

Comparative Study Between Local and Imported Apple (*Malus domestica*) Fruits and their Uses in Juice Production

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ABSTRACT

Background and Objective: Apple is the pomaceous fruit of the apple tree in the rose family. The aim of this study was to investigate the comparative study between local and imported apple fruits and their uses in juice production. **Methods:** For this, local and imported apple fruits were carried out in term of physico-chemical characteristic. **Results:** The physical characteristics results indicated that, imported apple fruit had higher contents of whole weight, pulps, length, width and volume (108.8 g , 88.64% , $117\pm 0.01\text{ mm}$, $90.3\pm 0.03\text{ mm}$ and $144\pm 0.01\text{ mL}^3$), respectively. In addition to this, the chemical analysis of local and imported apple fruits were moisture (82.75 ± 0.01 and $83.50\pm 0.02\%$), crude protein (0.23 ± 0.03 and $0.25\pm 0.01\%$), ash (0.30 ± 0.02 and $0.27\pm 0.03\%$), crude fat (0.41 ± 0.04 and $0.35\pm 0.01\%$), crude fiber (1.64 ± 0.01 and $1.83\pm 0.04\%$) and total carbohydrates (14.67 ± 0.01 and $13.80\pm 0.01\%$), respectively. On other hand, the pH and TSS values of local and imported apple fruit juices were (3.90 ± 0.04 and 4.18 ± 0.01), (13.80 ± 0.02 and $14.60\pm 0.02\%$), respectively. The sensory analysis indicated that, the apple fruit juices were accepted by the panelists and there are significant differences as regard to consistency, flavour and general acceptability. **Conclusion:** It could be concluded that, the imported apple fruit had a good quality in term of its physical characteristics.

Key words: Local apple fruit, physico-chemical characteristics, juices production, sensory evaluation

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INTRODUCTION

Apple (*Malus domestica*) is the pomaceous fruit of the apple tree in the rose family. The genetic variability found in the apple has allowed adapted types to be selected for different environments and regions. Orchards are now found in Siberia and northern China where winter temperatures fall to -40°C and in high elevation in Colombia and Indonesia straddling the equator where tow crops can be produced in a single year¹. Janick *et al.*¹ reported that, apples are popular because of the many ways that can be consumed and because of their convenience and durability and may be eaten off the tree or stored for up to a full year. Apples can be processed into sauce, slices or juice and are favored for pastries, cakes, tarts and pies. The pulp has been processed into candies and used as a source of pectin. The juice can be consumed fresh, either natural or filtered, fermented into alcoholic beverages such as cider or wine, distilled into brandy or transformed into vinegar. Apples have become the symbol of wholesomeness: "An apple a day keeps the doctor away" is a favorite aphorism and apple pie has become a symbol

of goodness along with motherhood¹. Faunally, several varieties of fruit trees are grown in Sudan. Some of them are ancient in the country while others were introduced not long ago. The most well known fruit trees in Sudan include date palm, banana, guava, citrus fruits and mango. There are also other fruit trees grown in Sudan but not limited scale. These include paw paw and pine apple which is mainly grown in the south and gapes. In Jebel Marra area, some fruit trees of the Mediterranean climate are grown; they include apple, pear, apricot, fig and others. The aim of this study was to investigate the comparative study between local and imported apple fruits and their uses in juice production.

MATERIALS AND METHODS

Sampling: The local apple fruits were purchased from Nertiti (Jebel Marra), Darfur regions, Sudan. The imported apple fruit (Chile) were obtained from Nyala local market, Southern Darfur State, Sudan.

Physical characteristics: The whole apple fruits were weighed then the fruits were peeled. The peels and pulps

are separated then each fraction was weighed using sensitive balance (KERN, EMB 1200-1, Germany) as described by Abdualrahman². The length and width of each sample was determined using (AEROSPACE, China) vernier. The apple fruit volume was determined using rapeseeds displacement volumeter method according to Pylar³. However, this method was modified by using pearl millets grains instead of the rapeseeds.

Proximate analysis: The proximate analysis of local and imported apple fruit was carried out for the contents of moisture, ash and crude fat according to the AOAC⁴. Crude protein was determined as N% \times 6.25 according to the AOAC⁵. Crude fiber was carried out using acid/alkali digestion according to the AOCS⁶. Total carbohydrates content was calculated by subtracting the previous components from 100. All the experiments were carried out at room temperature and the average values of three replications were reported.

