PROXIMATE COMPOSITION AND SENSORY PROPERTIES OF JUICE FROM WHOLE WATERMELON AND FRACTIONS.

ABSTRACT

This research work studied the proximate composition and sensory properties of juice from whole watermelon and fractions (2%peel, 30% rind and 68% pulp). Five samples for study were juice from whole watermelon (JWW), juice from pulp (JP), juice from pulp and rind (JPR), juice from pulp and peel (JPP), and juice from the rind (JR). Result of the proximate composition showed that the samples differed significantly ($p<0.05$) and had values that ranged between 94.45 – 93.20%, 1.02 – 0.32%, 0.22 – 0.10%, 0.36 – 0.13%, 5.45 – 4.29% for moisture, ash, fat, protein and carbohydrate, respectively. Sensory evaluation conducted on the juice samples showed that there was significance difference ($p<0.05$) between the samples in appearance, flavor, aroma, mouth feel and overall acceptability. It was observed from the study that juice made from whole watermelon had the best acceptability.

Keywords: watermelon, proximate analysis, sensory properties, whole watermelon juice, watermelon fraction juices.

1. INTRODUCTION

Fruit is a sweet and fleshy product obtained from plants containing seeds and can be consumed as food. In food scientific term, fruits are succulent part of plant taken as appetizer or desert. Botanically, fruits develop from ovaries and form seed of reproductive organ of flowering plant which are diverse, perishable, and seasonal by nature (Asha *et al*., 2014). Fruits contain a substantial number of antioxidants, minerals, vitamins, and dietary fiber which are vital to the human body. Thus, the consumption of fruits could help reduce the risk of many illnesses such as diabetes, cancer, cardiovascular diseases, and other illnesses (Hanzah *et al*., 2018). According to Jimenez-Sanchez *et al.* (2015), fruits contain vitamins such as vitamins A, C, E and K, minerals such as Na, Ca, K, Mg, fiber, phyto-chemical, organic acid and other nutrients that are essential to humans. Fresh fruits have typically between 75 and 95 percent water which accounts for the juicy refreshing distinguishing feature of fruits. Most fruits are more acidic than the others and the most common acids associated with fruits include citric acid, malic acid, and tartaric acid. Fruits are equally high in carbohydrates depending on the type of fruit and its maturity (Singh and McLellan, 2018). Research indicates that fruits are natural source of antioxidants, playing initiative taking roles against chronic degeneration and aging and protects against any form of deterioration that may occur in the human body (Costescu *et al.*, 2006; Pereira-Netto, 2018).

Alternatively, processing fruits help to minimize the post-harvest losses and save cost (Ukeyima *et al.*, 2017).

Fruit Juices are the aqueous liquids expressed or otherwise extracted usually from one or more fruits (Bello *et al*., 2014). Within fruit juice category, the regulated products (fruit juice, etc.) have been defined based on their composition, production and processing methods. The fruit juice may be produced from a single fruit or a combination of fruits (FAO, 2005). An instance can be seen from the extraction of watermelon juice or combination of watermelon and pineapple to extract their juices. In most part of the world, fruit juice contains 100 percent fruit. A blend of fruit juices with other ingredient, for example water, is regarded as a fruit drink. Fruit drinks are obtained by addition of water to specific quantity of fruit juice. It is important to note that fruit juices are not used in place of water in the treatment of dehydration (Heyman *et al.*, 2017). Juices are prepared mechanically by squeezing or macerating the pulp of fresh fruits or vegetables without application of heat or solvent to give an unfermented, clouded, unclarified and untreated juice ready for consumption. Diluting or blending is a common practice as many fresh juices are either too acidic or too strongly flavored to be pleasant for consumption (Asha *et al.*, 2014). Watermelon juice, as a beverage, is found almost exclusively as an over- the- counter drink made by hand. Watermelon juices are rare, with commercially available packaged watermelon juice drinks still in developing countries (Alam *et al.*, 2013).

2. MATERIALS AND METHODS

2.1 Materials and Sample Collection

The material required for the preparation was fully matured, ripe and fresh watermelon fruit which was procured from Eke Awka Market in Awka South Local Government Area of Anambra State, Nigeria.

