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RESEARCH PAPER

Evaluation of physicochemical and sensory properties of mixed fruit juice from blends of monkey kola (*Cola parchycarpa*) and watermelon (*Citrullus lanatus*)

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ABSTRACT

Physicochemical and sensory properties of mixed fruit juice from blends of monkey kola (*Cola parchycarpa*) and watermelon (*Citrullus lanatus*) was evaluated. *Cola parchycarpa* juice was blended with watermelon juice in ratio of 100:0, 70:30, 50:50, 30:70 and 0:100(v/v) which were coded as CPS, CWS,WPS, WCS and WMS respectively. The result of proximate composition showed that moisture content ranged from 89.37 to 94.70%, protein from 1.04 to 1.90%, fat content from 0.20 to 0.90% ash from 1.00 to 2.00% and carbohydrates from 0.91 to 6.46% There was a significantly ($P<0.05$) differences in pH, TTA, Total soluble solid, total solid vitamin and mineral contents of mixed fruit juice. Total titratable acidity, total soluble solid, total solid were significantly ($P<0.05$) higher in sample WCS (30% *Cola parchycarpa*: 70% watermelon) with values of 9.10%, 8.80oBrix, 7.50% and 1.24mg/100g respectively. The result mineral contents of mixed fruit juice revealed that calcium ranged from 7.90 to 17.70 mg/100g, magnesium from 35.73 to 76.24mg/100g and iron from 18.07 to 23.17mg/100g. Sample WPS (50% cola parachycarpa : 50% watermelon juice) was the most accepted mixed fruit juice in term of colour, taste, mouth-feel and overall acceptability. Quality mixed fruit juice can be produced from blends of *Cola parchycarpa* and watermelon.

Keywords: monkey kola. Watermelon, mixed fruit juice, physicochemical, sensory properties

1. INTRODUCTION

Fruits are flowering part plant obtained from the fertilization of one or more ovaries of flower [1]. Fruits are seasonal, highly perishable in nature and have short life span due to their high moisture content. Fruits contain sugar, vitamin A, C, and B-group, low in protein and lipids [2]. It is also contain high amount of minerals, moisture contents, low ash and crude fibre. According to Bate *et al.* (2012) fruits are rich in high level of bioactive and phytochemical such as antioxidant soluble fibre and organic acids (tartaric acids) [3]. There is a lot of health

benefits associated in eating fruit or fruit products such as it prevent diseases and growth of gut pathogens, and it also boost immunity [4]. Fruits are traditional or commercial processed in large quantities into varieties of products such wine, fruit juice, carbonated beverage, jams jellies alcoholic drinks among others. , thereby reduce post-harvest losses and also providing consumers with nutrients and diet variety.

Mixed fruit juice is filtered liquid, non-alcoholic drinks, produced from blends of one or more freshly fruit such as pineapple, watermelon, orange, banana among others [5]. Fruit is processed into mixed fruit juice to reduce post-harvest and also provide consumers with nutrient, convenient and diet variety

Monkey kola (*Cola parchycarpa*) is an underutilized fruit which belong to the family of sterculiaceae and genus cola. Monkey cola have three varieties namely: red Kola (*Cola Lateria*), yellow kola (*Cola parchycarpa*) and white kola (*Cola lepidata*). Monkey Kola is known by various local name in southern –Eastern Nigeria. ("ochicha" or "ochiricha" in Igbo and "ndiya" in Efik) it is commonly found in Southern Nigeria between the month of June to November [6] and western Cameroon [7]. It can be eaten raw cooked processed into jams [8] pastries or preserved by caning or drying [9]