Preparation of apple fruits juices: Full mature apple fruits from each sample were peeled, sliced by fruit and vegetables cutter machine (Model KG-40. Nihon Conk CO. Ltd., Japan). The slices were added to palatable drink water at a ratio of 1:3 (w/v) and then blended using (Laboratory Mixer Emulsifier Machine No. 18510, England) for half an hour and then sieved to remove the residue as described by Abdelwahab *et al.*⁷. The quality of obtained juices was conducted in term of pH using (Model Hanna, pH 211, Microprocessor pH meter) according to the AOAC⁵. The total soluble solid was determined using a digital refractometer (Model Atago, N1, brix 0~32, Japan) at 25°C according to the Pomeranz and Meloan⁸ method. All experiments were carried out at room temperature and the average values of three replications were reported.

Sensory evaluation: A panel of fifty members composed of adults male and female was used to judge the quality of juices prepared from local and imported apple fruits. The panelists were asked to evaluate each sample for appearance, consistency, colour, flavour and general acceptability using a 9 point hedonic scale from 1-9 as follows: 1: Extremely bad; 2: Very bad; 3: Bad; 4: Fairly bad; 5: Satisfactory; 6: Fairly good; 7: Good; 8: Very good and 9: Excellent as described by Mohammed⁹. The order of presentation of the samples was randomized and given codes before being tested by the panelists.

Statistical analysis: The results obtained from the hedonic scale were statistically analyzed and subjected to Duncan's multiple test¹⁰.

RESULTS AND DISCUSSION

As shown in Table 1, the whole weight of local apple fruit (40.51 g) was much lower than (108.8 g) for imported apple fruit. Rosnah *et al.*¹¹ reported (103.87 g and 68.93 g), respectively for whole weight of Kristal Taiwan and Semarang Rose water apple fruits. On the other hand, the peels of local apple fruit (14.74%) were higher than (11.36%) for imported apple fruit, while pulps (85.26%) were lower than (88.64%) for imported apple fruits.

As shown in Table 2, the length of local apple fruit (49.8 ± 0.01 mm) was much lower than of imported apple fruit (117 ± 0.01 mm). This result is also lower than (67.09 and 68.93 mm), respectively for Kristal Taiwan and Semarang Rose water apple fruit determined by Rosnah *et al.*¹¹. The width of local apple fruit (32 ± 0.02 mm) was lower than (90.3 ± 0.03 mm) for imported apple fruit. Rosnah *et al.*¹¹ reported that, the maximum and minimum observed diameters for Kristal Taiwan were (76.39 and 33.6 mm), respectively. These values for the Semarang Rose were (50.66 and 28.13 mm), respectively. For volumes, the local apple fruits (60 ± 0.03 mL³) had the lowest value, while the highest value (144 ± 0.01 mL³) was for imported apple fruits.

As presented in Table 3, the moisture content of local apple fruit ($82.75 \pm 0.01\%$) was lower than ($83.50 \pm 0.02\%$) for imported apple fruit. These results are agreement with the range of (76.69-88.37%)

Table 1: Weight of whole fruit, peels and pulps of local and imported apple fruits

| Apple fruit | Whole fruit weight (g) | Peels | | Pulps | |
|-------------|------------------------|------------|------------|------------|------------|
| | | Weight (g) | Weight (%) | Weight (g) | Weight (%) |
| LAF | 40.51 | 5.97 | 14.74 | 34.54 | 85.26 |
| IAF | 108.80 | 12.35 | 11.36 | 96.45 | 88.64 |

LAF: Local apple fruit, IAF: Imported apple fruit

Table 2: Length, width and volume of local and imported apple fruits

| Apple fruit | Length (mm) | Width (mm) | Volume (mL ³) |
|-------------|-----------------|-----------------|---------------------------|
| LAF | 49.8 ± 0.01 | 32 ± 0.02 | 60 ± 0.03 |
| IAF | 117 ± 0.01 | 90.3 ± 0.03 | 144 ± 0.01 |

LAF: Local apple fruit, IAF: Imported apple fruit

Table 3: Proximate analysis of local and imported apple fruits

| Component (%) | Samples treatment | |
|---------------------|-------------------|------------------|
| | LAF | IAF |
| Moisture | 82.75 ± 0.01 | 83.50 ± 0.02 |
| Crude protein | 0.23 ± 0.03 | 0.25 ± 0.01 |
| Ash | 0.30 ± 0.02 | 0.27 ± 0.03 |
| Crude fat | 0.41 ± 0.04 | 0.35 ± 0.01 |
| Crude fiber | 1.64 ± 0.01 | 1.83 ± 0.04 |
| Total carbohydrates | 14.67 ± 0.01 | 13.80 ± 0.01 |

