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EFFECT OF SELECTED SPICES ON FOOD SPOILAGE RATE

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Abstract

Food preservation aims at stopping or slowing down spoilage (loss of quality, edibility or nutritional value) of food. This study's intent was to determine the effect of sage, ginger, cumin, garlic and mixed spice on spoilage rate of cooked pumpkin. The study used an experiment where objective evaluation and subjective evaluation were employed. A t-test was used to find significant differences and Pearson correlation for correlations at a significance level of 0.05. Findings showed a significance ($p<0.05$) difference in bacterial growth between the food samples with spices and the control. Of the spiced food samples, one with garlic had the lowest bacterial count (1) and took the longest time to spoil (5 days). Pearson correlation showed an inverse relationship between bacterial growth and the time taken for the food to spoil. Moreover, spices help to preserve as well as improve on the shelf life of food items.

Key words: spice, food, prevention, spoilage.

1.0 Introduction

Food preservation aims at stopping or slowing down spoilage (loss of quality, edibility or nutritional value) of food. It prevents growth of microorganisms such as bacteria and fungi, as well as retarding the oxidation of fats which cause rancidity. There has been increasing concern on safety of chemical food additives since presence of these chemicals could be toxic to humans (Bedin *et al.*, 1999). According to Oiye and Muroki (2002), natural methods of preservation and natural preservatives are receiving increased attention. Spices are commonly used as medicinal and as flavouring agents in foods. Additionally, adding spices to food would increase its shelf-life preventing food loss due to their antioxidant and antimicrobial benefits (Oiye and Muroki, 2002).

Evidence from studies has shown the antimicrobial properties of spices. Arora and Kaur (1999) analyzed the antimicrobial activity of garlic, ginger, clove, black pepper and ground green chilli and their aqueous extracts on human pathogenic bacteria including *Bacillus sphaericus, Staphylococcus aureus*, *S. epidermidis, Enterobacteraerogenes, Escherichia coli, Pseudomonas aeruginosa, Salmonella tiphy* and *Shiguellaflexneri*. They found that all tested bacteria were sensitive to ground garlic and its extract. Moreover, garlic extract showed considerable cidal effect on *S. epidermidis, S. tiphy* and *E. aerogenes*. In another study by Sakagami *et al.* (2000), garlic extract inhibited vero-toxin production by enterohemorrhagic *Escherichia coli*. The antioxidant compounds of spices such as rosemary, cinnamon, sage, clove among others have been investigated and found to be effective (Oiye and Muroki, 2002). However, still little information is available emphasizing the preservative and antimicrobial role of spices in foods.

Maintaining or creating nutritional value, texture and flavour is an important aspect of food preservation. Although use of spices may not be employed as a primary preservative method, addition of spices aid in preserving foods. In this study, pumpkin was chosen as the food of choice onto which spices were added. Pumpkin is among the economically most important vegetable crop worldwide with a rich source of nutrients and is grown in both temperate and tropical regions (Sanjur *et al.*, 2002). Thus, this study's intent was to determine the effect of sage, ginger, cumin, garlic and mixed spice on spoilage rate of cooked pumpkin.

2.0 Materials and Methods

An experiment was done at the foods and nutrition laboratory of the University of Eastern Africa, Baraton. Objective evaluation (microscopic evaluation) and subjective evaluation (sensory test) were employed. One medium pumpkin and the spices used in the study were obtained from Eldoret market. The Pumpkin was cleaned, cut, peeled, boiled to tender and blended until it formed an even soup. This was then divided into six samples of 50 ml, five of which 1 tea spoon of dry ground spices (mixed spice, sage, garlic, cumin and ginger) were added respectively. One portion was left for control (without spice).

Each sample was cooked further stirring it for 15 minutes. When done, the samples were kept safely at room temperature. Observations were made on a 24-hourly basis for any sign of spoilage. Sensory evaluation was done to assess the spoilage by observing changes on texture, flavor, color and smell. The time taken for the food to spoil was noted.

Objective evaluation entailed preparing a culture from each sample in a nutrient agar. The cultured samples were incubated for 24 hours, to allow maximum microbial growth, at room temperature. The microbial growth from the culture was observed, bacterial count done by counting the bacterial colonies and confirmed through Gram staining.

Data obtained was analysed at a significance level of 0.05. Two statistical tests were employed: t-test was used to find significance differences and Pearson correlation for correlation.

3.0 Results

As shown in Figure 3.1, findings from subjective evaluation on time taken for the food to spoil showed that the food sample with garlic took the longest time (5 days) while the sample with mixed spice and control were the first to spoil (2 days).

