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Effects of drying methods on nutrients and organoleptic properties of dried pawpaw chips

Rowland Monday-Ojo Kayode[1], Victoria Auhoiza Joshua[1,2*], Mubarak Olalekan Oyetoro[1]

[1]*Department of Home Economics and Food Science, University of Ilorin, Ilorin, Kwara State, Nigeria*
[2]*Department of Science Laboratory Technology, Kogi State Polytechnic Lokoja, Lokoja, Kogi State, Nigeria*

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ABSTRACT

Fruit dehydration is one of the ways of preserving fruits and supplying consumers with healthy and nutritious fruits, particularly when these fruits are in their off-seasons. Pawpaw (*Carica papaya* L.) is a tropical plant grown for its edible fruit, having commercial importance because of its high nutritive and medicinal value. However, it is highly perishable. Hence, its processing and preservation are important to retain the product quality and nutritional value. This study investigated the effect of drying methods on the nutrient and organoleptic qualities of pawpaw. Fresh pawpaw fruits were purchased at *Oje* market in Ibadan, Nigeria. The pawpaw samples were sorted, washed with clean water, peeled and sliced into chips, then the chips were dried using five techniques - solar, open sun, oven, cabinet and dehydrator. Fresh and dried samples were evaluated for physico-chemical properties, selected bioactive compounds, colour, fibre, microbial quality and organoleptic properties. Significant ($p \leq 0.05$) differences were observed in the effects of the drying techniques employed. The pawpaw samples that were dried in the dehydrator had significantly ($p \leq 0.05$) higher amounts of bioactive compounds and TSS (8.10 ± 0.00°Bx). They also had the most appealing organoleptic properties and showed the least bacterial growth ($0.14 \pm 0.21 \times 10^4$cfu/g) in comparison to the samples dried using other techniques and the fresh sample ($91.5 \pm 13.44 \times 10^4$). While the sun-dried samples had the least fungal load ($0.05 \pm 0.07 \times 10^3$) in comparison to the samples dried using other techniques and the fresh sample ($315 \pm 7.07 \times 10^3$). Results also showed that the samples dried in the dehydrator were the lightest (26.81 ± 0.01) and yellowest (11.42 ± 0.00) of all dried samples. Generally, findings from the study showed that dried fruits portray a greater nutrient density and increased shelf life compared to fresh fruits.

Introduction

Fruits are a good source of energy, vitamins, minerals, and fibres. According to Escudero-Lopez et al. (2016), eating fruits and vegetables lowers the risk of developing oxidative stress-related diseases (inflammation, cardiovascular diseases, cancer, and aging-related disorders).

Pawpaw (*Carica papaya* L.), also called papaya, is one of such fruits in the *Caricaceae* family, usually cultivated for its edible fruit, which has commercial worth due to its high nutritional and therapeutic value. The fruit is high in beta carotene and fibre, which help to protect against cancer-causing free radicals and decrease cholesterol levels, respectively (Ashaye et al., 2005; Aravind et al., 2013).

Pawpaw ranks higher per serving than any other fruit in terms of nutrition, specifically focusing vitamin A, ascorbic acid, potassium, and fibre (Liebman, 1992; Parker et al., 2010). Governments and educated consumers have made healthy eating a priority in recent years. They were aware that eating fruits and vegetables more frequently should be a part of a healthy diet (Margetts et al., 1997).

*Corresponding author E-mail: joshuavictoria017@gmail.com

Increased demand for such healthy diets results in increased consumer demand for fresh, processed, and semi-processed pawpaws. However, due to the fact that these fruits have an extremely short shelf life and are seasonal, over 50% of them do not reach customers due to softening and moulding during harvesting and shipping (Moraga et al., 2006). Hence, processing and preserving such fruit is crucial to maintain the product's quality and nutritional worth.