2.2 Research Design

Table 1: percentage mixture of different juice samples

Total number of samples	Types of samples	% of mixture
1	Juice from whole watermelon (JWW)	Peel = 2% Rind = 30% Pulp = 68%
2	Juice from the pulp (JP)	Pulp = 100%
3	Juice from the pulp and rind (JPR)	Pulp = 68% Rind = 30%
4	Juice from the pulp and peel (JPP)	Pulp = 68% Peel = 2%
5	Juice from the rind (JR)	Rind = 100%

2.3 Sample Preparation

The watermelon fruit that was used in this study is the red watermelon. Whole watermelon fruits were cleaned of extraneous materials. Quality check of the watermelon fruits was conducted. The quality parameters of colour, ripeness, maturity and wholeness were checked before the fruits were selected. The selected fruits were washed first under running tap water. Then, they were washed with 5% hypochlorite solution to get rid of microbes and contaminants and then rinsed again immediately under running tap water. The whole fruits were cut longitudinally using a sterile knife, carefully fractionated and the different parts cut into small pieces. The different fractions involved such as outer layer skin (peel), inner whitish layer skin (rind) and flesh (pulp) were separately transferred into sterile blender and homogenized until sufficient juice was produced. The entire slurry was transferred into a sterile muslin cloth to filter off the unwanted particles. The juices were pasteurized using a low temperature long time (HTLT) at 80^0C held for 10 min as reported by Ohwesiri *et al.* (2016) and Okwori *et al.* (2017). The juice was aseptically transferred into clean sterile airtight bottles. The samples were cooled and evaluated for proximate and sensory properties.

2.3 Proximate Analysis of the juices

The moisture content, crude protein, ash content and fat content of the juices were determined in triplicate using established analytical procedures of AOAC (2010). The carbohydrate content was estimated by difference from 100% after accounting for moisture, protein, ash and fat.

2.4 Sensory Evaluation of the juices.

As reported by Iwe (2010), the organoleptic analysis was carried out by twenty-five member panel who are familiar and regular consumers of watermelon fruit and juice. The sensory parameters evaluated include appearance, aroma, flavour, mouth feel and overall acceptability. The juice samples were randomly served with clean, transparent plastic cups to each panelist with potable water provided to rinse mouth between evaluations. The sensory attributes were evaluated on a 9-point Hedonic Scale with 1 = disliked extremely, 5=neither liked nor disliked, and 9 = liked extremely.

2.5 Statistical Analysis

The data generated were analyzed using the Statistical Package for Social Sciences (SPSS) version 23. Analysis of variance (ANOVA) was done to detect significant differences ($p<0.05$) among the sample means and Duncan Multiple Range Test (DMRT) for the separation of the significant means.

3. RESULTS AND DISCUSSION

3.1 Proximate composition of juices from whole watermelon and its component fractions

The proximate composition of whole watermelon juice and the juices of its component fractions is shown in Table 2. The moisture content ranged from 93.20% in pulp-peel juice (JPP) to 94.45% in whole watermelon (JWW) and watermelon rind juice (JR).

Table 2: Proximate composition of juice from watermelon samples

Sample code	Juice source	Moisture	Ash	Fat	Protein	CHO
JWW	Whole fruit	94.45^{a}±0.05	1.02^{a}±0.02	0.11^{b}±0.01	0.13^{c}±0.03	4.29^{d}±0.01
JP	Pulp	93.78^{c}±0.07	0.33^{b}±0.02	0.10^{b}±0.01	0.34^{a}±0.01	5.45^{a}±0.02
JPR	Pulp/Rind	94.30^{b}±0.10	0.32^{b}±0.02	0.12^{b}±0.01	0.36^{a}±0.04	4.90^{c}±0.01
JPP	Pulp/Peel	93.20^{c}±0.10	1.00^{a}±0.00	0.22^{a}±0.02	0.33^{a}±0.03	5.25^{b}±0.02
JR	Rind	94.45^{a}±0.05	0.32^{b}±0.02	0.12^{b}±0.02	0.26^{b}±0.03	4.85^{c}±0.01

Values are mean scores ± standard deviation of triplicate determinations. Values bearing different superscript differ significantly ($p < 0.05$). CHO= Carbohydrate.

