Journal of Agriculture and Food Sciences
Volume 16 Number 1, April 2018 pp. 65 - 78 .

NUTRIENT AND MICROBIOLOGICAL COMPOSITIONS OF SOUP CONDIMENTS PREPARED FROM *Citrullus lanatus* AND *Curcubita ficifolia* SEEDS AND SENSORY EVALUATION OF THEIR SOUPS

Amadi, Joy A.C
Department of Nutrition and Dietetics,
Imo State University P.M.B. 2000, Owerri, Nigeria.
**Corresponding author email:Joyevans2012@yahoo.com +2347030987007*

ABSTRACT

Nutrient and microbiological compositions of soup condiments prepared from citrullus lanatus and curcubita ficifolia seeds and sensory evaluation of their soups was evaluated. Watermelon and pie melon fruits were washed and cut with a sterile knife. The seeds were removed and washed with clean water and allowed to sundry for 2days. The seeds were dehulled, washed and boiled for 5hrs at 100°C. It was allowed to cool, grinded and wrapped in banana leaves to ferment at ambient room temperature for 7days. The soup condiments were analyzed for nutrient and microbiology compositions. Sensory evaluation was carried out on the soups. Statistical product for service solution (SPSS) was used in analyzing the data.Pie melon soup condiment was higher in ash (2.61±0.18%), protein (22.95±1.20%), fa t (23.59±1.64%), carbohydrate (34.44±1.79%), iron (116.03±29.30mg/100g) and manganese (42.54±0.73mg/100g) contents while moisture (11.84±0.86%), fiber (11.44±0.63%), copper (24.23±0.53mg/100g), Zinc (51.45±7.00mg/100g), calcium (260.00±34.00mg/100g), potas sium (190.00±10.00mg/100g) and sodium (50.00±30.00mg/100g) contents were higher in watermelon soup condiment. The bacterial count shows higher growth in watermelon soup condiment from the starting day ranging from $3.23x10^{1}$cfu/g (bacteria count) to $5.84x10^{7}$cfu/gafter 7days. Fungi count was higher in watermelon soup condiment and ranged from $1.53x10^{3}$cfu/g(starting day) to 6.51 x 10^{7}cfu/g (day 7). The soup condiments were generally accepted but insignificantly higher in watermelon soup. The use of pie melon and watermelon in soup condiments production should be encouraged.

Keywords: Pie melon, watermelon, soup condiment, nutrient, microbiological
https://dx.doi.org/10.4314/jafs.v16i1.6

INTRODUCTION

Indigenous soup condiments consumed by different ethnic groups in Nigeria have been the pride of culinary traditions for centuries (Achi, 1999). Soup condiments are used in rural communities in the preparation of local dishes to serve as both non-meat proteins substitute and flavouring agents in soups (Achi, 2005). Dietary sources of plant origin are used in meeting the nutritional

needs of Nigerian population (Obizoba *et al.,* 1998). The use of plant seeds in soup condiment preparation has added advantage because it passes through fermentation which improves digestibility, nutritive value and flavour of the raw seeds (Ishiwu *et al.,* 2015). Examples of such soup condiments in Nigeria include ogiri" from castor bean, (*Ricinus communis*), "dawadawa" from African locust beans (*Parkia bilobosa*), "ugba" from African oil bean (*Pentaclethra macrophylla*) and ogiri isi from melon seed (*Cucumeropsis mannii*).