Pawpaw fruits are frequently consumed fresh, but can also be processed into jams, jellies, juices, dried, and other products. Food items are generally processed to increase palatability, minimise toxicity, and also preserve them (Ayankunbi et al., 1991). Many processing methods have been used on pawpaw to achieve these goals, including chilling, freezing, fermentation, and heat processing. Thermal processing is frequently used to extend shelf life.

Thermal processing helps to reduce microorganisms in foods to acceptable levels while also preserving certain quality traits like texture, colour, flavour, and nutrient content (Dewanto et al., 2002; Peng and Jiang, 2004). Drying pawpaw to get dried products in the form of cubes, chips, strips, etc, is one method of adding value to the fruit. Dehydration is a traditional and extensively used technology in the food industry that extends the fruit's durability, ensures its availability on national and global markets, and adds value to the product (Machado et al., 2015). Aside from its use in product processing, it is one of the essential preservation procedures for fruits.

For the manufacturing of dehydrated fruits, several drying techniques have been used, including convective hot air drying, vacuum, freeze, and spray drying; however, freeze drying is the best method for preserving fresh fruits' nutritional and antioxidant contents (Orrego et al., 2009). However, freeze drying is the most expensive drying method due to using a vacuum, which operates at extremely low temperatures and pressures (Khalloufi and Ratti, 2003). Research has shown that each drying method for fruits, especially pawpaw, has nutrient retention and overall quality drawbacks. Therefore, it is important to determine the effect of drying methods (solar, open sun, oven, cabinet and dehydrator) on the nutrient composition and organoleptic properties of dried pawpaw chips which have received little or no research attention. Furthermore, this study aims to suggest a promising drying alternative that is efficient and economical, yet gives products with high retention of product quality.

Materials and methods

Source of raw material

Fresh pawpaw fruits were purchased from a local market (*Oje*) in Ibadan, Oyo State. The purchased fruits were immediately transported in fruit baskets to the department of Home Economics and Food Science Processing Laboratory, University of Ilorin, for processing.

Preliminary operations

The fruits were visually inspected and wholesome fruits were selected for processing. They were washed, peeled, deseeded and sliced into chips/strips of irregular sizes and shapes before blanching. This was done in order to inactivate enzymes and aid colour retention.

Drying

About 300 g of fresh pawpaw chips were dried. Drying was prolonged until constant weight was obtained after an hour interval. For open sun drying, pawpaw chips were spread on trays and left in the sun and allowed to sundry in natural airflow at temperatures ranging between 24 °C – 31 °C. For oven, cabinet and dehydrator drying, pawpaw chips were dried at 65 °C (Paramanandam et al., 2021). Solar drying was done in a solar dryer exposed outside for solar radiation. The solar dryer had sides made of perforated plywood for adequate airflow. The average temperature in the solar dryer ranged from 25 °C – 52 °C. The dried samples were allowed to cool, packaged in an air tight plastic container and finally stored at ambient temperature for analysis. Samples were taken from each of the five portions while fresh pawpaw fruit was used as a control. The samples were pulverized and homogenised before analysis.

Physico-chemical analysis

The fresh and dried pawpaw chips were evaluated for total soluble solids (TSS), total titirable acidity (TTA), colour, pH, moisture and fibre. The TSS content was measured using a hand refractometer at 20 °C. The ground chips (5.0 g) was mixed with 20 ml distilled water then filtered through muslin clothes. A drop of the filtrate was placed on the prism and results were recorded as degree Brix (°Bx) (Lyu et al., 2015). Using phenolphthalein as indicator, a portion of the filtrate was titrated against 0.1 mol/L NaOH to determine TTA. TTA was calculated and expressed in mg citric acid per 100 g dry matter. Colour was determined

using a colorimeter (model: WR-10). The colorimeter is based on the CIE Lab method, where L* represents the whiteness/brightness, a* represents the redness/greenness and b* represents the yellowness/blueness (Zou et al., 2013). pH was determined using a digital pH meter previously calibrated with buffers solutions 4 and 7. Moisture content was determined by placing 2 g of ground pawpaw chips in an hot air oven at 105 °C until a constant weight was achieved. Results were expressed as a percentage of the dry matter. For the determination of fibre, 5 g of ground pawpaw chips was defatted using petroleum ether, then it was boiled with 200 ml of H_2SO_4 for 30 minutes. The mixture was filtered and the residue was washed with boiling water, then it was boiled in 200 ml of NaOH for 30 minutes. Results were expressed in g/100 g dry matter (AOAC 2010).