Watermelon (*Citrullus lanatus*) fruit is a sweet juicy, fleshy fruit that belongs to the family of cucurbitace. It is grown widely in the tropics and temperate region of the world [10]. There are various species with different coloured endocarp which includes red flesh, yellow flesh and orange flesh. .All parts of watermelon are valuable. The juice, rind and seed are believed to have a lot health benefits, nutritional and thirst quenching [11]. Watermelon is rich in vitamin B1 and B2, potassium, calcium, zinc and it also contain about 95% water [12]. Charoensiri *et al* (2009) reported that a serving cup of watermelon contains 12.31 mg of vitamin C, 864.88 IU of vitamin A 170.24 mg of potassium and 45.60 calories of energy [13]. It gives wide variety of dietary antioxidants such as carotenoids and phenolics [14]. It contains phytochemical which include lycopene, ascorbic acid and dehydroascorbic acid, flavonoids and other phenolics. These compounds are known to scavenging free radical thereby reducing the risk of certain types of cancers, cardiovascular diseases and age-related degenerative pathologies [15-17]. It mostly used to produce a variety of salads, juice and food flavor [18].

The high moisture and hard coat of these fruits have limited their consumption. Therefore there is need to process Monkey kola and watermelon fruit into a more convenient and easier to use form such as jams, jellies, and juice to derive maximum benefit from it [19-20]. *Cola parchycarpa* are well known for its sugary taste, yellowish color and its distinctive flavor while watermelon is commonly identified for its delightful color (red colour rich in lycopene) and water content. Blending this fruit in different proportion in production of juice will surely increase its utilization, improve nutritional content of developed product, make it available all year round and also reduce seasonal spoilage of these fruit. It against this background that this study seek to evaluate physicochemical and sensory properties of mixed fruit juice produced from blends monkey Kola and watermelon.

2. METHOD AND MATERIAL

2.1. Procurement of Raw Materials

Monkey Kola (*Cola parchycarpa*) and watermelon were purchased from Eke Ekwulobia Main Market in Aguata Local Government Area, Anambra State, Nigeria.

2.2. Sample Preparation

2.2.1. Preparation of monkey kola (*Cola parchycarpa*)

The modified methods of Okudu and Ene-Obong [21] was used to prepared *Cola parchycarpa* juice. *Cola parchycarpa* were sorted, the back was removed from kitchen knife and washed to remove dirt. The fruit was open longitudinally with a sharp knife to remove the seed from the pulp. The pulp of *C. parchycarpa* was placed in water containing lime juice (250 ml lemon juice per liter of water) to stop them from browning. Six hundred gram (600g) of Pulp was cut into smaller pieces and placed in an electric blender. About 250ml of water was added to *Cola parchycarpa* in the electric blender, was blended to smooth pulp. It was poured into a large mix bowl . A clean muslin cloth was used to filter the pulp. The monkey cola juice was drained into another container through the clean muslin cloth so as to stop any unblended pulp from getting into the final product. The juice was poured into sterilized a screw-top glass bottles and stored in refrigerator for further analysis

2.2.2. Preparation of watermelon juice

A mature watermelon fruit was sorted and thoroughly washed with distilled water to remove dirt, dust, pesticide residue. The washed