The moisture content of the pulp juice (JP) is 93.78% and pulp-peel juice (JPP) is 93.20% which did not differ significantly ($p<0.05$) were significantly lower than those of the pulp-rind (JPR) which is 94.30% and whole watermelon (JWW) which is 94.45% juice. The low moisture content of the pulp-peel juice (JPP) maybe attributed to much lower moisture content of the peel as attempt to produce peel juice without adding water was impossible. Close observations showed that all juices with rind fractions/ components namely whole watermelon, JWW, (94.45%), pulp-rind, JPR, (94.30%), and rind, JR, (94.45%) had relatively higher moisture content indicating the contribution of the rind to the moisture content of the juices. Olayinka and Etejere (2018) reported that pulp and rind contained higher moisture (93.65 and 96.76%, respectively) of whole watermelon. Abu-Hiamed (2017) reported that moisture is the predominant component of watermelon and it ranges from 67.00 to 87.14%. Ugbogu and Ogodo (2015) observed the moisture content of 92.93% for water melon juice obtained from a local market in Nigeria. A range of 92.80% to 94.00% moisture was reported by Abdulazeez *et al.* (2020) for watermelon fruits from different farms in Lapai, Niger state of Nigeria. The result is in close range (75-95 %) of moisture content for fruit juices as reported by Singh and McLellan (2018). Eke-Ejiofor *et al*. (2016) recorded moisture range of 92.82 to 95.85 % which is closely related with all the samples.

The ash content of watermelon fruit juices as presented in Table 2 revealed that the whole watermelon (JWW) and pulp-peel juices (JPP) had significantly ($p<0.05$) higher ash content of 1.02% and 1.00%, respectively, than the least of the juices that had 0.32-0.33% ash. It is likely that the ash is mostly found in the peel which may be the reason only watermelon components/ fractions with peels had higher ash. Ugbogu and Ogbodo (2015) reported ash content of 0.94% for watermelon juice which is comparable to 1.02% for whole watermelon juice (JWW) in this research. Olayinka and Etejere (2018) reported the ash content of 0.23% and 0.31% respectively, for the rind and pulp fractions of watermelon. This is comparable to 0.32-0.33% obtained for watermelon components/ fractions juices in this work. A range of 0.20% to 0.30% ash was observed in the rind of watermelon from different farms in Lapai, Niger State of Nigeria Abdulazeez *et al.* (2020). Al-Sayed and Ahmed (2013) reported the ash content of watermelon rind of 13.90% (dry weight basis).

Table 2 showed that the fat content of the juice ranged from 0.10% to 0.22%. Only the juice with peel component/fraction (pulp-peel juice) had significantly ($p<0.05$) the highest value above other juice samples. This showed the low level of fat in watermelon juice. The fat content was the lowest compared to other proximate parameters just as observed by Abu-Hiamed (2017) who reported a range of 0.64 – 1.09% (dry weight basis) for watermelon rind and pulp. Olayinka and Etejere (2018) reported the fat content of 0.13% in the rind and 0.21% in the pulp of watermelon which are comparable to the values in Table 2 Ugbogu and Ogodo (2015) observed a lipid value of 0.48% for watermelon juice from a local market in Nigeria while Abdulazeez *et al.* (2020) reported a range of 0.10 to 0.15% lipid for the rind of watermelon from different farms in Lapai, Niger state, Nigeria.

The protein content of the juice ranged from 0.13% in whole watermelon juice (JWW) to 0.36% in pulp-rind juice (JPR) in Table 2. Pulp-rind (JPR) and pulp-peel juices (JPP) with higher protein content (0.33-0.36%) differed significantly ($p<0.05$) from whole watermelon and rind juices (0.13% and 0.26%, respectively) which in themselves also significantly differed ($p<0.05$). Olayinka and Etejere (2018), reported the protein content of 0.53% for the pulp and 0.34% for the rind, noted that the protein was observed to be in high amount in the pulp when compared to the rind. The protein content of the watermelon juices (Table 2) was lower than the range of 0.55% to 0.80% reported for the rind of watermelon (Abdulazeez *et al*., 2020) and 1.22% for watermelon fruit juice from Nigerian local market (Ugbogo and Ogodo, 2015). A protein content of 11.17% (dry weight basis) was reported for watermelon rind by Al- Sayed and Ahmed (2013).

The carbohydrate content, shown in Table 2, ranged from 4.92% in the whole watermelon juice (JWW) to 5.45% in the pulp juice (JP) in Table 2, indicating higher carbohydrate content in the pulp than any other watermelon components/fraction. The rind juice had lower carbohydrate content (4.85%) and its combination with the pulp increased the carbohydrate content to 4.90%. The higher carbohydrate content in the pulp-peel juice, JPP, (5.25%) than the pulp-rind juice, JPR, (4.90%) may be indicating a higher carbohydrate content of the peel component in the pulp-peel juice (JPP). A carbohydrate content of 5.22% to 5.86% was reported for the rind by Abdulazeez *et al.* (2020) while Olayinka and Etejere (2018) observed 5.22% for the rind and 4.23% for the pulp of watermelon. The later contrasted higher carbohydrate contents of the pulp juice observed in this work. Carbohydrate content of 4.89% was observed by Ugbogu and Ogodo (2015) for watermelon juice from Nigeria local market while a range of 62.00- 87.14% (dry weight basis) was reported by Abu-Hiamed (2017) who noted that approximately 82% of the carbohydrate in the flesh pulp of mature watermelon fruit are sugars namely fructose, glucose and sucrose.