Bioactive compounds

The bioactive compound evaluated was ascorbic acid. The ascorbic acid content was determined using the 2,6-dichlorophenol indophenol titration method described by (Ndawula et al., 2004). Two grams of sample were homogenized in a mortar containing 10 ml of 0.5% oxalic acid (extraction solution) and the content was transferred into 100 ml volumetric flask. More extraction solution was added up to the mark. The content was mixed thoroughly, filtered immediately using Whatman No. 4 filter paper and 10 ml aliquots of extract were titrated against standardized 2, 6-dichlorophenol indophenol solution. An equivalent amount of the extraction solution was titrated against standard 2, 6-dichlorophenol indophenol solution serving as a blank. Ascorbic acid content was expressed as mg/100 g. Beta-carotene and lycopene were determined according to the method described by Soytong et al. (2021). For beta-carotene, 0.5 g of pawpaw chips was homogenized and extracted using 5ml of chilled acetone, and allowed to stand for 15 minutes in an ice bath. Mixture was centrifuged for 10 minutes at a speed of 1370 x g, the supernatant was filtered using Whatman filter paper No.42 and absorbance was read in a UV-Vis spectrophotometer at 449 nm. To measure lycopene content, 1 g of pawpaw chips was homogenized and extracted in 10 ml of acetone and n-hexane mixture (4:6), and it was left in an ice bath for 10 minutes. Centrifugation was done at 1370 x g for 10 minutes and the supernatant was filtered through Whatman filter paper No.42. Absorbance was read in a UV-Vis spectrophotometer at 472 nm. Total flavonoids were estimated using Aluminium trichloride method. Two grammes of pawpaw chips were homogenized with 50 ml of methanol for 30 minutes. The above methanolic extract solution (1.0 ml) was mixed with 1 ml of 2% methanolic $AlCl_3$ x $6H_2O$ for 10 minutes. Then, the absorbance at 430 nm was measured. Distilled water was used as blank. The result was expressed in mg rutin equivalent/100 g dry matter (Nurul and Asmah, 2012). Folin and Ciocalteu's method was used to determine the amount of total phenolics. The fruit chips (0.5 g) were homogenized with 10 ml of extraction solution (acetone/water, 7/3 v/v) for 10 minutes. After filtration, 3 ml of the filtrate was mixed with 2.5 ml of Folin-Ciocalteu reagent diluted with water (1/10). The mixture was allowed to react for 2 minutes after which 2 ml of 7.5% Na_2CO_3 was added, then it was incubated for 15 minutes in the dark. A spectrophotometer was used to determine the absorbance at 760 nm and results were expressed as mg gallic acid equivalent/100 g (George et al., 2005).

Evaluation of organoleptic properties

The acceptability of the fruit chips was evaluated in terms of its appearance, crispness, taste, aroma, and overall quality acceptability (Zou et al., 2013). The test was carried out by a 30-member evaluation panel (students and staff from the Department of Home Economics and Food Science, University of Ilorin). The pawpaw chips were assigned 3-digit codes and presented to the evaluation panel in saucers. Panelists were provided with warm water to rinse their mouths after assessing each sample. A 9-point hedonic scale was used with a score of 1–9, where 1 represented dislike extremely, 5 neither like nor dislike, and 9 like extremely.

Microbial analysis

Total bacterial and fungal counts were determined using the pour plate method as described by (Fawole and Oso, 2004). One gram of samples was added to 9 ml of sterile distilled water and five ten-folds serial dilutions were made. Then 1 ml was plated on nutrient agar and potato dextrose agar for total bacterial counts and total fungal counts, respectively. Plates for total bacterial counts were incubated at 37 °C for 24 hours and plates for total fungal counts were incubated at 25 °C for 48 hours. The colonies were counted and expressed as colony forming units per gram (cfu/g).

