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EFFECTS OF SOME TREATMENT PROCESSESON MICROORGANISMSASSOCIATED WITH FRESH CARROTS FROM SELECTED MARKETS IN GOMBE METROPOLIS

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Abstract

This study was aimed at analyzing the treatment effects of vinegar, salt and blanching on the growth of pathogenic microbes associated with fresh carrots. A total of 36 samples were bought from three different sellers in three different markets namely Gombe main market, Cross market and Tumfure market and then treated in the laboratory. The samples were subjected to the treatment processes for a precise contact time, the samples were further plated and isolates were observed for further result analysis. The mean colony count of the isolates obtained after treatment processes ranged from $1.34x10^2$-$1.85x10^2$ with average counts of 1.55 $X10^2$ for vinegar, $1.98x10^3$-$2.32x10^3$ with average counts of $2.14X10^3$ for salt broth, 2.72 $x10^4$- $3.48x10^4$ with average counts of 3.14 $X10^4$ for blanching while the mean count of the carrot without pretreatment ranged from $5.65x10^5$-$6.95x10^5$ with average counts of 6.03 $X10^5$ for bacteria. The occurrence of fungi isolates ranged from 0-2 growth for vinegar, 1-4 growth for blanching, 9 growth for salt broth while the control had a range of 4-16 species occurrence. The results obtained from the treatment of carrot indicates that the higher inhibitive effect of microbial growth was found to be associated with vinegar at 1.55 $X10^2$ cfu/mL and a negligible fungi growth while the average effect was found when salt was used at $2.14X10^3$ with the least fungi inhibition while blanching has the least inhibitive effect at 3.14 $X10^4$cfu/ml for bacteria and appreciable inhibition of fungi growth. It can be concluded that vinegar had the antibacterial and antifungal effectiveness on the samples treated and the inhibitory activity ranges depending on the constituents of the reagents. Vinegar used had the highest inhibitory effect and greater susceptibility of the microorganisms due to the presence of acetic acid in the vinegar which is lethal to the existence and growth of the microorganisms while salt as broth had the mild effect and minimal susceptibility on the microorganisms and finally blanching was least effective and the susceptibility of the microorganisms was abridged. Vinegar should be used by both consumers and sellers to ensure the reduction of microorganisms and provide healthy fruits that can be stored for a long time or eaten with less pathogens.

Keywords: Carrot, Treatment, Blanching, Period, Vinegar, Salt and Effect

Introduction

The quality of food can be adversely affected by physical, chemical, biochemical and microbiological processes. Quality deterioration caused by microorganisms may include a wide range of types of spoilage that are undesirable commercially, because they limit shelf life or lead to quality complaints, but are safe from a public health point of view. More seriously, the presence or growth of infectious or toxicogenic microorganisms (foodborne pathogens) represent the worst forms of quality deterioration, because they threaten the health of the consumer (ICMSF, 1996). Therefore, while the aim of effective food preservation is to control all forms of quality deterioration, the overriding priority is always to minimize the potential for the occurrence and growth of food spoilage and food poisoning microorganisms (ICMSF, 1996).

Carrot (*Daucuscarota*subsp. Sativus, Etymology: Middle French carotte, from Late Latin carōta, from Greek karōton, originally from the Indo-European root ker- (horn), due to its horn-like shape) is a root vegetable, usually orange in color, though purple, red, white, and yellow varieties exist. It has a crisp texture when fresh. The most commonly eaten part of a carrot is a taproot, although the greens are edible as well. It is a domesticated form of the wild carrot Daucuscarota, native to Europe and southwestern Asia. The domestic carrot has been selectively bred for its greatly enlarged and more palatable, less woody-textured edible taproot. The dietary intake of β-carotene has been inversely linked to the prevention of cancer, age-related macular degeneration (Seddon*et al*., 1994), and cardiovascular disease (Riemersma*et al*., 1991; Eichholzer*et al*., 1992; and Singh *et al*., 1993). β-carotene is also a most effective vitamin A precursor, and has been reported to protect humans against certain types of cancer and cardiovascular diseases (Steinmetz, 1996). It is a biennial plant which grows a rosette of leaves in the spring and summer, while building up the stout taproot, which stores large amounts of sugars for the plant to flower in the second year. The flowering stem grows to about 1 metre (3 ft.) tall, with an umbel of white flowers that produce a fruit called a mericarp by botanists, which is a type of schizocarp. The carrot gets its characteristic and bright orange colour from β-carotene, which is metabolized into vitamin A in humans when bile salts are present in the intestines. Massive overconsumption of carrots can cause carotenosis, a benign condition in which the skin turns orange. Carrots are also rich in dietary fibre, antioxidants, and minerals. Kaur*et al*., (2009) reported the consumption of carrot mainly as raw, juice, salads, cooked vegetable, sweet dishes etc. Fruit and vegetable juices have become important in recent years due to overall increase in natural juice consumption as an alternative to the traditional caffeine containing beverages such as coffee, tea, or carbonated soft drinks.

