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Production of Tomatoes Ketchup Using Two Local Spices Uziza and Ehuru

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Abstract : *This study produced tomato ketchup using two local spics that we know Uziza and Ehuru, the study was guided by the following objective; To ascertain the acceptability of the product, analyzed the nutritional facts at different tomato ketchup products. A total of ten (10) dietary supplement and sample comprised orient onions, jeera, cardman, cinnamon, red chilly powder, Ehuru, Uziza, salt, sugar and vinegar obtained from ose market in Onitsha, Anambra state of Nigeria. The study adopted questionnaires, in addition to library research were applied in order to collect data. Primary and secondary sources were used and data was analyzed using statistical package which was presented in frequency tables and percentages. These spices acted as anti-oxidant and also increased mineral constituent of the product which were beneficial to health purposes. The usefulness of this product was strongly recommended for commercial product because of its highly nutritional values. Government should encourage co-operative bodies, individuals to invest in this area of local condiment production and also should provide more sophisticated equipment and machineries to encourage mass production of these spices extracted, thereby making them more available and less expensive.*

Keywords: Tomato ketchup, Uziza, Ehuru, Nutritional values, and Local condiment.

INTRODUCTION

Tomato (*Lycopersicon Esculentum*) is one of the most important vegetables in Nigeria which has been in cultivation for a long time. It is an important component of the daily diet people consume both fresh and in pastry form.

Tomato has a very high water content and this creates storage problems. Tomato has been classified as a high perishable product. Bruising of the fruit occurs during harvesting, packaging and distribution and this predisposes the crop to attack of micro organisms. On these accounts, tomatoes suffer high rate of post harvest losses which coupled with the crops seasonal availability makes it difficult to meet the demand (Onwueme, 2007).

Preservation and processing efforts are being made to prolong the shelf life of tomatoes and ensure its supply all year round. Tomato is processed into various forms such as paste, puree, ketchup, juices and tomato powder. (Ihekoronye and Ngoddy) (2009). Ketchup, Catchup or Catsup, is highly seasoned with salt, pepper and spices, then boiled into a thick liquid and strained through a sieve creating a smooth and thick sauce. There are so many things that people put ketchup on, from hamburgers and fries to eggs, hash brown, mashed potatoes and so much more, (Rozin, 2005).

Ketchup is a sweet and tangy sauce, typically made from tomatoes, vinegar, a sweetener and assorted seasonings and spices.
Ketchup is made from tomatoes and has many health benefits. The ingredients in a typical modern ketchup are tomato concentrated, spirit vinegar, corn syrup or other sugar, salt, spice and herb extracts (including celery), spices and garlic powder, all spices, cloves, cinnamon, onion and other vegetables may be included (USDA National Nutrient Database for Standard, 2007).

The production of tomato ketchup involves a long list of desired flavor which can be added to give new dimensions to the diverse flavor of the ketchup. Therefore this study is aimed at the production of tomato ketchup using two local spices.

Statement of the Problem
In Nigeria, the consumption of tomato ketchup is very low due to high availability of fresh tomato in the market. Many people in the rural areas as a result of illiteracy find it difficult to take ketchup due to its tangent taste and high cost.

As a result of its low market in Nigeria, the local manufacturers are not encouraged to produce it. Processing of the excess tomatoes during the tomato season would have helped to prevent losses. Also there is a need to produce a type of tomato ketchup which is acceptable to our people, with the use of uziza and ehuru.

Objective of the Study
The objectives of this study are as follows: To

1. examine the methods of producing tomato ketchup using two local spices.
2. ascertain the acceptability of the products.
3. analyze the nutritional facts of different tomato ketchup produced.

Research Questions

1. What are the methods of producing tomato ketchup using two local spices?
2. Are the products acceptable?
3. What is the nutritional content of the different product?

LITERATURE REVIEW

History and Source of Tomato Ketchup
The word Ketchup is derived from a Chinese word, ke-tsiop. According to the Oxford English Dictionary the word ke-tsiop is from the (in the Amoy dialect) and means the brain of pickled fish.

By the early 18th Century, the table sauce had made it to the Malay states, where it was discovered by English explorers.

Many variations of ketchup were created, but the tomato-based version did not appear until about a century after other types. By 1801, a recipe for tomato ketchup was created by Sandy Addison and was later printed in an American cookbooks; the sugar cookbook.

As the century progressed, tomato ketchup began its ascent in popularity in the United States. Ketchup was popular long before fresh tomatoes were. Many Americans continued to

question whether it was safe to eat raw tomatoes. However, they were much less hesitant to eat tomatoes as part of a highly processed product that had been cooked and infused with vinegar and spices.