Statistical analysis

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) software, version 20 (SPSS Inc., Chicago, IL, USA). Results are expressed as mean ± standard deviation (SD) and analysed using

One-way ANOVA. Significant differences between means were assessed by the Duncan Post Hoc test, and $P < 0.05$ was considered as statistically significant.

Results and Discussion

Physico-chemical properties of the dried pawpaw chips

The total soluble solids (TSS) of the samples are presented in Table 1. The degrees of brix ranged from 5.25 to 9.20. A significant ($p \leq 0.05$) decrease was observed in all dried samples compared to the control. This result contrasts Reis et al. (2018), who reported an increase in soluble solids content after drying. The sugars may be degraded due to the high drying temperatures and extended drying times. In line with this, Idah et al. (2014) reported a decrease in the TSS content of the end product during drying at high temperatures of 50 °C, 60°C, and 70 °C.

The total titratable acidity (TTA) of the various dried pawpaw fruits, which ranged from 0.54 to 0.77%, increased significantly ($p \leq 0.05$) when compared to the control sample (0.20%). This finding conforms to that of Abrol et al. (2014) who found that TTA increased after drying. The increase in acidity may be attributed to a large amount of moisture lost, contributing to the acidic concentration of the dried sample. Additionally, the increase in acidity may also result from acid formation due to sugar inter-conversion and other chemical processes (Abrol et al., 2014).

The pH of the samples significantly ($p \leq 0.05$) decreased after drying. This is primarily due to an increase in titratable acidity. The study showed that pH and titratable acidity have an inverse relationship. pH falls as titratable acidity rises. Increased organic acids in fruits and vegetables have been connected to reduced pH (Ke, et al., 1994).

The moisture contents of the dried samples ranged between fresh 12.79 and 16.73%, which were significantly ($p \leq 0.05$) lower than the 89.14% in the fresh. The driers' different operating modes and efficiencies explain the varying moisture contents.

The crude fibre content of the samples did not differ significantly. However, literature has reported an increase in the fibre content of dried fruits (Siriwattanenon and Maneerate, 2016).

When compared to the control (fresh) sample, the L*, a*, and b* values of the dried samples were significantly ($p \leq 0.05$) different. However, similarities exist between the L* values of some drying methods (Table 1). The lightness (L*) of the pawpaw decreased after drying, indicating the occurrence of browning in the dried samples. The colour of the dried samples was more vivid and reddish than the fresh samples. This is apparent in the higher values of a*. The increased concentration of pawpaw carotenoids could explain this result after drying, particularly lycopene, the major carotenoid found in fresh pawpaw and responsible for the fruit's red colour (RodriguezAmaya, 2010). Mishra et al. (2015) dried pawpaw by combining osmotic dehydration with infrared drying. They also reported an increase in the value of the a* coordinate in the final product.

Bioactive compounds found in pawpaw chips

The bioactive compounds analysed in the fresh and dried pawpaw chips are presented in Table 2. The results revealed substantial variations in the bioactive chemicals examined for all samples. Vitamin C levels ranged from 124.90 to 571.09 mg/100 g. When compared to the control (fresh) sample, all samples showed a significant increase ($p \leq 0.05$). This could be linked to a rise in organic acid concentrations (concentration effect). This is in line with the findings of Reis et al. (2018) who found that dried papaya had a higher level of bioactive chemicals than fresh papaya, with values roughly six times higher. The antioxidant activity of these compounds increased as their concentration increased. The results were greater than the USDA's 60.9 mg/100 g standard reference. For adolescents aged 10 to 18 years and adults aged 19 to 60 years, the Recommended Nutrient Intakes (RNIs) for ascorbic acid are 40 and 45 mg per day, respectively (WHO, 2014). Since more than 100 g of the processed pawpaw can be eaten in a serving, it is considered that the ascorbic acid content in 100 g of the processed pawpaw will be sufficient to meet their vitamin C dietary needs. Ascorbic acid, which is known for its immune-boosting and antioxidant properties, is abundant in pawpaw. It focuses on a variety of methods that cancer cells use to grow and survive (Ngo et al., 2019). It has also been said to defend against infectious diseases, like coronavirus (Dunlop, 2020).