Soup condiments are generally referred to as *ogiri* are oily paste made from oil seeds in West Africa. It is normally a product of fermentation of melon seeds (*Citrullus vulgaris*). Melon based soup condiment is a food flavouring condiment with sharp smell in raw state but less pungent smell in dried form is normally prepared by traditional methods of uncontrolled solids state fermentation of melon seeds involving the use of chance fermentation (Akinyele and Oloruntoba, 2013; Nwosu and Ojimelukwe, 2000). The aroma of the soup condiment is dependent on the fermentation time and melon seed used (Ogueke and Nwagwu, 2007). The seeds of watermelon are under-utilized and normally discarded though it is a protein-rich oil seed, packed with both micronutrient and polyunsaturated fatty acids (Braide *et al.,* 2012; USDA, 2016). However, watermelon fruit is sweet, juicy, fleshy, fruit and is normally taken as fruit (Johnson *et al.,* 2012). In Eastern Nigeria, pie melon is normally taken as immature fruit when cooked and taken with palm oil, it can also be used in cooking pottage yam or cocoyam. Pie melon is used in treating diseases like anti-inflammatory, antiviral, analgesic urinary disorders, anti-ulcer, wound healing, tumor growth inhibition, immune-modulating and anti-diabetic (Smith, 2011; Chaturvedi, 2012). Watermelon and pie melon seeds are good sources of amino acids leucine, isoleucine, arginine, tryptophan, and methionine, carbohydrates and fat, vitamins B1, B2, and niacin are well represented as well as the minerals like calcium, magnesium, manganese, potassium, iron, and zinc (USDA, 2016).

Protein deficiency coupled with concurrent infections are prevalent among children and even adults in developing countries, especially in African countries and contributes to immune dysfunction, opportunistic infections and mortality (Glennie *et al.,* 2012). The major reason for lack of adequate protein in most African diet is due to economic constraints. Meat and fish contain high quality protein for people of all age groups but it is quite expensive for most African consumers who live on low monthly income with an average family size of six. Soup condiment prepared from melon seeds and water melon (*citrullus lanatus)* are good sources of protein, carbohydrate, fat, vitamins and minerals including anti-oxidant phytochemical (Akubugwo *et al.,* 2007; Ejimkeonye *et al.,* 2018; Adebayo *et al.,* 2018; Daivd and Aderibigbe, 2010). The introduction of pie melon condiment in soup preparation would help in filling gaps in food and nutrition security. There are darts of information on nutritional and microbiological composition of pie melon soup condiment and some developing countries like Nigeria require more information on the needs for increasing their utilization. Therefore, this study sought to

evaluate the nutrient and microbiological properties of watermelon and pie melon soup condiment and sensory evaluation of their soups.

MATERIALS AND METHODS

Sourcing of materials

Watermelon (*Citrullus lanatus*) and pie melon (*Curcubita ficifolia)* fruits and the ingredients used in soup preparation were purchased from Relief market in Owerri Municipal, Imo State, Nigeria.

Sample preparation

The traditional method of processing soup condiment (*ogiri*) was adapted from Akinyele and Oloruntoba (2013) with little modification. Watermelon and pie melon fruits were cut, the seed was sorted, washed, sun dried for 2 days and dehulled. It was boiled in water 3: 1 w/v for 5 hours using pressure cooker and meshed using pestle and mortar. It was packaged in banana leaves, left for 7 days to ferment at room temperature at 28 ± 2℃ to obtain watermelon and pie melon soup condiment.

Chemical composition

The proximate, mineral and microbiological composition of the soup condiments were carried out in duplicates using standard methods. Moisture content was determined using gravimetric method, protein was determined by micro-kjedahl method, and ash was determined by furnace incineration gravimetric method while carbohydrate was calculated by difference. Minerals which include sodium and potassium was determined by flame photometry, calcium, and magnesium was determined by colorimetric method and manganese, copper, iron and zinc was determined by atomic absorption spectrophotometric method all using AOAC (2012). Microbiological enumeration of total viable count was made using nutrient agar and fungal count by Sabourand Dextroase agar as described by (Akinyele and Oloruntoba, 2013).

Recipe for the soup preparation using water and pie melon soup condiment respectively

The recipe for preparing *ofe owerre* as described by Okeke (2014) was adopted with little modification. This was used in preparing soup with watermelon and pie melon soup condiments respectively.

Method

The meat, dried fish and stockfish was washed and steamed with salt and sliced onions for 10minutes on low heat. Two cups of water was added and continued cooking for 25 minutes. The

okazi, uziza and pumpkin leaves were washed and cut into tiny pieces. The prawn was prepared by removing the head and washed. The washed prawn, ground crayfish, pepper and palm oil was added; the pot was cover and allowed to boil for 5 minutes. The achi flour was mixed with water from the soup and boullion cubes were added and allowed to boil for 5 minutes. The pumpkin leaves, uziza and okazi was added and allowed to boil for 3minutes. Salt and pie melon soup condiment was added and allowed to simmer for 5minutes and the soup was cooked. The same method was used in the preparation of *ofe owerre* using watermelon soup condiment.