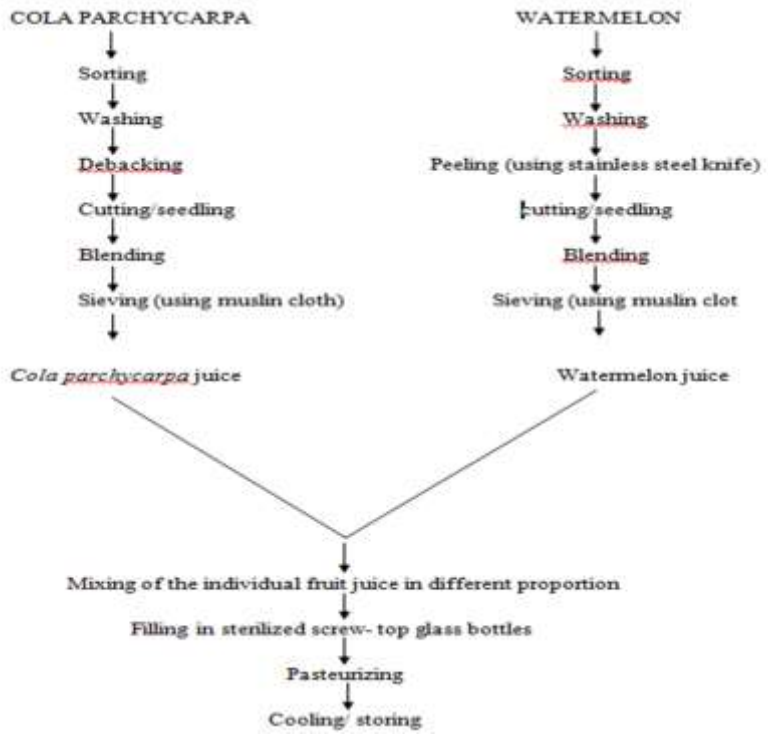

Image 1. Production of mixed fruit juice from C*ola parchycarpa* and watermelon blends

watermelon was cuts into quarter and the flesh were scoop out, watermelon rind was cut into smaller cube and the seed were removed with a kitchen knife. It was blended with a electric blender to give a smooth pulp. The smooth pulp was filtered using clean muslin cloth. The filtered juice was poured into sterilized a screw-top glass bottles stored in refrigerator for further analysis.

2.2.3. Formulation of mixed fruit juice from and watermelon juice

The *Cola parchycarpa* juice was formulated with watermelon juice in the following proportions 100:0, 70:30, 50:50, 30:70 and 0:100(v/v). The blends were homogenized, bottled, pasteurized at 75°C for 15 min and cooled to room temperature (27°C) and finally stored in a refrigerator at 5°C until further analysis.

2.3. Proximate composition

2.3.1. Determination of moisture content

Moisture content was determined by the hot air oven method described by the AOAC [22]. Stainless steel oven dishes were cleaned and dried in the oven (Fulton, Model NYC – 101 Sheldon Manufacturing Incorporation, Oregon, USA) at 100 °C for one hour. The oven dishes were cooled in a desiccator and then weighed. Ten milliliters (10 ml) of each of the sample was placed in the oven dish and dried at 100 °C. The sample was removed from the oven and placed in a desiccator to cool to room temperature (27 ± 2 °C) before weighing. The oven dishes were put back into the oven and weighed intermittently until a constant weight was recorded. The loss in weight from the original sample weight was calculated as the moisture content.

$$\% \text{ Moisture Content} = \frac{(W_2 - W_3)}{(W_2 - W_1)} \times 100 \quad \textit{...eq 1}$$

Where,

W_1 = weight of empty oven dish;

W_2 = weight of oven dish +sample before drying

W_3 = weight of oven dish + sample after drying

2.3.2. Crude Protein Determination

Crude protein was determined by Kjeldahl technique as described by AOAC [22]. A 10 mL of each sample was poured into a Kjeldahl flask and 3.0g of hydrated cupric sulphate (catalyst) was added to the flask. A 20 ml volume of anhydrous sodium sulphate and 1.0 g of concentrated sulphuric acid (H_2SO_4) was added to digest the samples. Themixture was clamped and heated until the solution become colourless. The clear solution was then cooled, diluted with distilled water and made up to 100 ml with distilled water. The digest (10 ml) was done by mixed with 5 ml of 40 % sodium hydroxide solution and distilled. The distillate was titrated with 0.1M hydrochloric acid (HCL). The titre value or end point at which the colour changed from green to pink was taken, the crude protein was calculated as percentage crude protein using the expression:

$$\text{Crude protein (\%)} = \frac{(14.01 \times 6.25 \times 25 \times T)}{(W \times 10)} \times 100$$

Where:

W = weight of sample

T = titre value

2.3.3. Fat content Determination

The Soxhlet extraction method [22] was used in determining fat content of the sample. Ten milliliter (I0ml) of each sample was measured into the extraction thimble using volumetric and put in the soxhlet extraction tube. A weighed flask was filled to about three quarter of its volume with petroleum ether (BP= 40-60 °C). The apparatus will be then set up and extraction was done for 6-8 hours to achieve complete extraction. The solvent (petroleum ether) was recoveredand the oil was left in the flask at the end of the extraction. The flask with the oil was dried in the oven at 80 °C for 30 minutes, cooled in a desiccator and finally weighed using digital balance. The fat content was expressed as a percentage of the raw material. The difference in the weight of empty flask and that of the flask with oil was notedand fat content was calculated as follows:

$$\% \text{ Fat} = \frac{(C-A)}{B}$$

Where: A = Weight of empty flask
B = Weight of sample in g
C = Weight of flask + oil

2.3.4. Ash Content Determination

The ash content of the sample was determined using the method of by AOAC [22]. A preheated and cooled crucible was weighed (W_1). Ten milliliter (I0mL) of each sample was measured into the crucible (W_2). The sample was charred in a Bunsen flame in a fume cupboard. The charred sample in the crucible was transferred into preheated muffle furnace and ignited in a temperature-controlled furnace at 550 °C for 2 hours. The crucible with its content was removed, cooled in a desiccator and weighed (W3).

The percentage ash content was calculated as follows

$$\% \text{ Ash} = \frac{W1 + \text{crucible} - W2 \times 100}{W3}$$

Where:
W1= weight of the sample
W2= weight of crucible difference
W3= Original weight of sample

2.3.5. Carbohydrate Content Determination

The carbohydrate content of the sample was determined by difference as

% Carbohydrate = 100 - (protein + Fat + Fibre + Ash + Moisture)

2.3.6. Determination of pH

The pH was determined using a pH meter as described by the AOAC method [22]. Five milliliters (5 ml) of sample was measured into the beaker and glass electrode was inserted inside the beaker and the reading was taken.

2.3.7. Determination of titratable acidity

Determination of titratable acidity of the wine was carried out in accordance with the method described by AOAC [22]. Ten milliliters (10 ml) of the wine was diluted to 250 ml using distilled water and titrated with standardized 0.1N NaOH (sodium hydroxide) solution using 0.3 ml phenolphthalein for each 100 ml solution being titrated indicator to a pink end point, which persisted for 30 seconds. This was expressed in terms of NaOH/100 ml of the sample.

2.3.8. Determination of vitamin C

The 2,6 dichlorophenol titrimetric method as described by AOAC [22] was used. Two milliliters (2 ml) of the sample was extracted by homogenizing sample in acetic acid solution. The standard solution was prepared by dissolving 50 mg of ascorbic acid in 100 ml of water. The solution was filtered to get a clear solution. Then, 10 ml of the filtrate was added into a flask in which 2.5 ml acetone had been added. This was titrated with indophenols solution (dye 2,6, dichlorophenol indophenols) to a faint pink colour which persisted for 115 seconds. The standard was treated identically.

Calculation:

$$\text{mg ascorbic acid / ml} = \frac{C \times V \times DF}{WT}$$

Where;

C=mg ascorbic acid ml dye;
V= volume of dye used for titrate of diluted sample;
DF=Dilution factor;
WT= volume of sample in ml

2.3.9. Determination of provitamin A

Provitamin A was determined using the method of AOAC [22]. Five milliliters (5 ml) of the sample was pipetted in duplicate into a glass stoppered test tube in equal volume. Two milliliters (2 ml)l of ethanol was added drop wise with mixing to give 50 % solution (v / v). At this concentration, the protein precipitated and (free from retinol and retinol esters) was extracted by addition of 3 ml hexane. The tube was stoppered and the contents mixed vigorously on the vortex for 2 minutes to ensure complete extraction of carotene for 5–10 minutes at 600 – 1000 (rpm) g to obtain a clean separation of phases. Two milliliters (2ml) of the upper hexane extract was pipetted. Absorbance due to carotenoids at 450 nm was used against a hexane blank (A_{450}). A standard curve was plotted from the A_{620} values on ordinary rectangular coordinate paper, where the ordinate was at the A_{620} values and the absicissa the µg vitamin A per tube and a factor (FA_{620}) calculated as below.