A man named Jonas Yerks (or Yerkes) is belived to have been the first man to make tomato ketchup a national phenomenon. By 1837, he had produced and distributed the condiment nationally. Shortly thereafter, other companies followed suit F. & J. Heinz launched their tomato ketchup in 1876. Heinz tomato ketchup was advertised.

Prior to Heinz (and His fellow innovators) commercial tomato ketchups of that time were watery and thin, in part due to the use of unripe tomatoes, which were low in pectin. They had less vinegar than modern ketchups; by pickling ripe tomatoes, the need for benzoate was eliminated without spoilage or degradation in flavor. But the changes driven by the desire to eliminate benzoate also produced changes that some experts (such as Andrew F. Smith) believed were key to the establishment of tomato ketchup as the dominant American condiment.

Uses of Tomato Ketchup

1. It is used as a flavoring condiment with other food items like French fries, hamburgers, chips, hotdogs and many others.
2. Universally, tomato ketchup is a source of a fermented and sweet pungent taste which is not only delicious but also healthier due to its safe ingredients.
3. The thick paste of the tomato ketchup is widely used to prepare pastas of all kinds.
4. The rich and diverse flavor of the tomato is accompanied by their high viscosity which turns the sauce to be a thick flavoring (USDA) Food Nutrient Database).

Health Benefits

Colon Health

A study published in *American Journal of Clinical Nutrition*, (2011) found that in patients with colorectal 14 adenomas, a type of polyp that is precursor for most colorectal cancers, blood levels of lycopene were 35% lower compared to study subjects with no polyps. Blood levels of beta-carotene also tended to be 25.5% lower, although according to researcher, this difference was not significant. Low levels of lycopene increased risk.

Prostate Health

Tomatoes have been shown to be helpful in reducing the risk of prostrate cancer.
In this study, laboratory animals feed lycopene rich diet and treated with N-methyl-N-nitrosourea (a carcinogen) and testosterone to induce prostrate cancer as rats fed a control diet.

Research concluded this was due to the fact that tomato contain merely lycopene, but a variety of protective phytonutrients and suggests that lycopene found in human prostate tissue and the blood of animals and humans who remain free of prostate cancer of not just lycopene but other compounds working in synergy with it.

When the data from all 21 studies were combined, men who ate the highest amounts of raw tomatoes were found to have an 11% reduction in risk of prostate cancer. These, eating the most cooked products fared even better with a 19% reduction in prostate cancer risk. Even

eating just one 6 ounce serving a day of raw tomatoes provided some benefits a reduction in prostate cancer risk of 39%.

Significance of Anti-Oxidant Protection

In addition to the center-stage phynutrient, lycopene, tomatoes are packed with traditional nutrients that have been shown in many studies to be helpful for all the above conditions.

Example, tomatoes are an excellent source of vitamin C and A, the letter notably through its concentration of carotenoids including beta-carotene. These antioxidants travel through the body neutralizing dangerous free radicals that could otherwise damage cells and cell membranes, escalating inflammation and the progression or seventy of atherosclerosis, diabetic complications, asthma and colon cancer.

In fact, high intakes of these antioxidants have been shown to help to reduce the risk of severity of all these illness.

In addition, tomatoes are very good sources of fiber, which has been shown to lower high cholesterol levels, keep blood sugar levels from getting too high and help prevent colon cancer. A cup of fresh tomato will provide 57.3% of the daily value for Vitamin C, plus 22.4% of the daily value for Vitamin A, and 7.9% of the daily value for fiber.

Reduction in Heart Disease Risk

More good news for those at risk of atherosis, or just trying to avoid it is that tomatoes are very good source of potassium and a good source of niacin, vitamin BC and Folate. Niacin has been used for years as a safe way to lower high blood pressure and reduce the risk of heart disease. Vitamin BC and folate are 19 both needed by the body to convert a potentially dangerous chemical called homocysteine into other beings molecules. High levels of homocysteine, which can directly damage blood vessel walls are associated with an increased risk of heart attack and stroke. All these nutrients work together to make tomatoes a truly heart-healthy food. In a cup of tomato, one will get 11.4% of the daily value for potassium, 5.6% of the daily value for niacin, 7.0% of the daily value for B6 and 6.8% of the daily value for folate.

Blood Clothing Tendencies

Tomato juice can reduce the tendency towards blood clothing, suggests Australian research published in the *Journal of the American Medical Association.* In this study, 20 people with type 2 diabetes were given 250ml (about 8 ounces) of tomato juice or a tomato flavoured placebo daily subjects had no history 21 of clothing problems and were taken no medications that would affect blood clothing ability.

After 3 weeks, platelet aggression (the clumping together of blood cells) was significantly reduced among those drinking red tomato juice, while no such effect was noted in these receiving placebo.