Sensory Evaluation

Sensory attributes (color, texture, aroma, and general acceptability) of the soups were evaluated using a nine point hedonic scale. Fifty trained final year students of Nutrition and Dietetics Department, Faculty of Health Sciences, Imo State University were selected as judges. Water was provided for rising of their mouth after tasting each soup (Onwuka, 2005).

Statistical Analysis

Data obtained was subjected to analysis using Statistical Products and Services Solution (SPSS) version 22 for mean and standard deviation. Analysis of variance (ANOVA) was used to compare and decision criterion was set at $P< 0.05$ to be significant.

RESULTS

Proximate composition of watermelon and pie melon soup condiment

Table 2 below shows the proximate composition of watermelon and pie melon soup condiments. Pie-melon soup condiment was higher in ash (2.61±0.18%), protein (22.95±1.20%), fat (23.59±1.64%) and carbohydrate (34.43±1.79%) content while watermelon soupcondiment was higher in moisture (11.84±0.86%) and fiber (11.44±0.6%1) content. The samples were significantly ($p<0.05$) different except in protein, fat and carbohydrate.

Mineral content of watermelon and pie melon soup condiment

Pie melon soup condiment was significantly ($p<0.05$) higher in manganese (42.54±0.73mg/100g) and iron (116.03±29.30mg/100g) content while Watermelon soup condiment was higher in copper (24.23±0.53mg/100g), Zinc (51.45±7.00mg/100g), calcium (260.00±34.00mg/100g), potassium (190.00±10.00mg/100g) and sodium (50.00±30.00mg/100g) (Table 3). Zinc and potassium are significantly ($p<0.05$) difference.

Enumeration of total bacteria and fungi count of pie melon and watermelon soup condiment

Total bacteria and fungi count was presented in Table 5. Bacteria were isolated in their increasing population throughout the 7 day period of fermentation which ranged from 2.01 x 10^1cfu/g in pie melon soup condiment to 3.23 x 10^1cfu/g (watermelon soup condiment) at the starting time. After 7days, the population increased from 5.81 x 10^7cfu/g (pie melon soup condiment) to 5.84 x10^7cfu/g (watermelon soup condiment). Fungal growth started on Day 1 in watermelon soup condiment (1.53x 10^3cfu/g) to2.32x10^3cfu/g (pie melon soup condiment) while on day 7 it ranged from 5.86 x10^7cfu/g (pie melon) to 6.51x10^7cfu/g (watermelon soup condiment).

Sensory properties of watermelon and pie melonsoup condiment

Watermelon and pie melon soup condiment compete favourably among each other but the sensory properties scores was higher in colour (8.20±0.67), taste (8.68±0.62), texture (7.20±1.41) and general acceptability (8.60±1.16) (Table 5). However, aroma (8.95±1.62) was significantly ($p<0.05$) higher in pie melon soup condiment.

DISCUSSION

Proximate composition

Pie melon soup condiment had low moisture contents compared to watermelon soup condiment and will encourage the activity of microorganisms that causes food spoilage (Azi *et al.,* 2017). The moisture content of watermelon soup condiment obtained in this study was higher than 3.5% reported by Adebayo*et al.* (2018) but lower than 33.15% by Ejimkeonye *et al.* (2018) on watermelon soup condiment. However, the watermelon soup condiment moisture content was similar to Azi *et al.* (2017) who recorded 12.5 to 15.1% and 11.8 to 13.9% as moisture content for *ogiri-egusi* and *ogiri-ugba*, respectively. Pie melon soup condiment had high ash content than watermelon soup condiment. The ash content of watermelon soup condiment in the present study was higher than that reported by David and Aderibigbe (2010) on watermelon *ogiri* condiment who obtained lower value of ash content (2.97±0.2g/100), though lower than (Ejimkeonye *et al.* 2018; Adebayo*et al.* 2018) who reported 5.75% and 5.5% respectively.