$$FA_{620} = \frac{\mu g \text{ vitamin A/tube}}{A_{620}}$$

2.3.10. Determination of mineral content (Calcium, Magnesium,iron)

Mineral analysis was determined using method described by Shahid et al. [23]. 2 ml of the sample was weighed and subjected to dry ashing for 5 hrs in well-cleaned porcelain crucibles at 550°C. The resultant ash was dissolved in 5 ml of HNO_3/HCl/H_2O (1:2:3) and heated gently on a hot plate until brown fumes disappeared. 5 ml of deionized H_2O was added and heated until a colorless solution was obtained. The solution on each crucible was filtered into 100 ml volumetric flask and the volume made up to 100 ml with deionized water. The individual mineral element was determined from the solution. Calcium was determined using flame photometer while iron and magnesium were determined using atomic absorption spectrophotometer.

2.3.11. Determination of total soluble solid (TSS)

Mixed fruit juice was analyzed for TSS using a digital refractometer the machine was standardized using purified water before taking readings. It is express as °Brix.

2.4. Sensory evaluation

About 10 untrained panelists were used to evaluation of mixed fruit juices sweetened with date syrup on a 9-point hedonic scale (where 9= extremely like and dislike extremely). The samples were scored for color, flavor, mouth feel, taste, and overall acceptability.

3. RESULTS AND DISCUSSION

Table 1 shows the result proximate composition of mixed fruit juice from blends of cola parchycarpa and watermelon. There was a significant ($P<0.05$) differences in moisture content of mixed fruit juice of all the samples . Sample WMS had highest value (94.70%) while sample CPS had the lowest value (89.37%) of moisture contents. The value of moisture content of 100% cola parchcarpa juice obtained in this study was lower than the value 93.25 recorded by Okudu, and Ene-Obong, (2015) in cola parchycarpa juice [21]. The high moisture content of watermelon is in line with the work by Oyeleke *et al.* (2012) who stated that watermelon juice had 94.63 % moisture content [24]. High moisture content makes the juice suitable for refreshing and thirst-quenching product which is characteristic of good juice [9]. Moisture content of fruit is used determine its quality and shelf life stability [25]. The protein contents of mixed fruit juice ranged from 1.04 to 1.90%. Sample WMS (100% watermelon) was significantly higher in protein contents than other samples, The value of in protein contents *Cola parchycarpa* in this study was similar with value (1.14%) reported by Okudu and Ene-Obong (2015) [21]. The range of protein content cola parchycarpa/ watermelon juice was slightly higher than the range (0.81 – 1.17%) reported by Ohwesiri *et al.* (2016) in orange/ pineapple

Table 1. Proximate Composition of Mixed Fruit Juice from blends of *Cola parchycarp* and Watermelon juice

Samples	Moisture (%)	Protein (%)	Fat contents (%)	Ash contents (%)	Carbohydrate (%)
CPS	$89.51^{c} \pm 0.01$	$1.24^{c} \pm 0.10$	$0.41^{ab} \pm 0.10$	$2.30^{a} \pm 0.10$	$6.54^{a} \pm 0.10$
CWS	$90.08^{c} \pm 0.01$	$1.74^{b} \pm 0.10$	$0.50^{b} \pm 0.10$	$1.18^{ab} \pm 0.01$	$6.50^{e} \pm 0.01$
WPS	$89.37^{c} \pm 1.00$	$1.34^{c} \pm 0.01$	$0.31^{ab} \pm 0.10$	$2.20^{a} \pm 0.10$	$6.78^{a} \pm 0.10$
WCS	$92.30^{b} \pm 0.01$	$1.04^{e} \pm 0.01$	$0.20^{b} \pm 0.10$	$1.18^{ab} \pm 0.01$	$5.28^{b} \pm 0.10$
WMS	$94.70^{a} \pm 0.01$	$1.90^{a} \pm 0.10$	$0.90^{a} \pm 0.10$	$1.00^{b} \pm 1.00$	$1.50^{c} \pm 0.01$