Carrot is the second most important vegetable in Germany and the quantity sold is about 547073t year^{-1} with an annual consumption of seven kg per person (Habegger and Graβmann 2007). World total production is about 27.39 million in

the year 2008. The average yield in Germany is 53.5 t $ha^{-1}$and in the world it is 22.41t ha^{-1} (FAO, 2008). In Myanmar, carrot can be grown in upland areas like Shan State and PyinOoLwin throughout the year and in lowlands it can be grown only in the winter season. The average yield of carrot in Myanmar is 5 to 12 t ha^{-1}, quite low as compared to world average. There are three major categories of constraints that hamper the vegetable production in tropical developing countries: environmental, technical and socioeconomic restrictions. Depending on the nature of the crop and circumstances, the solutions to overcome these constraints will be different (AVRDC, 1997).At this stage, the quality defect can be reversed by dipping the carrots in water and allowing for rehydration (Cisneros-Zevallosand Krochta, 2003).

Blanching consists of mild heat treatment of vegetables in different heating system (Steam, hot water and microwave) to varying time periods. It is influenced by various factors such as blanching media, temperature, time, physical and physiological characteristics of the vegetables, average size of the pieces and uniformity of heat distribution and penetration. (Muftagil, 1985 and Masure and Campbell, 1944). The factors are highly specific for different leafy vegetables as the surface area exposed per unit mass varies from one to another. (Giannakourou and Taoukis, 2003).

Salt (NaCl; MW 58.44) is one of the most important adjuncts in food preservation for centuries. It is employed on large scale, especially for meat, fish and vegetables. Salt has retained its importance in food preservation to the present day, although it is now used less as a preservative in its own right than in combination with other preservatives and preservation methods. Salt is obtained from rock salt deposits and seawater. The rock salt obtained by mining is not sufficiently pure for use in food. To produce salt for culinary purposes, rock salt is dissolved underground in water and, after appropriate purification, is dried by evaporation in large pans. To obtain sea salt, sea water is allowed to evaporate in shallow tanks in hot countries by solar heat, thus causing the individual salts contained in seawater to crystallize out in succession (Kaufmann, 1960). Salt lowers the water activity of a system and thus renders conditions less favorable to microbial life. Its mode of action is therefore comparable with that of drying; hence the term "chemical drying" to describe the used of salt. However, since the water activity value of saturated salt solution is only about 0.75 and a number of microorganism varieties are able to grow even below this limit, it is impossible to protect a food stuff reliably from all microbial attack by using salt alone, unless the flavor becomes completely unacceptable (Kushner 1971).

Methodology

Sample collection

A total of 36 samples were bought, 4 samples from 3 sellers in 3 markets namely: Cross (old) market, Gombe main market and Tumfure market and brought to the laboratory for treatment.

Sample preparation for treatment

The carrots were weighed on a measuring scale and washed using clean, distilled water, to remove dirt and dust, drain the samples. The carrots were sliced using a grater. The samples were weighed using an electric measuring scale.

Treatment Process(s) procedure
Blanching process

One (1) g of the weighed sample was picked and blanched in hot water at 65^0C for 5 minutes. After the timing was attained the sample was removed from the hot water and was rinsed with distilled water and drained for 5 minutes (Agarry*et al.,* 2005).