Viscosity of Tomato Ketchup

Tomato ketchup has an additive, usually xanthangum, which gives the condiment a pseudoplastic or “shear thinning” property. This increases the viscosity of the ketchup considerably with a relatively small amount added. Usually 0.5% which can make it difficult to pour from a container. However, the shear thinner property of the gum ensures that when a force is applied to the ketchup it will lower the viscosity enabling the sauce to flow. A

common method to getting ketchup out of bottle involves inverting the bottle and shaking it or hitting the bottom 23 with the heel of the hand, which causes the ketchup to flow rapidly. A technique involves inverting the bottle and forcefully tapping its upper neck with two fingers (index and middle finger together).

***Piper Guineanees* (Uziza)**

Piper guineanees – (Uziza): Is a spice that belong to the piperacear family. Uziza is highly medicinal. It is found to have a stimulating property like pepper and excellent flavoring properties. It has extensive culinary usage, and is used in pickles, ketchups and sauces, for seasoning dishes and in sausages, scrambled eggs and other international foods.

Based on the usefulness and importance among all the spices, black pepper is commonly referred as "the king of spices". It is valued for its flavor, aroma, nutritional and medicinal uses making it an important commodity. It is a natural anti-oxidant, it acts as anti-inflammatory, anticancer, anti-periodic, anti-pyretic and immune enhancer. Also it lowers the cholesterol level in the body. It contains mainly vitamins A, C, E, K, niacin and B carotene and traces of minerals such as iron, calcium, phosphorous, copper, magnesium and zinc.

Chemical Composition

The berries contain 17.1% protein, 1.25% calcium, CHO 11%, fat 2.6%, moisture 1.01%. They also contain an essential oil which mainly account for its flavor.

***Monodora Myristica* (Ehuru)**

The *Monodora* plant belongs to the family of plant called Annonace. In traditional medicine practice, it is widely used to relieve toothache, dysentery, dermatitis, headache, and as worm expeller. When ground to powder, the kernel is used to prepare soup as a stimulant to relieve constipation and control passive uterine hemorrhage in women immediately after child birth. Other uses include the treatment of body aches, chest pains and rashes due to river blindness and leprosy.

Chemical Composition

The seed contain 1.0% moisture, 17.6% protein, 2.8 fat, 5-9% of a colourless essential oil consisting largely of terpenes and with a pleasant taste and smell. 9% CHO, 21% calories and about 33-36% of a reddish brown fixed oil which is mainly lionleic acid 46.9% and oleic acid 35%.

Nutritional Facts of Different Tomato Product

The following table compares the nutritional value of ketchup with raw ripe tomatoes and salsa, based on information from the USDA food nutrient database.

Nutrient (per 10g)	Ketchup	Low sodium ketchup	Tomatoes year-round	USDA commodity Salsa
Energy	100kcal 419KJ	104kcal 435KJ	18kcal 75KJ	36kcal 150KJ
Water	68.33g	66.58g	94.50g	89.70g
Protein	1.74g	1.52g	0.88g	1.50g
Fats	0.49g	0.36g	0.20g	0.20kg
Carbohydrate	25.78g	27.28g	3.92g	7.00g

Sodium	1110mg	20mg	5mg	430mg
Vitamin C	15.1mg	IS.1mg	12.7mg	4mg
Lycopene	17.0mg	19.0mg	2.6mg	n/a

Ketchup has moderate health benefits. Ketchup is a source of lycopene an antioxidant which may help prevent some forms of cancer. This is particularly true of the organic brands of ketchup, which have three times as much lycopene. Ketchup, much like marinara sauce and other cooked tomato foods, yields higher levels of lycopene per serving because of cooking increase lycopene bioavailability.

MATERIALS AND METHODS

Source of the Material

Tomato *(lycopersicon esculentum)* Ehuru *(mondora mynstica)* Uziza *(piper guineanees)* used for this research work of the best quality was obtained from Ose market in Onitsha, Anambra State of Nigeria. Other materials, equipment/chemicals were obtained from the Food Science and Technology Department, Federal Polytechnic Oko Anmabra State.