Table 2. Physicochemical properties of mixed fruit juice from blends of *Cola parchycarp* and watermelon

Samples	pH	TTA (%)	Total soluble solid (°Brix)	Vitamin A mg/100g	Vitamin C mg/100g
CPS	$4.23^{c} \pm 0.10$	$5.30^{c} \pm 0.10$	$5.80^{c} \pm 0.10$	$0.65^{c} \pm 0.10$	$5.93^{c} \pm 0.01$
CWS	$4.28^{bc} \pm 0.10$	$6.30^{b} \pm 0.10$	$6.00^{b} \pm 1.00$	$1.26^{a} \pm 0.10$	$6.84^{b} \pm 0.10$
WPS	$4.46^{b} \pm 0.10$	$6.30^{b} \pm 0.10$	$6.00^{b} \pm 0.10$	$1.07^{b} \pm 0.10$	$7.69^{a} \pm 0.10$
WCS	$4.48^{b} \pm 0.10$	$9.10^{a} \pm 0.10$	$8.80^{a} \pm 0.10$	$1.24^{a} \pm 0.01$	$5.13^{d} \pm 0.10$
WMS	$5.30^{a} \pm 0.10$	$1.12^{d} \pm 0.10$	$8.80^{a} \pm 0.10$	$1.26^{a} \pm 0.10$	$7.69^{a} \pm 0.10$

fruit juice [26]. The relatively high protein content of mixed juice from blend of cola parchycarpa and water melon makes it an important source of protein which can be used to complement other sources of protein.

Significant (P<0.05) differences was observed in fat contents of mixed fruit juice. The fat contents of mixed fruit juices were generally low. Many researchers reported that low fat contents is commonly in fruit juice. Nwokocha and Akobundu (2013) observed low fat in orange juice, pineapple juice and water melon juice [27]. Akubor and Egbekun (2009) also reported low value of fat in Spondias mombin juice [28]. According to Okudo *et al.* (2015) low fat can be used for weight reduction. Sample CPS (100% cola parchycarpa) had highest value (2.30%) of ash content while sample WMS (100% watermelon) had lowest value (1.00%), There were significant (P<0.05) differences in ash contents of the samples. The range of ash contents of mixed fruit juice from blends cola parchycarpa and watermelon juice was higher than range (0.42- 1.86%) in orange and pineapple fruit juice as reported by Ohwsiri *et al.* (2016) [26]. According to Nwokocha and Akaboundu (2013) low ash content recorded in most juice [27]. The value of carbohydrate was significantly (P<0.05) higher in sample CPS than other samples. Carbohydrates content of mixed fruits juice ranged from 0.94 to 6.46%. When compared with other juices the carbohydrate content of Cola parchycarpa juice in this study was higher than value (4.9%) recorded [21] of *Cola parchycarpa* juice. The range of mixed fruit juice observed in this study was lower than the range (8.16 to 11.19%) of orange and pineapple juices as reported by Ohwsiri *et al*. (2009) [26]. The low carbohydrate value found in this mixed juice may be due to dilution effect during extraction of juice (27).