Table 2 shows the results of the lycopene and beta-carotene tests. Lycopene and beta carotene ranged from 0.02 to 0.13 mg/100 g and 0.01 to 0.06 mg/100 g, respectively. The results showed a significant increase ($p \leq 0.05$) in all samples when compared to the control (fresh) sample; however, beta-carotene levels are not significantly different between sun and cabinet dried samples, and lycopene levels are not significantly different between dehydrator and cabinet dried samples. The drying temperature had no negative effect on the quantitative changes in total lycopene and beta-carotene in dried pawpaw, according to this study. Total lycopene and beta-carotene alterations during drying were observed to

vary slightly depending on the technique used for drying. Normally, high temperatures, light, oxygen, acids, catalysts, and metal ions can influence the carotenoids concentration in food items by causing all-trans and cis-isomer degradation and/or isomerisation from all-trans to cis-isomer (Shi et al., 2002). However, it was unclear whether the low preservation of carotenoids was due to longer drying durations or higher temperatures. Although higher temperatures have been proven to induce significant losses of carotenoids, the extraction yield may be enhanced, resulting in an increase in carotenoid content. The fact that most phytochemical substances are attached to other molecules or cell structures describes this. The ability of heat treatment to disrupt the cell membrane has been proven, allowing bound phytochemical substances to be liberated from chromoplasts into the cytoplasmic medium. As a result, they are easier to extract. Furthermore, increasing the exposure of carotenoids compounds to oxidation during long-term drying at low temperatures may enhance their vulnerability to degradation (RodriguezAmaya and Kimura, 2004).

Table 2 shows the results of the total phenol content (TPC) test. The concentrations ranged from 32.95 mg/100 g to 109.35 mg/100 g. The results showed a significant increase ($p \leq 0.05$) in all samples when compared to the control (fresh) sample. However, there was no significant difference between the sun and cabinet dried samples. This is in contrast to several earlier research that found that drying tropical fruits such as mango, pitaya, starfruit, muskmelon, watermelon, and pawpaw can cause a decrease in TPC (Shofian et al., 2011; Yi et al., 2017). In the current study, the TPC of all samples increased significantly after drying. In line with this, other authors have reported that various drying techniques resulted in an increased TPC in pawpaw as compared to fresh ones. They attributed it to the polyphenolic compounds released from the food matrix during drying (Annegowda et al., 2014). Also, the availability of phenolic precursors via non-enzymatic inter-conversion between phenolic molecules may contribute to the formation of phenolic compounds at high temperatures (Que et al., 2008).

The total flavonoid concentration (TFC) of the fresh pawpaw analysed was 3.61 mg/100 g (Table 2). This value is similar to the findings of Spinola et al (2015). TFC levels in dried papaya chips increased as a result of drying. The ability of drying to break down covalent bonds has been suggested and, thus, aids the liberation of bio-compounds such as flavonoids from repeating polymers (An et al., 2016), resulting in increased flavonoid quantification.

