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Effects of Three Organic Spices (Ginger, Clove, and Turmeric) on the Proximate and Sensory Properties of Tomato Powder

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Abstract. In this study, the effects of three organic spices (ginger, clove and turmeric) on the proximate and sensory properties of tomato powder evaluated revealed that moisture, ash, crude fiber, fat, protein and carbohydrate content ranged from 15.89 - 18.60%, 5.50 - 7.41%, 5.32 - 7.41%, 4.10 - 4.59%, 11.40 - 14.65% and 51.33 - 52.47% respectively. The increase in the proportion of organic spices decreased the moisture content and protein content while increasing significantly the ash and carbohydrate content of the samples. However, the fat content of the control and sample DDD were significantly different ($P \leq 0.05$). The increase in the ash content of the supplemented samples could be attributed to the minerals and phytochemical abundance in organic spices. Generally, consumer's preference decreased with increase in the proportion of organic spices. This could be because the products are novel to most people.

Keywords: Organic spices, proximate, sensory, tomato powder

INTRODUCTION

The Spanish were the first to find in the American hemisphere a herbacea plant whose fruit was edible, called "tomati", which translated to Spanish became tomato (Coto et al., 2012). There are known different varieties of tomato, round, oval, "cherry", but all have the same nutritional characteristics, being an important source of: potassium, phosphorus, magnesium, iron, so necessary to the normal activity of nerves and muscles (Dujic et al., 2009). Tomato is the edible often red fruit of the plant *Solanum lycopersicon* commonly known as tomato plant. It belongs to the night shade family, Solanaceae. The phylogenetic classification of the Solanaceae has been recently revised and the genus Lycopersicon re-integrated into the *Solanum* genus with its new nomenclature. *Solanum lycopersicon* is the only domesticated species it is an annual crop which can grow to a height of 70 - 200 cm (Peralta & Spooner, 2007).

According to Food and Agriculture Organization Statistics in 2014, tomato production accounts for about 4.8 million hectares land area globally with an estimated production of 162 million tons. It is highly seasonal, perishable and available in large quantities at a particular season of the year. Tomato fruits are high in beta carotenes, vitamins A and C (Grubeen, 2003). Tomatoes are relatively low in fat content (Opega, Yusufu, Kadri, & Ishaka, 2017). Lipid fraction of tomatoes is composed of triglycerides, diglycerides, sterols, sterol esters, free fatty acids, and hydrocarbons. Kapp (1966) initiated investigations on the total lipids in the pericarp of tomatoes but found no definite relationship with color development. He reported that total lipids varied with cultivar, fruit maturity at harvest, and storage treatment. Opega, Yusufu, Kadri, & Ishaka (2017) studied the composition of vegetables and observed that starch accumulated until nearly the large-green stage and then rapidly decreased. Relatively low starch contents in the last stage of tomatoes fruit maturation were noticed by Davies (2006); Rosa (2006); Sando (2000); and Saywell & Cruess (2002). Despite all the numerous benefit from the crop, many challenges are making its production unprofitable in most developing countries especially those in Africa. The marketing of fresh tomato during the season is a great problem because of its short post-harvest life, which leads to high post-harvest losses (Jadhav & Salunkhe, 1972; Oliveira, Reis, Sacramento, Duarte, & Oliveira, 2009).

Tomato is one of the popular and versatile vegetable all over the world, plays a vital role in providing a substantial quantity of vitamin C and vitamin A in human diet. The fruits are eaten raw or cooked. It is most popular as salad in the raw state and is made into soups, juice, ketchup, pickles, sauces, conserves, puree, paste, powder and other products (Nahar & Gretzmacher, 2011). Tomato and their products are the major source of lycopene and are considered to be important contributors of carotenoids in human diet (Guola & Adamopoulos, 2005; Tapiero, Townsend, & Tew, 2004). Nutrition involves not only nourishing the body but also protection against harmful organisms. Organic spices do not only possess the ability to impact desirable culinary attributes, they also possess anti-microbial, anti-oxidant and anti-inflammatory substances. These substances help to protect the body against certain diseases and infections. Therefore, there is the need to incorporate these spices into our diet. Additives used in food processing can be natural or synthetic in nature. The use of natural additives in food processing has been encouraged due to the health hazards, non-nutritiveness and high cost usually associated with their synthetic counter parts. Hence, this research work is aimed to determining the effects of three

selected natural additives (ginger, clove, and turmeric) on the proximate and sensory properties of tomato powder/organic spices blends in order to encourage the use of natural additives and to establish their best concentrations for the production of tomato powder.

MATERIALS AND METHODS

Materials and Methods

Fresh tomatoes (*S. lycopersicon*) used for this study was obtained from Anyigba central market in Kogi State, Nigeria. Other materials, apparatus and equipment used were obtained from Food Science and Technology laboratory and Biochemistry laboratory, both in Prince Abubakar Audu University, Anyigba, Kogi State, Nigeria.

Sample Preparation

Ripe but firm uniform *Roma saladette* (red coloured tomato varieties) were selected. They were washed thoroughly with tap water, rinsed with distilled water as described by Owusu, Ma, Wang, & Amissah (2012). The tomatoes were blanched in boiling water (100 °C for 10 seconds), sliced and spread on an open tray. It was then dried for 3 days using green house. The dried tomato slices were reduced into powder by milling using hammer mill. The powdered spices were added with three organic spices (ginger, clove and turmeric) and mixed at ratio to give each sample. The experimental data generated were statistically analysed using analysis of variance (ANOVA) using SPSS version 20.0. Duncan multiple range test was used to separate the mean at $p < 0.05$ significant differences.