The result of physicochemical properties of mixed fruit juice is presented in table in 1. The pH ranged from 4.23 to 5.30. Sample WMS (100% watermelon) had highest value of pH (5.30) while 100 % cola parchycarpa had the

Table 3. Mineral composition of mixed fruit juice from blends of *Cola parchycarpa* and Watermelon juice

Sample	Calcium mg/100g	Magnesium mg/100g	Iron mg/100g
CPS	8.82^{c}±0.10	76.24^{a}±1.00	21.77^{b}±0.01
CWS	9.20^{c}±0.10	56.19^{c}±0.10	22.19^{b}±1.00
WPS	7.90^{d}±0.10	52.30^{d}±1.00	18.07^{d}±0.01
WCS	17.70^{a}±0.10	35.73^{e}±0.10	23.17^{a}±0.01
WMS	15.57^{b}±0.10	63.11^{b}±0.01	19.54^{c}±0.01

Table 4. Result of Sensory Evaluation of Mixed Fruit Juice from Blends of *Cola parchycarpa* and Watermelon Juice

Sample	Colour	Flavor	Taste	Mouth feel	Overall acceptability
CPS	7.00^{a}±1.00	8.20^{a}±0.1 0	4.60^{e}±0.10	4.70^{c}±0.10	6.10^{e}±0.10
CWS	6.80^{b}±0.10	6.00^{b}±0.10	5.70^{c}±0.10	5.90^{b}±0.10	7.10^{b}±0.10
WPS	7.10^{a}±0.10	6.00^{b}±0.10	6.10^{b}±0.10	6.00^{b}±0.10	7.20^{b}±0.10
WCS	5.80^{b}±0.10	6.50^{b}±0.10	5.40^{d}±0.10	6.00^{b}±0.10	6.90^{bc}±0.10
WMS	7.40^{a}±0.10	6.80^{b}±0.10	7.20^{a}±0.10	7.50^{a}±0.10	8.30^{a}±0.10

lowest value of pH (4.23). The results on pH showed that *Cola parchycarpa* juice is acidic (pH < 7.0) and that of watermelon is slightly acidic, (between 5.0 and 5.8) according to Akinosun (2010) [29]. The pH level of this mixed juice is acidic. This may be attributed to increase in the hydrogen ion concentration. As proportion of watermelon juice increase the pH of mixed fruit juice decreases. The pH is a measure of the degree of acidity or Alkalinity of a product [5]. The pH value of 3-4 may give the juice a good potential of inhibiting the growth of pathogenic bacteria although mould, yeast and pathogenic microorganism can tolerate this and cause spoilage [30-31]. The pH is the main factor affecting the stability of vitamin C thus high value pH favoring the oxidation processes of vitamin C [32].

There were significant (P<0.05) differences in TTA of the samples. Sample WCS had highest value (9.10%) while sample WMS had the lowest value (1.12%). As the mixed fruit juices become more acidity the pH decrease. There is exit relationship between pH and acidity of the juice, the higher the acidity, the lower the pH of the juice. According to Lui (2012) the dominant organic acids in watermelon flesh are citric and malic acid [33].

The value of total soluble solid of mixed fruit juice ranged from 5.80 to 8.80 Brix and significant (p<0.05) difference was observed among the samples. The total range of value obtained in this study was lower than the range of 8.50 to 10.50 Brix reported by Onyekwelu (2017) 1n sweetened mixed fruit juice with date syrup [34].

Pro- vitamin A of mixed fruit juice ranged from 0.65 to 1.26 mg/100g. Sample WMS (100% watermelon) had the highest value (1.26 mg/100g) while sample CPS (100% *Cola parchycarpa*) had the lowest value (0.65mg/100g). The vitamin increased as proportion of watermelon increased. This may be due to that watermelon is rich in lycopene and β- carotene [12]. It may ba also that α-carotene (with higher provitamin A activity) responsible the yellow colour found in fruts (pineapple, *Cola parchycarpa*). The β- caroteneis also known as antioxidants which helps in neutralizing free radical thereby fighting against degeneration diseases, boost immune system as well as reducing the risk of infection [15-17].