Recipe/Ingredients

2 spoons of dried onions
Half tea-spoon of Jeera
5 pieces of cardamom
2 spoons of cinnamon
Half teaspoon of red chilly powder
5 pieces of Ehuru
5g of uziza
5g of salt
10-70g of sugar
50ml preservatives (vinegar)

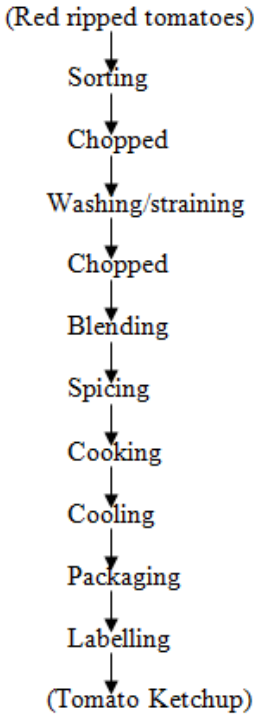
Method/Procedure

The modified method according to (Pretzer, 2011) was adopted. 5kg ripe red quality tomatoes were sorted, washed and chopped. The pulp was transferred into a thick pot and cooked for about 10 minutes. The seeds and skin of the tomatoes were removed by churning and straining immediately. Churning of the skin were removed from the fire precise amount of sugar, salt, spices were added to the tomato pulp to avoid excessive evaporation, vinegar were mixed in later.

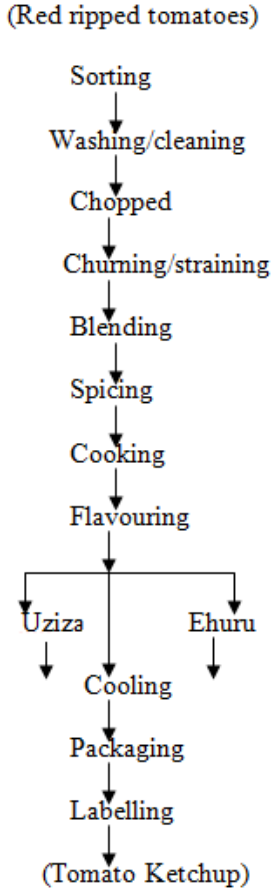
However, most spices were added early in the cooking process such as Onion, Garlick, Ehuru, Uziza were cut into fine pieces and slightly tied up into a form bundle using Muslin cloth and dropped into the vessel of the tomato pulp, the remaining sugar and salt were added at the later stage to prevent burning and further cooked till juice thickens to sauce consistency. Vinegar was added also. The mixture was allowed to cook for 30-45 minutes with consistence stirring. At the end of cooking process, the ketchup was allowed to cool to a temperature not lower than 190^0f (40^0c) hot filled into sterilized bottle and tightly closed. The ketchup was cooled to room temperature and stored away from sunlight in a cool place.

The ketchup container were labeled and coded with product information which included the ingredients.

Flow Chart of Processing of Tomato Ketchup



Flow Chart of Processed Tomato Ketchup Using Uziza and Ehuru



Preparation of Sample Tkcu (Uziza)

Red ripped tomatoes was sorted, washed and chopped. The pulp was transferred into a thick pot and was cooked for about 10 minutes. The seeds and skin of the tomatoes were removed by churning and straining immediately. Churning of the skin were removed from the fire blended, spiced and cooked for 20 minutes and later added the preservatives like sugar, salt, and flavoured with *uziza* and was cooked for 6 minutes more, later was cooled to 40^0c and packaged in a bottle and tightened firmly.

Preparation of Sample Tcke (Ehuru)

Red ripped tomatoes was sorted, washed and chopped. The pulp was transferred into a thick pot and was cooked for about 10 minutes. The seeds and skin of the tomatoes were removed by churning and straining immediately. Churning of the skin were removed from the fire, blended, spiced and cooked for 20 minutes and later added the preservatives like sugar, salt and flavoured with Ehuru and was cooked for 6 minutes more, later was cooled to 40^0c and packaged in a bottle and tightened firmly.

Analysis

Proximate Analyses

The proximate composition of each sample was determined based on the standard of AOAC (2009). The analysis carried out on tomato ketchup were Moisture content, Fat content, Protein content, Ash content, Carbohydrate content and Fiber content.

Determination of Moisture Content

The AOAC (2000) the Petri dish was thoroughly washed and dried; in the oven at 100^0C for 30 minutes and allowed to cool in a desiccators.
The dried Petri dishes were then weighed empty and their weights were recorded.

About 2g of the sample were weighed into the dishes and placed inside the oven at 100^0c for 4 hours. They were returned to the oven, dried for further 25 minutes, cooled and weighed.

The drying was continued and weighed repeatedly until a constant weight was obtained. The percentage moisture content was calculated from the weight loss of the sample.

% moisture =

$$\frac{\text{wt of dish + sample before drying} - \text{wt of dish + sample after drying}}{\text{Wt of sample}} \times \frac{100}{1}$$

Determination of Fat Content

The method of Pearson (2006) was used 250ml clean boiling flasks was dried in oven at 11^0c for about 30 minutes, transferred into a desiccator and allowed to cool, the flasks were weighed.