Table 1. Physico-chemical properties of fresh and dried pawpaw chips

Parameters	Fresh	Solar tent	Sun	Cabinet	Oven	Dehydrator
TTA (%)	$0.20^{e}\pm0.00$	$0.70^{b}\pm0.01$	$0.54^{d}\pm0.01$	$0.77^{a}\pm0.03$	$0.54^{d}\pm0.00$	$0.63^{c}\pm0.04$
TSS (Brix)°	$9.20^{a}\pm0.00$	$6.65^{c}\pm0.07$	$5.25^{f}\pm0.07$	$5.80^{d}\pm0.00$	$5.60^{e}\pm0.00$	$8.10^{b}\pm0.00$
pH	$6.55^{a}\pm0.01$	$5.40^{e}\pm0.00$	$5.46^{d}\pm0.00$	$5.07^{f}\pm0.00$	$5.79^{b}\pm0.01$	$5.57^{c}\pm0.00$
Moisture content (%)	$89.14^{a}\pm0.69$	$12.79^{d}\pm1.99$	$12.90^{cd}\pm1.05$	$16.29^{bc}\pm1.90$	$12.92^{cd}\pm0.12$	$16.73^{b}\pm1.31$
Crude fibre (g/100g)	$10.89^{a}\pm1.24$	$10.57^{a}\pm0.64$	$10.92^{a}\pm0.83$	$9.53^{a}\pm0.10$	$10.79^{a}\pm0.30$	$9.71^{a}\pm0.04$
*L**	$26.75^{a}\pm0.23$	$24.36^{b}\pm0.00$	$24.06^{c}\pm0.01$	$23.97^{c}\pm0.01$	$24.47^{b}\pm0.02$	$26.81^{a}\pm0.01$
*a**	$0.28^{f}\pm0.00$	$1.14^{d}\pm0.00$	$1.28^{c}\pm0.01$	$1.39^{b}\pm0.01$	$0.62^{e}\pm0.01$	$2.01^{a}\pm0.01$
*b**	$12.58^{a}\pm0.13$	$8.04^{d}\pm0.00$	$7.86^{e}\pm0.01$	$7.71^{f}\pm0.01$	$8.45^{c}\pm0.02$	$11.42^{b}\pm0.0$

**Values are mean ± standard deviation. The mean values in a row with the same superscript are not significantly ($p \leq 0.05$) different from each other.*

Table 2. Bioactive compounds found in pawpaw chips

Samples	Lycopene (mg/100g)	Beta-carotene (mg/100g)	Ascorbic acid (mg/100g)	Total phenol (mgGAE/100g)	Total flavonoid (mgRE/100g)
Fresh	$0.02^{e}\pm0.00$	$0.01^{d}\pm0.00$	$124.90^{f}\pm1.08$	$32.95^{d}\pm3.18$	$3.61^{c}\pm0.39$
Solar tent	$0.01^{e}\pm0.00$	$0.00^{e}\pm0.00$	$328.79^{b}\pm6.20$	$103.82^{b}\pm0.64$	$5.21^{ab}\pm0.19$
Sun	$0.02^{d}\pm0.00$	$0.05^{b}\pm0.00$	$190.01^{d}\pm0.59$	$98.06^{c}\pm0.28$	$4.57^{ab}\pm0.45$
Cabinet	$0.11^{a}\pm0.00$	$0.05^{b}\pm0.00$	$159.60^{e}\pm0.72$	$94.70^{c}\pm1.76$	$4.36^{bc}\pm0.44$
Oven	$0.05^{b}\pm0.00$	$0.01^{c}\pm0.00$	$279.28^{c}\pm13.86$	$104.30^{b}\pm1.27$	$4.70^{ab}\pm0.23$
Dehydrator	$0.13^{a}\pm0.00$	$0.06^{a}\pm0.00$	$571.09^{a}\pm7.33$	$109.35^{a}\pm0.29$	$5.39^{a}\pm0.38$

**Values are mean ± standard deviation. The mean values in a column with the same superscript are not significantly ($p \leq 0.05$) different from each other.*

Table 3. Total bacterial and fungal counts of fresh and dried pawpaw chips

Samples	TBC ($\times10^4$cfu/g)	TFC ($\times10^3$cfu/g)
Cabinet	NG	0.61^{b}±70.57
Solar tent	35.00^{b}±5.66	NG
Oven	35.00^{b}±7.07	0.35^{c}±7.07
Dehydrator	0.14^{c}±0.21	0.30^{c}±0.07
Sun	35.50^{b}±24.75	0.05^{d}±0.07
Fresh	91.50^{a}±13.44	315^{a}±7.07

NG = No Growth. *Values are mean ± standard deviation. The mean values in a column with the same superscript are not significantly ($p\leq0.05$) different from each other.