There was a significantly (P<0.05) in Vitamin C of all the samples. Vitamin C contents is significantly (P<0.05) higher in sample WPS(50% colaparchycarpa: 50% watermelon) other sample. The range of vitamin C (5.13 to 7.69mg/100g) obtained in this present study was higher than the range reported by Onyekwelu (2017) in mixed fruit juice sweetened with date syrup [34]. The high value of vitamin C may be as a result of that fruits are good sources of vitamin C [35]. Vitamin C is an important anti-oxidant, helps protect against cancers, heart disease, stress, it is part of the cellular chemistry that provides energy, it is essential for sperm production, and for making the collagen protein involved in the building and health of cartilage, joints, skin, and blood vessels [36].

Table 3 shows mineral composition of mixed fruit juice from blends of cola parchycarpa and watermelon. Significantly (P<0.05) was

observed in the mineral contents of the mixed fruit juice. Calcium content ranged from 7.90 to 17. 70mg/100g. Sample WCS had the highest value (17.70mg/100g) while sample WPS (50% watermelon: 50% *Cola parchycarpa*) had the lowest value (7.90 mg/100g). This values of this result was lower than the value (93.7mg/100g) reported by Okudu and Ene-Obong (2015) in cola parchycarpa juice [21]. Calcium builds healthy/strong bones and teeth and also assists in blood clotting.

There was a significantly ($P<0.05$) differences in magnesium of the samples. The magnesium content of mixed fruit juice ranged from 35.73 to 76.24mg/100g. CPS (100% in cola parchycarpa juice) had value of 76mg/100g. This value was higher than the value reported by Okudu and Ene-Obong (2015) in 100% in *Cola parchycarpa* juice [21]. The difference in magnesium content may be due to preparation of juice.

Iron content ranged from 18.07 to 23.17mg/100g. When compared with the result of other researchers the value was higher than values [21] for *Cola parchycarp* juice and for mixed fruit juice sweetened with date fruit [34]. The iron content is good constituent of hemoglobin and its presence is important in the process of blood formation.

The result sensory evaluation of mixed fruit juice from blends of cola parchycarpa and watermelon juice is presented in Table 4. There was no significant ($P>0.05$) differences in colour of 100% cola parchycarpa juice, 100% watermelon juice and 50% *Cola parchycarp*: 50% watermelon juice. The similar mean score (7.00 – 7.40) observed may be due red colour of watermelon whch may be as result of lycopene and bright yellow colour of cola parchycarpa contain β- carotene which might enhance their acceptability for colour . The mean score for flavor varied from each other. Sample CPS (100% *Cola parchycarpa*) had the highest mean score(8.20) while sample CWS and sample WPS had the lowest mean score (6.00) in flavor. There were significant ($P<0.05$) differences in taste and mouth feel among the samples. 100% watermelon had the highest mean score (7.20 and 7.50) in taste and mouth feel respectively while sample CPS (100% *Cola parchycarpa*) had the lowest mean scores (4.60, 4.70) in taste and mouth feel respectively. Sample WMS was most preferred in term of overall acceptability while sample CPS was least preferred in term of overall acceptability.

4. CONCLUSION

Watermelon and *Cola parchycarpa* fruits were blended to produce mixed fruit juice which will help to create varieties and provide convenient products thereby reducing post-harvest loses. The 100% watermelon juice was significantly ($P<0.05$) higher in protein content and fat while 100% *Cola parchycarpa* had the highest value in ash contents. Physicochemical properties evaluated shows that sample WCS (30% *Cola parchycarpa* juice: 70% watermelon juice) had the highest values in total titrable acidity, total soluble solid, calcium and iron. All samples were accepted by panelists since their mean scores were above 5.0 except sample CPS (100% *Cola parchycarpa*) whose mean score was below 5.0 in term of taste and mouth feel. The most accepted mixed fruit juice in term of colour, taste, mouth feel and overall

acceptability was sample WPS (50% *Cola parchycarpa*: 50% watermelon juice) which compared favourably with 100% watermelon juice.

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NA

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

7. SOURCE/S OF FUNDING

NA

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