The soup condiments recorded high protein content though higher in pie melon than watermelon. The report on protein content was consistent with (Adebayo*et al.* 2018; Adams *et al.,* 2008) who reported protein content of 21.1% and 23.6 ±3.0% on watermelon and melon *ogiri* condiments respectively. Melon seeds soup condiments may be used as one of the common protein sources like those of groundnut, and soybean. This high protein in melon seeds ogiri condiment will help to combat protein deficiency among Nigerian population, if families use it in soup preparations.

The relatively high protein content makes the soup condiment of the present study suitable for use as cheap sources of protein for those who cannot easily afford proteins of animal origin. Fat content was higher in all the soup condiment though higher in pie melon and was expected, because melon seeds are oil seeds (Milovanoic and Picuric-Jovanovic, 2005). The high fat content makes them good sources of energy and fat soluble vitamins. The fat content was lower than (Ejimkeonye *et al.* 2018; Adebayo*et al.* 2018) who reported 15- 40% and 36.9% respectively, but higher than (Oboh, 2006) who reported 12.2±1.4% in fermented ogiri melon seed condiment. The high fat content of the soup condiments would help in aroma attribute of the products (Adebayo*et al.* 2018; Dosumu *et al.,* 2012).

The soup condiment was high in fibre content though it was higher in watermelon soup condiment. The ash content observed was higher than previous studies (Ejimkeonye *et al.* 2018; David and Aderibigbe, 2010) but similar with (Oboh, 2006) on pie melon soup condiment.Pie melon soup condiment had higher carbohydrate content than watermelon soup condiment. The study was similar with the carbohydrate content as reported by (Ejimkeonye *et al.* 2018; Adebayo*et al.* 2018) with 29.28% and 33% respectively. However, David and Aderibigbe (2010) reported low carbohydrate content (25.20±1.3g/100g).

Mineral Composition

Pie melon was significantly ($p<0.05$) higher in iron content than watermelon. The study was higher than (David and Aderibigbe, 2010; Oboh, 2006) who reported 14.50±0.83mg/100g and 1.9±0.6mg/g on watermelon *ogiri* condiments respectively. Iron is required for hemoglobin formation as well as for energy metabolism. In the present study, iron was the most abundant mineral was more observed in pie melon soup condiment. Potassium content was lower than that reported by (David and Aderibigbe, 2010). The zinc was more in abundant in watermelon soup condiment than in pie melonsoup condiment. The result of the present study inconsistent with (Oboh, 2006) who reported lower zinc content (3.6±0.3mg/g) on watermelon *ogiri* condiments. Zinc is essential in biochemical reactions in human system and is also implicated in wound healing, growth and enhancement of taste and appetite (Alayande *et al.,* 2012). Pie melon and watermelons soup condiments are good sources of zinc. Pie melon soup condiment had higher manganese than watermelon soup condiments and was lower than (David and Aderibigbe, 2010) who recorded 1.15±0.09mg/100g and 7.56±0.20mg/100g on watermelon *ogiri* condiments and fermented *ogiri egusi* condiments. Manganese is a microelement essential for human nutrition. It acts as an activator of many enzymes (Soetan *et al.,* 2010) and works with vitamin K and B complex vitamins to support blood clotting. Manganese also helps to control the effects of stress. Birth defects can possibly result when an expectant mother does not get enough of this important element (Anhwange *et al.,* 2004). Copper content of the soup condiments were similar in the present study but were higher than10.14±2.12mg/100g reported by (David and Aderibigbe, 2010). Copper is also a micro mineral that facilitates the absorption of iron and information for

red blood cells. It is also required in the body for enzymes production and biological electron transfer (Anhwange *et al.,* 2004). The differences in mineral contents could be as a result of soil composition and the rates of uptake of the mineral by the plant.