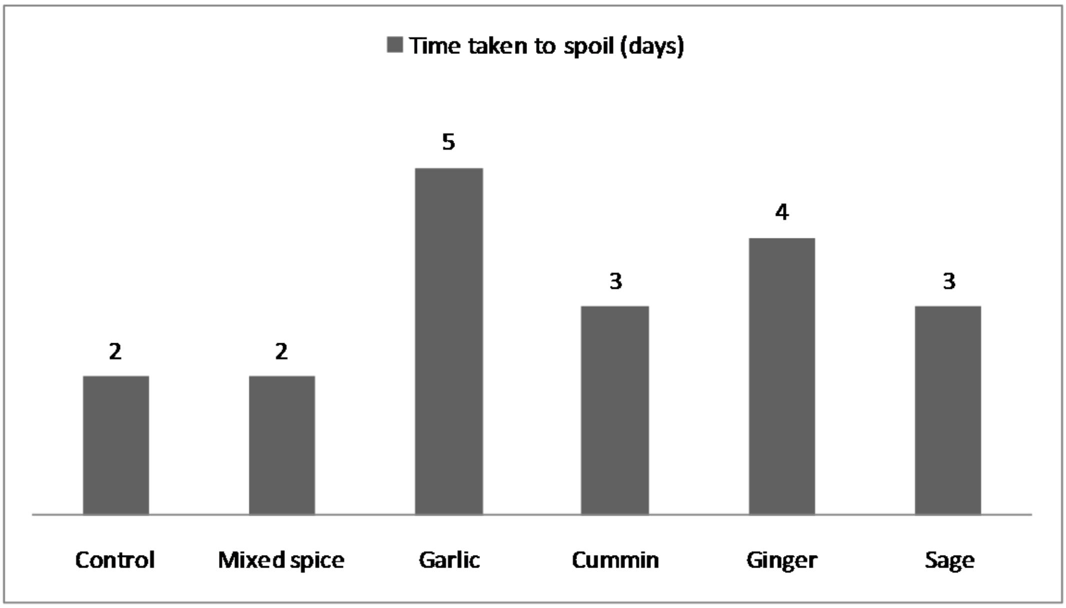

Figure 3.1 Time taken for the food sample to spoil

Findings from objective evaluation showed that the food sample with garlic had only one bacterium while sample without spice had many bacteria (102) followed by those with mixed spice (80), cummin (52), ginger (48) and sage (35) as indicated in Table 3.1.

Table 3.1: Results of bacterial count from cultures of samples

Spice added	Bacteria present	Bacterial count
None (control)	√	102
Mixed spice	√	80
Cummin	√	52
Ginger	√	48
Sage	√	35
Garlic	√	1

Key √-Yes ×-No

T-test was done to find a significant difference in bacterial count between control and spiced food samples (Table 3.2).

Table 3.2: Differences in bacterial count in food samples

Food sample	Bacterial count	Statistical test
Mixed spice	80	t= -4.576, 4df, p= 0.010
Garlic	1	
Cummin	4	
Ginger	52	
Sage	35	

There was a significance (t= -4.576, 4df, p= 0.010) difference in the bacterial count between control and food samples with added spices.

Pearson correlation showed an inverse relationship (r= -.888, p= 0. 044) between bacterial growth and the time taken for the food to spoil. Food with high bacterial concentration was more likely to spoil faster.

4.0 Discussion

Deterioration of food quality occurs during processing and storage. Spices are recognized to stabilize foods from microbial deterioration. They help preserve the freshness of food by inhibiting bacterial growth on/in the food. This could be observed when spices show initially high microbial change and as time progresses, the microbial growth become progressively slower or it is eventually totally suppressed (Kizil and Sogut, 2003).

From the study findings, garlic was found to be more effective in preventing food spoilage. This is in tandem with findings from other studies. In a study by Ankri (1999), various garlic preparations exhibited a wide spectrum of antibacterial activity against Gram-negative and Gram-positive bacteria including species of Escherichia, Salmonella, Staphylococcus, Streptococcus, Klebsiealla, Proteus, Bacillus and Clostridium. All this is due to allicin properties of garlic. The antimicrobial effect of allicin is due to its chemical reaction with thiol groups of various enzymes (Ankri and Mwelman, 1999).

Other food samples with cummin, ginger and sage spices fairly took longer to spoil as compared to the control. Spices such as sage exhibit antioxidant and antimicrobial properties and have not been found to have toxic substances (Oiye and Muroki, 2002). According to Skrinjar (2009), spices owe their antimicrobial properties mostly to the presence of alkaloids, phenols, glycosides, steroids, essential oils, coumarins and tannins. Further, the mode by which microorganisms are inhibited by spices and their chemical compounds seems to involve different mechanisms. For example, inhibition has been found to involve phenolic compounds (Kim *et al*., 1995).

The food sample with mixed spice spoiled faster than those with the rest of selected spices. This can be due the combination of spices which could reduce the antimicrobial activity. Similarly, the magnitude of synergistic interactions between the mixtures of spices or their individual components is too low to be of any practical importance (Kalemba and Kunicka, 2003). Some studies have reported that the whole spice or extracts have a greater activity than the major components mixed together (Gill and Holley, 2006; Lambert *et al*., 2001). According to Burt (2004), minor components are critical to antimicrobial activity and may have a synergistic effect or potentiating influence on prevention of food spoilage.

5.0 Conclusion

Spices not only add flavor to food but also preserve and improve on the shelf life of food items. From the study findings, addition of spices to food had an effect in reducing food spoilage. Garlic was found to be the most effective in enhancing food preservation. However, use of the mixed spice showed no considerable difference from the control in the time taken for the food to spoil. This calls for further investigation on effects of using mixed spices and such products as Royco which contain several spices.

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