About 2g of samples was weighed in a filter paper into labeled thimble. The boiling flasks was filled with about 250ml petroleum of spirit, after which the extraction-thimble was plated lightly with cotton wool, assembled the soxhlet apparatus and allowed to reflux for about 5 hours. The thimble was removed with cann 5 and collected recovered spirit in the top container of the set up and drained into a container for refuse. The flask was removed when the flask was almost free of petroleum spirit and dried, at 110^0c for 1 hour, after which it was transferred into a desiccators and allowed to cool, then weighed.

$$\% \text{ fat} = \frac{\text{Weight of fat}}{} \times \frac{100}{}$$

Weight of sample 1

Determination of Protein Content

The method of Birch (2006) was used.

a. Protein Digestion Procedure

About 1g of sample was weighed into a kjeldahli flask and 2g of anhydrous sodium sulphate plus 1g copper sulphate and a pinch of selenium powder was added to the mixture in the flask. 10ml sulpheric acid was inserted and the flask was placed inside the fume cupboard on a heating mantle and was heated very gently at first then increased heating from time to time till solution assumes a green color or clear, it was cooled.

After which it was re-heated gently at first until the green color disappears and allowed to cool. After cooling, the digest was transferred into a 100ml volumetric flask and made up to the mark with distilled water.

b. Protein Distillation Procedure

Steam was passed through mickjeldah distillation apparatus for about 15 minutes. 5ml of boric acid was placed in a 25ml conical flask and 2 drops of indicator was added. The conical flask was placed under the condenser receiver such that the condenser tip was dipping in the boric acid indicator solution. 5ml of the diluted digest was placed in the distillation apparatus and was rinsed down with distilled water followed by 5ml of 4% NaQH solution. Steam was then passed through until about twice the volume of boric acid indicator was gotten. The boric acid indicator was then titrated with 0.01 MHCL to the end point.

$$\% \text{ crude protein} = \frac{\text{Q.OOP } 140 \times 6.25 \times 5 \times \text{titer}}{\text{Wt of sample}} \times \frac{100}{1}$$

Determination of Ash Content

The method of Onwuka (2005) was adopted for carbohydrate content was determined by calculating (% fat w^1 + % moisture w^2 + % crude 10^3 fiber + ash w^4 + % protein w^5) subtract by 100.

$100 - (w^1 + w^2 + w^3 + w^4 + w^5) =$ carbohydrate

Let carbohydrate be x

$Cud - (w^1 + w^2 + w^3 + w^4 + w^5) = y$

$\therefore 100 - y = x$

Organoleptic Evaluation

The samples were subjected to sensory evaluation using 10 panelist drawn from a staff and students of Home and Rural Economics Department using 9 point hedonic scale as shown below.

Attributes evaluated include color, flavor, texture, taste.

Data generated were subjected to one way analysis of variance (ANOVA) and significant difference between Ihekoronye and Ngoddy (2005).

9-point Hedonic scale

9 = like extremely
8 = like very much
7 = like moderately
6 = like slightly
5 = neither like or dislike
4 = dislike slightly

3 = dislike moderately
2 = dislike very much
1 = dislike extremely

RESULTS

Proximate Analysis Carried Out

The results of the proximate analysis of the various products produced were as follows:

Table 1

Proximate composition of the samples in %

Sample	Protein	Fat	Moisture	CHO
TKCCP	$1.7^{b} \pm 0.21$	$0.48^{b} \pm 0.03$	$68.95^{a} \pm 0.35$	$25.07^{a} \pm 0.01$
TKCNP	$L705^{b} \pm 0.45$	$0.48^{b} \pm 1.30$	$68.96^{a} \pm 0.00$	$24.98^{a} \pm 0.41$
TKCU	$4.70^{a} \pm 0.3.2$	$3.20^{a} \pm 0.25$	$64^{b}.02 \pm 1.00$	$21.86^{bc} \pm 0.31$
TKCE	$4.01^{a} \pm 0.49$	$4.98^{a} \pm 0.10$	$67.85^{a} \pm 0.30$	$16.94^{C} \pm 2.10$

Data in the same column bearing different superscript are significantly different ($P<0.05$)
Hints:
Sample TKCCP – (Tomato Ketchup with commercial product)
Sample TKCNP – (Tomato Ketchup with non-spices product)
Sample TKCU – (Tomato ketchup with Uziza)
Sample TKCE – (Tomato ketchup with Ehuru)
In the study of tomato ketchup, it was subjected into different processing methods using spiced and non-spiced product.

Table 1

Table 1 presents the proximate analysis of commercial, non – commercial, Uziza spiced and Ehuru spiced tomato ketchup.