Sample Codes

AAA **:** 95% tomato, 1% ginger, 1% clove, 3% turmeric

BBB **:** 90% tomato, 2% ginger, 2% clove, 6% turmeric

CCC **:** 85% tomato, 3% ginger, 3% clove, 9% turmeric

DDD **:** 80% tomato, 5% ginger, 5% clove, 10% turmeric

EEE **:** 100% tomato, 0% ginger, 0% clove, 0% turmeric

RESULTS AND DISCUSSION

The result of the proximate composition of tomato/organic spices made from four different blends are shown in Table 1. Moisture ranged from 15.89 - 18.60%. Moisture content decreased with increase in organic spices. This result was expected since tomato is a juicy vegetable with high water composition. This result shows that the shelf life of tomato powder could be improved with increase in the proportion of organic spices. The ash content of the samples ranged from 5.50 - 8.47%. The 100% tomato is the lowest while 80% tomato was highest. This could be attributed to the aboundance of minerals inherent in organic spices. Crude fiber and fat content ranged from 8.32 - 6.93% and 4.59 - 4.10% respectively, while potein and carbohydrate content of the samples ranged from 14.65 - 11.40% and 52.47 - 52.22% respectively. Protein decreased while carbohydrate increased as the proportion of organic spices increased. This could be as a result of tomato fruits, which has high protein and low carbohydrate compared to the organic spices used.

Table 1. Proximate for each samples.

Sample	Moisture (%)	Ash content (%)	Crude fiber (%)	Fat content (%)	Protein (%)	Carbohydrate (%)
AAA	17.22 ± 0.02^{b}	7.72 ± 0.03^{c}	7.41 ± 0.01^{a}	4.10 ± 0.00^{e}	13.25 ± 0.06^{b}	51.35 ± 0.10^{e}
BBB	16.25 ± 0.07^{c}	8.02 ± 0.03^{b}	7.15 ± 0.07^{b}	4.22 ± 0.02^{cd}	12.66 ± 0.03^{c}	52.08 ± 0.42^{cd}
CCC	15.89 ± 0.01^{d}	8.05 ± 0.07^{b}	7.10 ± 0.00^{b}	4.35 ± 0.07^{c}	11.85 ± 0.06^{d}	52.22 ± 0.22^{bc}
DDD	15.95 ± 0.07^{d}	8.47 ± 0.03^{a}	6.93 ± 0.04^{c}	4.58 ± 0.02^{a}	11.40 ± 0.02^{e}	52.47 ± 0.03^{a}
EEE	18.60 ± 0.00^{a}	5.50 ± 0.00^{d}	5.32 ± 0.02^{d}	4.59 ± 0.01^{a}	14.65 ± 0.06^{a}	51.33 ± 0.04^{e}

**Values represent an average of 2 determinations ± SD. Means with the same superscript in a column are not significantly different ($p \leq 0.05$)*

Table 2 shows the result of sensory attributes of the samples. Colour attributes ranged between 5.8% for sample DDD and 8.30% for sample EEE. Colour acceptability reduced as the level of organic spices increased. The changes observed in the colour could be due to the yellow golden colour impacted by the curcumin present in turmeric (Yew, 2011).There was significant difference ($p < 0.05$) in the samples for all parameters. Sample AAA was rated highest for taste. Thereafter, preference for taste reduced as the proportion of organic spices increased. This could be due to the moderate taste impacted by all the additives.

Table 2. Sensory analysis for tomato powder.

Sample	Color	Taste	Flavor	Texture	General acceptability
AAA	8.00 ± 0.94^{b}	8.30 ± 0.67^{a}	7.80 ± 0.91^{a}	7.80 ± 0.63^{c}	8.50 ± 0.52^{a}
BBB	7.80 ± 0.91^{c}	6.60 ± 0.96^{c}	7.30 ± 1.25^{b}	8.00 ± 0.94^{a}	7.20 ± 0.42^{c}
CCC	6.40 ± 0.84^{d}	4.60 ± 0.96^{d}	6.40 ± 1.2^{c}	7.00 ± 1.15^{d}	6.00 ± 0.81^{d}
DDD	5.80 ± 1.13^{e}	3.90 ± 0.87^{e}	5.60 ± 1.17^{e}	7.80 ± 0.42^{c}	5.30 ± 0.82^{e}
EEE	8.30 ± 0.67^{a}	7.40 ± 1.07^{b}	5.80 ± 0.63^{d}	7.90 ± 0.73^{b}	7.80 ± 0.63^{b}

**Values represent an average of 2 determinations ± SD. Means with the same superscript in a column are not significantly different ($p \leq 0.05$)*

Flavour parameter which is a function of both taste and aroma ranged from 5.60 - 7.80%. Sample AAA was preferred. This could predominantly be due to the moderate taste of sample AAA. Textural properties of the samples ranged from 7.00% for sample CCC to 8.00% for sample BBB. Texture has important roles to play in determining quality and acceptability of the final products (Yagci & Gogus, 2008). Sample AAA was generally accepted by the panelists. This might be due to the much moderate addition of ginger, cloves and turmeric.

CONCLUSIONS

This study revealed that tomato powder can be combined with organic spices at different ratio to produce a richer powder which could be reconstituted to produce tomato sauce and also increase the shelf life through a reduced moisture contents. However, the lesser the proportion of organic spices, the more acceptable it is to consumers. Sample AAA could therefore be produced for commercialization.

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