Salt preservative

Bowls were prepared and 2 litres of cold water was poured into it and then 0.6g of sodium chloride was dissolved in each bowl. The samples were added into the bowl and the timing was monitored, then each sample was removed when the timing was attained (10 minutes), plenty of distilled water was used to rinse the sample, and drained for 5 minutes (Sultana *et al*., 2014).

Vinegar (fermented apple) solution

Fifty (50) ml of the vinegar was poured in a bowl. The samples were added into the bowl and monitor the timing, when the timing was attained removed the samples, it was rinsed under clean cold running water and allowed to drain for 5 minutes (Sengun*et al.,* 2004).

Control Procedure

One (1) gram of the carrot was weighed into distilled water for 5 minutes. After the timing is attained, the carrot was removed and drained.

Procedure for treated sample analysis

One (1) g of the carrot of each treated sample include the control sample to be analyzed was measured into 9ml of distilled water and shook thoroughly to form homogenate (a stock solution). Five (5) test tubes containing 9ml of the distilled water were arranged. Using a micro pipette, 1ml of the soaked sample was drawn and into the first tube containing 9ml of distilled water and shake evenly, another 1ml was drawn from the first test tube into the second test tube and shake evenly, this procedure was repeated until the last test tube.

Isolation of microorganism Isolates

Using a micro pipette 1ml of each of the sample from Dilution 10^{-1}, 10^{-3} and 10^{-5} was inoculated in triplicate onto Nutrient agar (for total Viable bacteria) and Potato dextrose agar containing 0.1% streptomycin (for fungi) using pour-plate technique, and then incubated under aerobic condition at 37^0C for 24 hours for bacteria, with the exception of Potato dextrose agar plates which were incubated at 25^0C for 5 days for fungi (Nyenje*et al*., 2012). Finally, the characteristics, number of the colonies formed by the control were compared with the pretreated samples to determine the effectiveness of the treatment processes.

Enumeration

The effectiveness of the treatment were determine by the average numbers of colonies on the nutrients agar after incubation for specified number of days at specified temperature. The total viable cells formed of both the bacteria and fungi were counted using digital colony counter andrecorded, and expressed as colony forming unit per ml of sample homogenate (cfu/ml) (Clarence *et al*., 2009).

Results

In all, a total of 36 carrots were obtained from the three sources viz, Cross market and Main market in Gombe and Tunfure market. Each sample pretreated against fungi and bacteria associated with its spoilage was found to be effective but with an appreciable reduction in the pretreated samples when pretreated with reagents and when compared with the control.

In this work, both bacteria and fungi species were isolated and enumerated. The bacterial isolates were counted for the viable colony formed. The fungi species were also enumerated base on occurrences and there frequency computed and compared with the control the species.

Bacterial count

Total colony counts of the bacteria were recorded from the test samples. The most

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Bacterial count

Total colony counts of the bacteria were recorded from the test samples. The most effective pretreatment reduced the microbial count. The colonial formed units are shown in table 1 from the three proposed market as it can be seen below.

Fungi count

As in bacteria fungi were also observed and enumerated from the samples plated. But in some pretreated cases we found no growth on the plate due to the effect of the reagents. Table 2 shows the occurrence of fungi from the three proposed market.

Discussion of Results

Carrot is an edible as a nutritious fruit and enjoyed by people globally due to it sweet

taste and crisp nature when cut into pieces or eaten as whole. In this study carrot from all the markets had microorganisms but they vary in numbers from one seller to another and ranged from ($5.65X10^5$ – $6.59x10^5$) for bacteria. And an occurrence rate of 4-16 growth for fungi. This can be attributed to the poor personal and environmental hygiene, handling, transportation and storage problems.