The spiced tomato ketchup with Uziza ((TKCU) had 4.70% protein that was significantly higher than the protein of all the product of tomato ketchup ($p<0.05$); followed by (TKCE) which had value of 4.01%; The commercial product (TKCCP) and non-spiced product (TKCNP) had comparable protein values of 1.70 and 1.65% ($P>0.05$). These values were significantly different from the protein of the other tow samples.

In the fat content, sample (TKCE) had higher fact of 4.98% that was significantly different from other samples, followed by 43 sample (TKCU) that had 3.20%, which showed valid significant difference from samples ($p<0.05$). TKCCP and TKCNP which are significantly the sample wit the value of 0.48 and 0.48% ($p>0.Q5$).

In the moisture content, it shows a varied values. Sample TKCNP has higher moisture content of 68.996%, followed by other sample TKCCP and TKC which has value of 68.96% and 67.85% ($p<0.05$) respectively. Sample TKCU had the lowest values of moisture when compared with other three samples and is significantly different ($p>0.05$) it has the value of 64.02%.

Carbohydrate content of the sample showed clerical values. Sample (TKCE) had the lowest value of 16.94% and other samples are comparable. TKCCP and TKCNP has 25.07% and 24.98% and they had higher values that are significant ($p<0.05$). sample TKCU has 21.86%, it also showed varied value and is significantly varied ($p<0.05$).

TABLE II

Results of Sensory Evaluation

The results of the sensory evolution of the various products produced were as follows:

Sample	Flavour	Colour	Texture	Taste
TKCU	8.3 ± 0.92	8.3 ± 0.83^{2}	8.39 ± 0.077^{a}	8.2 ± 0.67^{a}
TKCE	$7.3 + 0.34^{ab}$	$7.8 \pm 0{,}59^{a}$	7.8 ± 0.49^{a}	7.5 ± 0.28^{2}
TKCNP	5.0 ± 0.98^{b}	$5.8 = 0.56^{b}$	$5.6 + 0.77^{D}$	6.4 ± 0.36^{b}
TKCCP	6.2 ± 0.28^{bc}	5.2 ± 0.90	66.1 ± 0.49^{b}	$6.0 \pm 0{:}59^{b}$

Data are means of 10 patients ± SD

Data in the same column bearing different superscript are significantly different ($p<0.05$).

From the observation by the taste panellists, it observed that:

In Flavour, sample TKCU is higher ranked by 70% (like extremely), followed by sample TKCE by 50% while sample TKXXP was liked slightly and sample TKCNP was neither like or disliked.

In taste 60% of the panellists like sample TKCU, followed by sample TCK5 which has 30% which is significantly different ($p<0.05$). Sample TKCCP and TKCNP were neither like nor disliked.

In colour, sample TKCU was liked extremely by 5 panellist more than sample TKCCP and TKCNP which had 10% and 20%.

Sample TKCU had 50% of panellist. It is also significant under ($p<0.05$).

In texture, sample TKCU was ranked very high by 60% (like very much), followed by sample TKCE by 305 while sample TKCNP and TKCCP were ranked lower.

Summary

Table 1, shows the proximate composition of tomato ketchup produced using different local spices (Uziza and Ehuru with commercially produced (standard) and the non-spiced produced ketchup.

In moisture content, sample TKCCP and TKNP tends to have high level of moisture in comparison with sample TKCU and TKCE which has the value of 64.02-67.85. Sample TKCCP and TKCNP have almost the same values of 68.95-68.95 which is significant ($p>0.05$).

In the protein content, sample TKCU and TKCE had high protein, this is due to the local spices which was used to increase the protein retention of the sample. It ranges from 3.47-470% which shows varied value under ($p<0.05$).

From the fat determination, sample TKCU and TKCE also tend to have high level of fat in comparison with sample TKCCP and TKCNP which has value of 0.48%. Sample TKCU and TKCE has value of 3.20% and 4.98%.

This increase fat value may be due to some essential fatty acid found in local spices and it tends, to increase the level of oil present in the products.

For carbohydrate content, sample TKCCP and TKCNP has almost the same value which ranges from 24.98-25.07. Sample TKCCF and TKCNP had higher carbohydrate content than sample TKCU and TKCE which ranges from 16.94-21.86. As described by Okeke (2006) that food rich in carbohydrate are bound to produce more calories than the one that has less carbohydrate.

Table II shows the mean sensory scores of the samples.

From the table, the result showed that sample TKCU was liked very much, while sample TCKE was liked moderately by the panellists.

Flavour, sample TKCU was ranked very high more than sample TXCE, TKCNP and TKCCP, this may be due to the flavour of Uziza which was added to it. Sample TKCE was also ranked moderate due to the flavour of Ehuru added on it. While the other two samples TKCNP and TKCCP was neither liked nor disliked.