3.2Sensory Properties of whole watermelon juice and its fractions

The results of the sensory evaluation carried out on the samples are presented as mean ± standard deviation in Table 3. The sensory properties tested were appearance, flavor, aroma, mouth feel and overall acceptability.

The average scores on appearance ranged from 6.15 (moderately liked) for a rind juice (JR) to 8.57 (extremely liked) for the pulp juice (JP). This is not surprising giving the bright red color of the watermelon pulp. This showed that the juices were positively liked with regard to appearance, the most liked or preferred juice being the pulp juice (JP) had 8.57 and the least liked was rind juice (JR) which had 6.15. Both whole watermelon juice, JWW, (7.92) and pulp-peel juice, JPP, (7.96) were very much liked.

The preference of flavor ranged from 4.57 designated as neither liked nor disliked for the rind juice (JR) to 8.42 (very much liked) for the whole watermelon juice (JWW). The juice from pulp (JP) alone was much liked (7.46). Its combination with the rind (pulp-rind juice) decreased the preference to moderately liked whereas the introduction of the peel to the pulp in pulp-peel juice improved the preferences to very much liked (8.03). Hence, rind negatively impacted the preference of the pulp juice (JP) while the peel positively influenced it. Whole watermelon juice with all the fruit fractions gave the most preferred flavor.

The aroma of the pulp with peel fraction, pulp-peel juice, (JPP) was best preferred with average score of 7.50 (very much liked). Again, the rind juice (JR) with average score of 4.65 (neither liked nor disliked) was least preferred. The aroma of pulp juice (JP) and whole watermelon juice (JWW) (6.76 and 7.29, respectively) were much liked although the later was rated higher. The pulp-rind juice (JPR) was moderately liked (5.88) indicating the negative effect of the rind on the aroma of the pulp.

Mouth feel is about the texture. The whole watermelon juice (JWW) and pulp-peel (JPP) juice were equally rated (8.26) and most preferred. They were very much liked; and followed by the pulp juice, JP, (7.46) which was much liked; and then the pulp-rind juice (JR) that was moderately liked (6.19).

In overall acceptability, whole watermelon juice (JWW) was rated best with average score of 8.75 (extremely liked). This reflected the score on appearance in which it was second to pulp juice (JP); first in flavor and mouth feel and again second in aroma after pulp-peel juice (JPP). Rind juice (JR) was rated least in all sensory parameters and was in overall least accepted (5.53) and was moderately accepted.

Table 3: Sensory Properties of Watermelon juices

Sample codes	Sample source	Appearance	Flavour	Aroma	Mouth feel	Overall acceptability
JWW	Whole fruit	7.92^{b}±1.52	8.42^{a}±0.98	7.29^{b}±1.35	8.26^{a}±1.28	8.57^{a}±0.70
JP	Pulp	8.57^{a}±0.70	7.46^{c}±1.33	6.76^{c}±1.24	7.46^{b}±1.27	7.92^{c}±1.19
JPR	Pulp/ Rind	6.38^{c}±1.52	6.03^{d}±2.08	5.88^{d}±1.60	6.19^{c}±1.95	6.69^{d}±1.80
JPP	Pulp/ Peel	7.96^{b}±1.11	8.03^{b}±1.03	7.50^{a}±1.60	8.26^{a}±0.96	8.30^{b}±0.88
JR	Rind	6.15^{d}±2.25	4.57^{e}±2.31	4.65^{e}±2.39	4.26^{d}±2.25	5.53^{e}±2.17

Values are mean scores ± standard deviation of 25 panelists. Values in the same column bearing different superscript differ significantly ($p < 0.05$).

4. CONCLUSION

This research work studied the proximate properties of juice from whole watermelon and its fractions. The juice gotten from the whole watermelon was more preferred among the other four samples. It is observed that from the results obtained, the juice has little fat and no fibre as a result of the processing method used.

In classifying the acceptability of the watermelon juices in their decreasing order, we have; JWW>JPP>JP>JPR>JR.

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