The microbial colony count after treatment indicated $3.48X10^4$, $3.48\ X10^4$, $2.72X10^4$ bacterial growth count with an average count of $3.14\ X10^4$ for blanching process, $1.34X10^2$, $1.49\ X10^2$, $1.82X10^2$ bacterial growth count and an average count of $1.55\ X10^2$ for vinegar and $1.98X10^3$, $2.12\ X10^3$, $2.32X10^3$ bacterial growth count with an average count of $2.14X10^3$for salt broth respectively compared with that of control $6.95\ X10^5$, $5.65\ X10^5$ and $5.80\ X10^5$ bacterial growth count with average count of $6.03X10^5$ **Table1**. The occurrence of fungi after pretreatment process also indicated four (4) fungal growth for blanching, two fungal (2) growth for vinegar and nine (9) fungal growths for salt broth treatment respectively compared to the control which gave a total of sixteen (16) fungal growths **Table 2**.

From the results it is clearly shown that blanching process does not have great effect on the bacteria when compared with the control $3.14\ X10^4$ and $6.03\ X10^5$ average counts respectively but mild effect was displayed with fungi when compared with the control with frequency of occurrence of 4 and 16 respectively. Salt broth had a mild effect on the bacteria when compared with the control $2.14X10^3$ and $6.03\ X10^5$ average counts respectively but little effect was displayed with fungi when compared with the control with frequency of occurrence of 9 and 16 respectively. The highest microbial activities was observed in vinegar when compared with control $1.55\ X10^2$ and $6.03\ X10^5$ average counts for bacteria and frequency of 2 compared with control 16 for fungal as represented in **Table 1 and 2**. The highest antimicrobial activity carried out by vinegar might be attributed to the constituents present in the vinegar.

Table 1: The effectiveness of each of the pretreatment process on bacterial isolates

S/n	Market	Mean Bacterial plate Count (cfu/mL)			
	C	**B**	**V**	**S**	
1.	Gombe main market	$6.95X10^5$	$3.22X10^4$	$1.82X10^2$	$2.32X10^3$
2.	Cross Market	$5.65X10^5$	$3.48X10^4$	$1.49X10^2$	$2.12X10^3$
3.	Tunfure market	$5.80X10^5$	$2.72X10^4$	$1.34X10^2$	$1.98X10^3$
	Average	$6.03\ X10^5$	$3.14\ X10^4$	$1.55\ X10^2$	$2.14X10^3$

KEY: C= Control B= Blanching V= Vinegar broth S= Salt broth

Table 2: The effectiveness of each of the pretreatment process on fungal isolates

S/N	Market	Mean frequency occurrence of fungi			
		C	**B**	**V**	**S**
1	Gombe main market	4	1	0	3
2	Cross market		7	2	1	3
3	Tumfure market	5	1	1	3
	Total		16	4	2	9

Key: C=Control, B= Blanching V= Vinegar broth S=Salt broth

The use of vinegar as in pickling was able to reduce microbial growth of bacterial colonies when compared and also inhibit the growth of most fungal species; the success of fungi inhibition was due to the effect of the vinegar on the organisms at the given contact time. Vinegar also maintained the color characteristic softness and the scent with and additional mineral that helps inhibits future microbial colonization for a given period. We cannot conclude that the pretreatment process really reduced the microbial population just like that, but due to the stipulated contact period that was ensured during the pretreatment and also avoiding contamination careful and professional handling of the samples.

Bleaching the carrot did not reduce much bacterial load when compared to the control, but the use of salt broth was able to reduce the bacterial. The salt treatment process was found to be averagely on the carrot sample which were brought from different sellers and markets($1.98X10^3$) for bacteria but was least effective for fungi growth (3) growths. The blanching effect on the carrot was seen to be the least in microbial reduction and this was due to the fact that the blanching process although has a high temperature and some contact time was not able to reduce an appreciable amount due to the nature of the wild organisms as some cannot be destroyed at the blanched temperature as well as some developed an immediate immunity to the blanching.

Conclusion

From the results, based on the activity it is advisable that the effectiveness of the treatment on both bacteria and fungi ranges from the most effective to the least effective. The bacteria found on the treated samples were counted and compared with the control and the susceptibility of the microorganisms to the treatment. Vinegar was highly effective on the microorganisms followed by salt broth that had mild effect and while blanching had least effect and the susceptibility was minimal as shown in table 1 and 2.The predisposition of the carrot to the treatment process really slowed the growth of microorganisms and ensured the proper handling procedures to have a good and healthy food vegetables.

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