Colour, sample TKCU was like very much more than sample TKCNP and TKCCP, followed by sample TKCE which was liked moderately. Sample TKCNP and TKCCP was neither liked nor disliked.

Texture, sample TKCU was liked very much by the panellists, followed by sample TKCE which was liked moderately. But sample TKCNP and TKCCP was ranked low in texture by the panellists.

Taste, sample TKCU and TKCE was ranked very high due to the taste of local spices added on the tomato ketchup (Uziza and Ehuru) more than sample TKCNP and TKCCP.

Conclusion

From the analysis and the sensory evaluation report, the new product mixture of Uziza (*Piper guineanees*) and Ehuru (*Monodora myristica)* showed a significant high quality standard when compared with the control product.

Based on the researchers approach to the samples, the research carried out by, the researcher in production of tomato ketchup using two local herbs as spices (Uziza and Ehuru). It is observed that there are increase in the nutritional composition of the sample added with the local spices sample TKCU and TKCE than that of commercial and produce i.e. sample TKCCP and TKCNP.

These spices acts as anti-oxidant and also increase mineral constituent of the products which are beneficial for health purposes.

Recommendations

The usefulness of this product (tomato ketchup mixed with Uziza) i.e. sample TKCU cannot be over emphasized. The product is hereby strongly recommended for commercial production because of its highly nutritional values, the black pepper is a natural anti-oxidant, acts as an anti-inflammatory, anti-cancer, anti-periodic, anti-pyretic and immune enhancer.

Also it lower the cholesterol level in the body.

The studies in Britain suggest that the ketchup may be the long sought cure for heart disease, infertility helps prevent diabetes due to the presence of lycopene.

Today in Nigeria very few companies undertakes the production of this product, it should be recommended that extracts from these spices should be standardized and used in food processing industries to replace some of the artificial anti-oxidants.

Moreover, government should encourage co-operative bodies, individuals to invest in this area of food condiment production and also should provide more sophisticated equipment and machineries to encourage mass production of these; spices extracts thereby making them more available and less expensive.

REFERENCES

Akinysoye, O.V. (2002). *Tropical Agric for West African* Macmillan Ltd London, 2nd Edition p.158 – 159.

Andre7, F., Smith (2004). Pure Ketchup, a History of America's National Condiment with Recipes p.242.

Ihekoronye, A.I., and Ngoddy, P.O., (2001). *Integrated Food Science and Technology for the Tropics.* Macmillan Publishers, 1st Edition p.305 – 306.

Manthey, J.A., (2009). *Citrus Subtropical Products. Journal of Agricultural and Food Chemistry* p. 811 – 814.

Onwueme, I.C., (2005). *Crop Science.* Casseli's Limited London. Bcok2. p. 131.

Pearson, D., (2002). Composition and Analysis of Food 7th Edition Cr Mrch Hill Living. Stone New York. P. 252 – 258.

Peckhaga, C.G., (2009). *Foundation of Food Preparation* 3rd Ed:. Ion, Macmillan Publishing Co, New York p. 201.

Ruben, L.V., (2000). Report 1980. "Tomatoes in the Tropics". Nichort Annual Report 1980.
Sandy Addison (2006). The Creator of Tomato Ketchup Recipe p. 141.
Tindial, D.H., (2005). Commercial Vegetable Sowing Oxford University Press, P. 123 – 125.

APPENDIX I
PROXIMATE COMPOSITION OF THE SAMPLES

SAMPLE TKCCP
FAT CONTENT

$$\%Fat = \frac{w-2}{B} \times \frac{100}{1}$$

Where
w=wt of Flask plus fat
z=wt of-empty flask
B=wt of sample

$$\therefore \% = \frac{133.462-133.452}{2} \times \frac{100}{1}$$

= 0.50

Protein Content

$$\% \text{ protein} = \frac{0.0001401 \times 6.25 \times \text{titre} \times 5}{1} \times \frac{100}{1}$$

$$= \frac{0.000 \therefore 401 \times 6.25 \times 3.94 \times 5}{1} \times \frac{100}{1}$$

= 1.72

MOISTURE CONTENT

$$\% \text{ mc} = \frac{\text{wt of petridish + sample before drying =wt after dying}}{\text{wt of sample}} \times \frac{100}{1}$$

$$\% \text{ mc} = \frac{34.264-32.879}{2} \times \frac{100}{1}$$

69.20

CARBOHYDRATE CONTENT

100 - % protein + % fat + % fibre + % moisture
= 100 – 1.72 + 0.50 + 2.90 + 69.20
= 100 – 75.22
= 24.78
Standard Deviation
Sample TKCCP
Moisture