LAF: Local apple fruit, IAF: Imported apple fruit

reported by Campeanu *et al.*¹² and lower than the range of (90.54-92.58%) and (90.66-92.41%), respectively for Kristal Taiwan and Semarang Rose water apple fruit determined by Rosnah *et al.*¹¹. FAO¹³ reported that, vegetables contain generally 90-96% water while for fruit normal water content is between 80-90%. However, the lower moisture content of local apple fruit is an indication of a good shelf life. Crude protein of local apple fruit ($0.23 \pm 0.03\%$) was close agreement with the ($0.25 \pm 0.01\%$) for imported apple fruit. All of these results are lower than (0.30%) reported by FAO¹³ and (2.21% - 5.22%) registered by Campeanu *et al.*¹². The ash content ($0.30 \pm 0.02\%$) was agreement with the ($0.27 \pm 0.03\%$) for imported apple fruit. The data are agreement with the (0.3%) determined by FAO¹³ and lower than the range of (1.63 - 2.77%) reported by Campeanu *et al.*¹². On the other hand, crude fat and total carbohydrates of local apple fruit ($0.41 \pm 0.04\%$ and $14.67 \pm 0.01\%$), respectively were slightly higher than (0.35 ± 0.01 and $13.80 \pm 0.01\%$), respectively for imported apple fruit. The data are lower than (0.40 and 15.0%), respectively reported by FAO¹³. In addition to this, FAO¹³ reported that, generally fruit and vegetables contain very low level of fats, below (0.5%). Crude fiber content of local apple fruit ($1.64 \pm 0.01\%$) was lower than ($1.83 \pm 0.04\%$) for imported apple fruit.

As shown in Table 4, the pH value of local apple fruit juice (3.90 ± 0.04) was lower than imported apple fruit juice (4.18 ± 0.01). The data are close agreement with the range of (3.40 ± 0.07 - 4.16 ± 0.13) reported by Wu *et al.*¹⁴. However, Rosnah *et al.*¹¹ reported pH values of (4.44 - 4.63 and 3.84 - 4.12), respectively for Semarang Rose and Kristal Taiwan water apple fruits. TSS of local apple fruit juice ($13.80 \pm 0.02\%$) was less than imported apple fruit juice ($14.60 \pm 0.02\%$). The data are within the

Table 4: pH and TSS of local and imported apple fruit juices

| Parameters | Samples treatment | |
|------------|-------------------|------------------|
| | LAFJ | IAFJ |
| pH | 3.90 ± 0.04 | 4.18 ± 0.01 |
| TSS (%) | 13.80 ± 0.02 | 14.60 ± 0.02 |

LAFJ: Local apple fruit juice, IAFJ: Imported apple fruit juice

Table 5: Sensory evaluation of local and imported apple fruits juices

| Kind of juices | General | | | | |
|----------------|------------------|------------------|------------------|------------------|------------------|
| | Appearance | Consistency | Colour | Flavour | Acceptability |
| LAFJ | 8.0 ^a | 7.8 ^b | 8.1 ^a | 7.5 ^b | 7.7 ^b |
| IAFJ | 8.1 ^a | 8.4 ^a | 8.3 ^a | 8.7 ^a | 8.1 ^a |

Based on 9 points scale (9 = excellent, 1 = extremely bad), ^{a,b} means within the same column having the same letters are not significantly different ($p \geq 0.05$) according to Duncan's multiple range tests, LSD: Least significant difference, LAFJ: Local apple fruit juice, IAFJ: Imported apple fruit juice

range of (10.48 ± 0.46 - $14.68 \pm 1.49\%$) reported by Wu *et al.*¹⁴ and higher than the ranges of (7.4 - 9.6 and 5.3 - 9.0%), respectively for Kristal Taiwan and Semarang Rose water apple fruit found by Rosnah *et al.*¹¹.

The sensory evaluation of juices prepared from the local and imported apple fruits are presented in Table 5. The results indicated that, the juices were accepted by the panelists and there are no significant differences as regard to appearance and colour. However, there are significant differences as regard to consistency, flavour and general acceptability.

CONCLUSION

The chemical analysis results of local and imported apple fruits are close agreement. The sensory attribute of the local and imported apple fruit juices indicated that there are significant differences as regard to consistency, flavour and general acceptability.

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