Calcium content of watermelon soup condiment was significantly ($p<0.05$) higher than pie melon soup condiment. The calcium content of the soup condiments are relatively low for adults but will supply half of recommended calcium intake of children 1-3 years (500mg/day). It plays an important role in building and maintaining strong bones and teeth, large parts of human blood and cellular fluids. Calcium is also necessary in normal functioning of cardiac muscles, blood coagulation, clotting and regulation of cell permeability. Calcium deficiency causes rickets, back pain, osteoporosis, indigestion, irritability, pre-menstrual tension, and uterus cramping (Soetan*et al.,* 2010). In the present study, there was no significant ($p<0.05$) different in magnesium and sodium content of watermelon soup condiment and pie melon soup condiment. The soup condiment contained low magnesium and sodium content compared to 400 and 310mg/day (male/female respectively) and <2,400mh/day for adults respectively. David and Aderibigbe (2010) reported higher values (58.72mg/100g and 369.36 mg/100g) for magnesium and sodium content of watermelon *ogiri* but Oboh (2006) reported a similar trend with the present study. Magnesium plays important role in energy metabolism, muscle contraction, nerve impulse and bone mineralization. Sodium as the primary electrolyte regulates extracellular fluid levels in the body.

Enumeration of total bacteria and fungi count of pie melon and watermelon soup condiment

Total aerobic growth had increasing population in watermelon soup condiment than in pie melon soup condiment during the period of 7 days fermentation. This may be as a result of the seed providing a condition required for the rapid growth and multiplication of the micro-organisms population. However, the bacterial and fungal population was higher in watermelon than pie melon, this can be explained by the moisture content of the soup condiment which was observed to be higher in watermelon soup condiment. Higher moisture content has been reported to encourage spoilage organisms (Adams and Moss, 2008). The study observed that on the starting day before packaging the soup condiments in banana leaves, there was no fungal count in the soup condiments but was multiplied after 24hours (first day), this could be explained by the banana leaves which was used in wrapping the soup condiments during fermentation. After day 5 and 6 for pie melon and watermelon soup condiments respectively, the growth and multiplicity of fungi should be inhibited by storing it in refrigerator (Adebayo *et al.,* 2018).

Sensory Evaluation

Watermelon and pie melon soup condiments were all generally accepted though water melon soup condiment had the highest mean score in all the quality attributes of the soups. This agreed with the report of (Adebayo *et al.,* 2018) that water melon ogiri soup was rated the same with melon seed ogiri soup. The study was consistent with Ejimkeonye *et al. (*2018) on the acceptability of watermelon. The implication of the present study was that pie melon can be used instead of watermelon and melon soup condiments since that compete favourably.

CONCLUSION

This study shows that pie melon and watermelon soup condiment are good sources of macro and micro nutrients. However, protein, fat, ash and carbohydrate were higher in pie melon soup condiment. It was also observed that pie melon soup condiment was a good source of iron. The microbiological content of pie melon soup condiment was lower than water melon soup condiment.Both watermelon and pie melon soup condiments were both accepted but higher in water melon soup condiments. The use of both pie melon and watermelon soup condiment should be encouraged.

REFERENCES

A.O.A.C. (2012). Official Methods of Analysis, (15thed), Association of Official Analytical Chemists. Wasington, D.C.

Achi, O. K. (2005). The Upgrading of Traditional Fermented Foods through Biotechnologies. African Journal of Biotechnology; *4:375-380.*

Achi, O.K. (1999). Quality attributes of fermented yam flour supplemented with processed soy flour Plant Foods. Human Nutrition; 54:151-158.

Adams, M. R. and Moss, M. O. (2008) Bacterial Agents of Food borne Illness In Food Microbiology Third Edition. The Royal Society of Chemistry, Cambridge, UK. P 182 - 269

Adebayo, F.O., Mukhtar, O.A., and Rafiat, B., Abdus, S. (2018). Microbiological, Proximate and Organoleptic Analysis of a fermented condiment made from seeds of *Citrullus Lanatus* (watermelon). South Asian Research Journal of natural products; 1 (1): 1-7.

Akinyele, B.J., and Oloruntoba, O.S. (2013). Comparative Studies on *Citrullus vulgaris, Citrulluscolocynthis* and *Cucumeropsis mannii* for Ogiri Production. BritishMicrobiology Research Journal; 3(1):1-18.