X	**X**	$\mathbf{(x-x)^2}$		

69.2	68.95	68.95 – 69.2	0.25	0.0625
68.7	68.95	68.95 – 68.7	0.25	0.0623
137.6				

SD = $\frac{(x - X)^2}{n - 1}$ = $\frac{(0.125}{1}$ = 0.35

68.95 + 0.35

Protein		**x – x**	**$(x - x)^2$**	
X	X	1.705 = 1.72	0.015	0.000225
1.72	1.705	1.705 = 1.69	0.015	0.000225
1.69	1.705			0.00045

SD = $\frac{\sqrt{(\sum x - X)^2}}{n - 1}$ = $\frac{\sqrt{(0.0045}}{1}$

= 0.021 = 1.70 = 0.021

= 1.726

FAT

X	**X (Mean)**	**(x – x)**		**$(x - x)^2$**
0.50	0.48	0.48 – 0.50	0.02	0.0004
0.48		0.48 – 0.48	0.00	0.00
0.45		0.48 – 0.45	0.03	0.009
1.43			0.05	0.0013

SD = $\sqrt{\frac{(x - X)}{n - 1}}$ = $\sqrt{\frac{(0.0013)^2}{3 - 1}}$

= $\sqrt{0.00065}$

= 1.726

Mean 0.48 + 0.025

APPENDIX II

Please taste these sample based on their quality sing the 9 point Headonic scale method.

9 – like very much
8 – Dislike moderately
7 = like moderately
6 = like slightly
5 = neither like or dislike
4 = dislike slightly
3 = dislike moderately
2 – dislike very much
1 = dislike extremely

Colour/Appearance

No of panellist	**Sample TKCCP**	**Sample TKCNP**	**Sample TKCU**	**Sample TKCE**
1	9	8	7	7
2	9	7	8	7
3	8	6	5	6

4	8	8	6	8
5	8	7	7	2
6	8	8	5	3
7	8	8	3	7
8	9	9	2	5
9	9	9	4	6
10	7	9	7	7
Total	83	78	52	58
Mean	8.3	7.8	5.2	5.8

Mean for Colour

Mean for sample TKCCP = $\frac{83}{10} = 8.3$

Mean for sample TKCNP = $\frac{78}{10} = 7.8$

Mean for sample TKCU = $\frac{52}{10} = 5.2$

Mean for sample TKCE = $\frac{58}{10} = 5.8$

For flavour

No of panellist	**Sample TKCCP**	**Sample TKCNP**	**Sample TKCU**	**Sample TKCE**
1	9	8	8	5
2	7	7	7	9
3	8	8	8	9
4	8	8	8	2
5	9	7	7	7
6	8	7	7	2
7	8	6	6	5
8	9	7	7	5
9	9	8	8	3
10	8	7	7	3
Total	83	73	62	50
Mean	8.3	7.3	6.2	5.0

Mean for Flavour

Mean for sample TKCCP = $\frac{83}{10} = 8.3$

Mean for sample TKCNP = $\frac{73}{10} = 7.3$

Mean for sample TKCU = $\frac{62}{10}$ = 6.2

Mean for sample TKCE = $\frac{50}{10}$ = 5.0

For Texture

No of panellist	Sample TKCCP	Sample TKCNP	Sample TKCU	Sample TKCE
1	8	9	5	6
2	9	7	6	7
3	8	8	7	8
4	7	9	8	6
5	9	8	7	5
6	9	8	6	3
7	8	7	4	4
8	9	8	3	4
9	7	9	7	5
10	9	7	7	8
Total	83	78	61	56
Mean	8.3	7.8	6.1	5.6

Mean for Texture

Mean for sample TKCCP = $\frac{83}{10}$ = 8.3

Mean for sample TKCNP = $\frac{78}{10}$ = 7.8

Mean for sample TKCU = $\frac{61}{10}$ = 6.1

Mean for sample TKCE = $\frac{56}{10}$ = 5.6

Taste

No of panellist	Sample TKCCP	Sample TKCNP	Sample TKCU	Sample TKCE
1	8	9	9	5
2	8	8	7	8
3	9	6	7	8
4	9	7	4	6
5	7	6	6	7

6	9	6	7	6
7	8	7	2	8
8	9	8	3	8
9	7	9	8	4
10	8	9	7	4
Total	82	75	60	64
Mean	8.2	7.5	6.0	6.4

Mean for Taste

Mean for sample TKCCP = $\frac{82}{10}$ = 8.2

Mean for sample TKCNP = $\frac{75}{10}$ =7.5

Mean for sample TKCU = $\frac{60}{10}$ = 6.0

Mean for sample TKCE = $\frac{64}{10}$ = 6.4