Table 4. Mean organoleptic score of the dried pawpaw chips

Samples	Appearance	Taste	Crispness	Aroma	Overall acceptability
Solar	5.83^{b}±0.83	6.13^{b}±1.28	5.13^{bc}±1.57	5.07^{bc}±1.20	6.00^{b}±1.15
Cabinet	3.60^{c}±1.43	4.23^{c}±1.04	4.73^{bc}±1.20	5.17^{bc}±1.53	4.53^{c}±1.07
Dehydrator	8.03^{a}±0.77	7.20^{a}±1.71	5.97^{a}±1.50	6.10^{a}±1.52	7.20^{a}±1.69
Sun	5.30^{b}±1.37	6.07^{b}±1.29	5.43^{ab}±1.33	5.70^{ab}±1.34	5.73^{b}±1.23
Oven	5.37^{b}±1.16	3.83^{c}±1.49	4.40^{c}±1.30	4.70^{c}±1.56	4.27^{c}±1.84

*Values are mean ± standard deviation. The mean values in a column with the same superscript are not significantly ($p\leq0.05$) different from each other.

Microbial counts of fresh and dried pawpaw chips

The microbial count was carried out to ascertain the safety of the pawpaw chips for human consumption. Table 3 shows the total bacterial counts (TBC) and total fungal counts (TFC) for fresh and dried pawpaw slices. The microbial counts for TBC and TFC ranged from 0.14×10^4 to 91.50×10^4 cfu/g and 0.05×10^3 to 315×10^3 cfu/g respectively. All samples showed a substantial decrease ($p\leq0.05$) when compared to the control (fresh) sample. However, samples dried in the oven and dehydrator are not significantly ($p\leq0.05$) different in fungal counts. Similarly, no significant ($p\leq0.05$) difference was observed in the bacterial counts of the oven, solar, and sun-dried samples. The reduced moisture content and pH may also hamper microbial activities in the dried samples. However, in the dried fruit samples, all samples were within tolerable limits for bacteria (10^4 - 10^5) and fungi (10^3), respectively (Uzor and Dick, 2022). The higher microbial load found in the control sample could be attributed to contamination from the handler during preliminary operations.

Organoleptic properties of dried pawpaw chips

Table 4 shows the mean sensory scores for the dried pawpaw chips in terms of colour, taste, texture, scent, and overall acceptability. The results revealed that there were significant ($p\leq0.05$) differences in the overall acceptability of dried pawpaw chips. The sample dried in the dehydrator had the highest sensorial appeal in terms of colour, taste, crispness, aroma, and overall acceptability. This could be attributed to the better drying conditions (drying rate and uniformity) in the dehydrator, as the sensory appeal of dried fruits is reported to be influenced by the drying method employed (Ssemwanga et al., 2020). While the cabinet dried sample received the lowest score (3.60) for colour appeal; the oven dried sample scored lowest in texture (4.40) and aroma (4.70) and cabinet dried and oven dried samples both obtained the lowest sensory score for taste. The low scores recorded for aroma, and the intermediate scores recorded for taste could have bee influenced by a decrease in the amount of volatile flavour compounds.

Conclusions

In conclusion, the data obtained suggest that drying fruits in a dehydrator proves to be an effective technique that could be applied to process sensitive food materials. This is evident by the results reported in this study which shows that the pawpaw chips dried in a dehydrator had higher amounts of bioactive compounds, good colour retention, acceptable microbial loads and the best sensorial appeal. It is recommended that fruits should be dried in a dehydrator to minimize losses (in the physical, nutritional and organoleptic properties) that could occur during processing. Furthermore, shelflife study should be carried out and the effect of packaging materials on the shelf life in view of commercial considerations should be assessed. Also, different blanching periods are recommended in order to prevent browning of fresh fruits during subsequent processing and to improve the quality of dried product.

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