Akubugwo, I.E., Obasi, N.A., Chinyere, G.C., Ugbogu, A.E., (2007). Nutritional and chemical value of *Amaranthus hybridus* L. leaves from Afikpo, Nigeria. African Journal of Biotechnology; 6(24): 2833-2839.

Alayande, L.B., Mustapha, K.B., Dabak, J.D and Ubom, G.A. (2012). Comparism of nutritional values of brown and white beans in Jos North Local Government markets. African Journal of Biotechnology; 11(43): 10135-10140.

Anhwange, B.A., Ajibola, V.O., and Oniye, S.J., (2004). Chemical studies of the seeds of Moringa oleifera and Detarium microcarpum. Journal. Biological Sciences; 4(6): 711-715.

Azi, F., Odo, M. O., Okorie, P. A., Njoku, H. A., Nwobasi, V. N., and Nwankwegu, A. S., (2017). Fungi and aflatoxin analysis of processed *ogiri-egusi* and *ogiri-ugba* consumed in Abakaliki metropolis. African Journal of Biotechnology; 16(42): 2024-2030.

Braide, W., Odiong, I.J and Oranusi, S. (2012). Phytochemical and antibacterial properties of the seed of watermelon (*Citrullus lanatus*). Prime Journal of Microbiology Research; 2 (3): 99-104.

Chaturvedi, P. (2012). Antidiabetic potentials of *Momordica charantia*: multiple mechanisms behind the effects. Journal Medicinal Food; 15: 101-107.

Collins, C.H., Lyne, P.M., Grange, J.M. and Falkinham, J.O. (2004). Collins and Lyne's microbiological methods. 8th ed. London: Arnold Hodder Headline Group Publishers.

David, O. M. and Aderibigbe, E. Y. (2010). Microbiology and proximate composition of Ogiri, A pastry produced from different melon seeds. New York Science Journal; 3(4): 19-27.

Dosumu, O.O., Oluwaniyi, O.O., Awolola, G.V. and Oyedeji, O.O. (2012). Nutritional composition and antimicrobial properties of three Nigerian condinment. Nigerian Food Journal; 3(1): 43-52.

Ejimkeonye, U.B., Nduka, O.C. and Offia, O. B.I (2018). Effect of fermentation duration on the nutritional and Anti-nutritional content of watermelon seeds and sensory properties of their *ogiri* products. European Journal of Food Science and Technology; 6 (2): 1-16.

Glennie, S.J., Nyirenda, M., Williams, N.A., Heyderman, R.S. (2012). Do multiple concurrent infections in African children cause irreversible immunological damage? Immunology; 135 (2): 125-132.

Ishiwu, C. N., Anib, J.C., and Tope, V.A. (2015). Effects of period of fermentation on nutrient of castor oil seed (Ricinus communis); 3 (10): 178-183.

Johnson, J.T., Iwang, E.U., Hemen, J.T., Odey, M.O., Efiong, E.E., and Eteng, O.E. (2012). Evaluation of antinutrient contents of watermelon – *Citrullus lanatus*. Annals of Biological Resources; 3 (11): 5145 – 5150.

Milovanoic, M. and Picuric-Jovanovic, K. (2005). Characteristics and composition of melon seeds oil. Journal of Agricultural Sciences; 5 (10): 41.

Nwosu, C. D. and Ojimelukwe, P. C. (2000). "Improvement of the traditional methods of „ogiri" production and identification of the microorganism associated with the fermentation process. Journal of Applied Microbiology; 94: 381 - 391.

Obizoba IC, AU Osagie, OU Eka. (1998). Fermented foods. In nutritional quality of plant food. Benin City: Post Harvest Research Unit Publication; 7:160- 198.

Oboh G. (2006). Nutrient and anti-nutrient composition of Condiments produced from some fermented Underutilized legumes. Journal of Food Biochemistry; 30(2006) 579–5

Ogueke C. C. and Nwagwu A., (2007) "Comparative study of melon seeds (*Citrullus Vulgaris*) fermented with mixed cultures and pure cultures of bacteria isolates from ogiri egusi. Life Science Journal; 4: 41 - 46.

