilution

A seven-fold serial dilution was made, the test tube was filled with 9ml of distilled water using pipette, 1ml of the tomato paste and tomato powder was transferred differently with the aid of a pipette into the first assigned test tube 10-1 (making it 10ml), and thoroughly mixed after which immediately was covered with cotton wool, further sequential dilution was made by taking 1ml of 10ml to other test tubes 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} for uniform distribution of the cells. After serial dilution, the sterilized agar was poured into the Petridish, 1ml of the aliquots taken from 10^{-1} and 10^{-7} dilutions of each were transferred to sterile Petri plates with three replicates for each dilution for bacteria and fungi isolates. Nutrient agar for bacteria and Potato Dextrose Agar for fungi were poured into Petri dishes (pour plate method). Plates were incubated at room temperature (28 ± 2^0C) for 24hours (for bacteria isolates) in inverted position and 3-5 days for fungi isolates and after 5 days for yeast and moulds under fluorescent daylight. Colony forming units per grams (CFU/g) were counted using laser colony counter as described by Mukhtar et al.,(2010) .

Results and Discussion

Table 1: Microbial Analysis of Tomato Paste and Tomato Powder

Sample	TML (cfu/g)	YnM (cfu/g)	TFC(cfu/g
TF (5 days)	1.05×10^1	1.01×10^1	2.15×10^1
TF (10 days)	1.36×10^1	1.08×10^1	2.32×10^1
TT (5 days)	1.81×10^1	3.04×10^1	2.13×10^1
TT (10 days)	2.06×10^1	9.56×10^1	7.57×10^1

*Mean ± Standard Deviation (SD) of triplicate determination

TF = Tomato Flour TT= Tomato Paste

Microbial analysis of tomato paste and tomato flour

The results obtained from the microbial quality investigated are shown in Table 1. The result obtained showed that the total microbial load were low in all tomatoes sample evaluated (< $1.5x10^2$ cfu/g).

There was an observed increase in the total microbial load of the tomato flour and tomato paste as the number of days increases. The highest total microbial load was recorded in the tomato paste stored for 10 days with a total microbial load of 2.06 x 10^1 cfu/g. the high oil content must be responsible. The high oil and fibre content are critical to the survival of microbes and will ultimately affect the shelf stability of the product (Ezeama, 2007).

There was an observed increase in the yeast and mould and total fungal count (cfu/g) as the storage period increased. Value obtained ranged between 1.01 x 10^1 - 9.56 x 10^1 and 2.15 x 10^1 – 7.57 x 10^1 for yeast and mould and total fungal count respectively. Tomato paste stored for 10 days was observed to record the highest yeast and mould and total fungal content ($9.56x10^1$ and $7.57x10^1$) the yeast/mould and total fungal count content of the sample analyzed were lower than the maximum limit 10 cfu/g maximum) stimulated by codex Alimentarius (CAC, 2011), which implies good implementation of good manufacturing practice (GMP).

Conclusion

Microbial analysis shows that the tomato flour had a lower microbial load during the storage period under review indicating a longer storability compared to the tomato paste. The study showed that significant difference exist in the microbial composition of samples containing tomato paste and tomato powder.

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