Okeke, P.N. (2014). Basis in Food Management. Austrop Printing and Publishers Int'l Ltd, Imo State, Nigeria. :153-155.

Onwuka, G.I. (2005). Food Analysis and Instrumentation Theory and Practice. Naphtali Print, Lagos, Nigeria. : 81 -90.

Smith, B.D. (2011). The initial domestication of *Cucurbita pepo* in the Americas 10, 000 years ago. Science; 276: 932-934.

Soetan, K.O., Olaiya, C.O., and Oyewole, O.E., (2010). The important of mineral elements for humans, domestic animals and plants: A review. African Journal of Food Science, 4(5):200-222.

USDA (United States Department of Agriculture) (2016). Agricultural Research services national nutrient database for standard references release 28. http://ndb.nal.usda.gov/ndb/ (Accessed 15/2/2019).

Table 1: Recipe for soup preparation

Ingredients	Quantity used
Palm	60g
Water	600g
Stockfish	500g
Meat	500g
Dried fish	200g
Salt	2g
Pepper	5g
Milled crayfish	50g
Prawn	10g
Bouillon cube	2 cubes
Achi *(Brachystegia eurycoma)*	30g
Ogiri watermelon/ogiri pie melon	40g respectively
Uziza leaves	20g
Okazi leaves	40g
Pumpkin leaves	25g

Table 2: Proximate Composition of watermelon and pie melon *ogiri* condiment

Proximate composition (%)	Pie-melon soup condiment	Watermelon soup condiment	P_{value}
Moisture	8.06±0.25	11.84±0.86	0.02
Ash	2.61±0.18	1.72±0.18	0.03
Protein	22.95±1.20	21.18±1.04	0.25
Fat	23.59±1.64	22.42±0.78	0.46
Fibre	8.36±0.61	11.44±0.63	0.03
Carbohydrate	34.43±1.79	31.40±3.13	0.35

The values are the mean ± standard deviation of two duplications.

Table 3: Mineral content of watermelon and pie melonsoupcondiment

Mineral composition (mg/100g)	**Pie melon soup condiment**	**Watermelon soup condiment**	**p-value**
Calcium	230.00±10.00	260.00±340.00	0.43
Magnesium	25.00±10.00	30.00±140.00	0.69
Potassium	40.00±10.00	190.00±10.00	0.00
Sodium	40.00±20.00	50.00±30.00	0.65
Manganese	42.54±0.73	19.82±0.31	0.00
Iron	116.03±29.30	98.37±2.92	0.04
Copper	24.23±0.53	25.42±0.79	0.22
Zinc	51.45±7.00	95.69±1.48	0.01

The values are mean ± standard deviation of two duplications

Table 4: Enumeration of total bacteria and fungi count of pie melon and watermelon soup condiment

Days	Total Bacteria count		Total Fungi count	
	Pie melon soup condiment (cfu/g)	Watermelon soup condiment (cfu/g)	Pie melon soup condiment (cfu/g)	Watermelon soup condiment (cfu/g)
0	2.01×10^1	3.23×10^1	0	0
1	3.33×10^3	1.80×10^5	2.32×10^1	1.53×10^3
2	3.81×10^4	3.22×10^5	4.01×10^1	2.05×10^3
3	1.90×10^4	3.84×10^5	2.38×10^4	5.19×10^5
4	3.23×10^5	3.02×10^6	4.12×10^4	2.64×10^6
5	3.51×10^5	4.57×10^6	1.83×10^5	2.93×10^6
6	2.46×10^6	4.95×10^6	3.21×10^6	4.32×10^7
7	5.81×10^6	5.84×10^7	5.86×10^6	6.51×10^7

Table 5: Sensory properties of watermelon and pie melon soup condiment

Sensory properties	Pie melon	Watermelon	P_{value}
Aroma	8.95±1.62	8.64±0.56	0.05
Colour	8.01±1.13	8.20±0.67	0.07
Taste	8.52±1.94	8.68±0.62	0.09
Texture	6.12±2.45	7.20±1.41	0.04
General acceptability	8.50±0.58	8.60±1.16	0.13