THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

Chemical and Phytochemical Composition of the Kenyan Apple and Tommy Atkin Mango Pulp

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Abstract:
Processing mango fruit into shelf-stable products such as chips, pulp, nectar, and juices can reduce post-harvest losses and provide farmers with income while also eliminating inequalities in food security and nutrition. Mango pulp is rich in macronutrients and microminerals but needs to be verified before being used to make nectar. This study aimed to examine the chemical and phytochemical composition of two mango cultivars, Tommy Atkins and Apple, cultivated in Machakos County. The Association of Official Analytical Chemists' methods assessed the chemical, nutritional, and phytochemical properties of two mango cultivars using a completely randomized design. There is a statistically significant difference ($p<0.05$) between most of these parameters. The result showed that Mango pulp contains total phenolics (31.468 for apple and 28.378 mg for Tommy Atkin GAE/100g DW), flavonoids (11.457 for apple and 9.427 mg Tommy Atkin QE/100g DW), Vitamin C (75.81 for apple and 22.69 for Tommy Atkin mg/100g) and Vitamin A (10.12 for apple and 2.65 for Tommy Atkin mg/100g). Apple mango pulp had the most phenolics, flavonoids, and antioxidants (vitamins C and A) compared to Tommy Atkin mango pulp. The nutritional composition result showed that apple mango fruit pulp had a significantly higher amount of protein (4.85%), fiber (7.92%), calcium (48.05 mg/100g D.W), and zinc (4.42 mg/100g D.W) than Tommy Atkin mango fruit pulp (protein - 4.72%, fiber - 7.26%, calcium - 33.2mg/100g DW, and zinc - 4.4.17 mg/100g DW). However, the amount of iron in Tommy Atkin mango fruit pulp (9.36 mg/100g DW) is higher than that of apple mango fruit pulp. Apple mango fruit can be used to reduce hunger and protect against deficiencies in nutrients.

Keywords: *Apple mango, Tommy Atkin mango, mango pulp extraction, proximate composition and phytochemical*

1. Introduction

Mango (Mangifera indica) is a tropical, subtropical, and frost-tolerant fruit belonging to the Anacardiaceae family (Sennhenn et al., 2014). The fruit is a fleshy drupe of varying size, color, fiber content, and taste. The shape varies from round to ovate-oblong and longish, ranging from 2.5 to 30 cm. The mature fruit is highly nutritious and can serve as an energy source (Bello et al., 2016). Mango is the second most traded tropical fruit in Kenya, second only to bananas, and Africa's seventh most produced tropical fruit. In subhumid to semiarid regions of Kenya, mango is a high-potential fruit farmed for domestic and export markets (Bello et al., 2016). Mango output was 779,147 million tons, valued at KES 11.9 billion in 2016 (Bello et al., 2016).

In Kenya, post-harvest losses in the mango fruit supply chain are estimated to be between 40 and 50% due to the lack of proper post-harvest handling technology, processing facilities, and market, negatively affecting farmers' revenue (Maloba et al., 2017).

Due to the lack of value-added technologies, viable markets for fresh fruit, and intense competition from manufactured and imported juices, less than 1% of mango fruit is processed into value-added products in Kenya (Okoth, 2013). Mango fruit value addition may be utilized to make shelf-stable products while reducing poverty via enhanced food and nutrition security (Okoth et al., 2013).

This is made possible by treatments that retain fruit quality after harvest. The process includes hand harvesting, chilled transportation, cleaning, cooling/refrigerated storage, drying, packaging and labeling, and pulp extraction (Okoth et al., 2013). Mango processing in Kenya can decrease post-harvest losses by processing the fruit into pulp that can be utilized to manufacture a range of products such as juices, jams, concentrates, nectars, powders, and slices (Riaz & Ahmed,

2010). Fresh fruit's edible pulp makes up 33–85% of the total weight, while the skin and seed make up 7–24% and 9–40%, respectively. Mango pulp products are frequently preserved by thermal processing, which uses high temperatures (>90oC) over prolonged periods of time in order to assure microbiological safety and enzyme inactivation to improve shelf life (Kaushik et al., 2018).

Calcium, copper, iron, phosphorus, manganese, magnesium, zinc, boron (0.6-10.6 mg/kg), and selenium are all present in significant proportions in mango pulp. Along with organic acids like citric acid, malic acid, oxalic acid, succinic acid, and tartaric acid, the pulp is also abundant in bioactive compounds like phenolic acids, sterols, and alkaloids. (Owino et al., 2021). Mango pulp is the primary raw material for various products, including nectar, jam, jelly powder, fruit bars, and mango flakes. However, its inherently pulpy characteristics and high viscosity level are less desirable (Siva et al., 2022). Furthermore, Prior research has shown that mango pulp is rich in macronutrients and microminerals, such as calcium, iron, and zinc; however, these findings must be confirmed before mango pulp is utilized to manufacture nectar.

This study provides the chemical, nutritional, mineralogical, and phytochemical composition of mango pulp collected in Machakos County, Kenya, even though there has been very little scientific research on the antioxidant content of mango pulp in Kenya.

2. Materials and Methods

2.1. Study Design

The study design of this current investigation was a completely randomized design conducted as a comparative analysis of mango pulp. The chemical, nutritional, and phytochemical properties were carried out on two mango varieties (apple and Tommy Atkin) cultivated in Kenya. The mango fruits were randomly collected from farms based on color, size, and maturity stage in Machakos County between January and April 2022.

2.2. Procurement of Fruits

Apple and Tommy Atkin mangoes (500 pieces of each kind) were harvested when mature (firm) but not ripe or ready to eat (soft) from smallholder farmers in Machakos County. The fruit was harvested early in the morning (6 to 8 a.m.) to avoid direct sunlight and gathered under shade. The fruits were brought to the University of Nairobi's food science, nutrition, and technology department in a perforated crate. Apples and Tommy Atkin mangoes were kept at room temperature (25±2^{o}C and 47% relative humidity) until they were processed.

2.3. Preparation of Mango Pulp

Apple and Tommy Atkin mangoes were sorted based on the color of their skins as they turned green to yellow/orange for Apple, dark red to orange and yellow accents for Tommy Atkin, and washed in continuous tap water before being weighed, peeled, destoned, and pulped in a pulping machine equipped with a 0.5 mm stainless steel screen (D.K Engineering, Kenya). The extracted pulps were then pasteurized (70°C for 10 minutes) and preserved with sodium metabisulphite at 300ppm, as recommended by (FAO, 2005; Omayio et al., 2022). Pasteurized mango pulp was filled into 500 ml PET plastic bottles at 55^{o}C and promptly frozen at -20^{o}C until further utilization (analysis).

2.4. Sample Collection

Approximately ten bottles of each mango pulp fruit (apple and Tommy Atkin) were frozen at -20^{0}C. One bottle of each variety was randomly selected as a sample. In duplicate, the frozen sample was thawed in running water and then used to determine the proximate, chemical, and phytochemical composition.

2.5. Analytical Method

2.5.1. Proximate Composition of Mango Pulp

The moisture content was determined using an AOAC (2005) forced air oven drier and the AOAC (2005) Methodology 930.15. (Memmert 40500-IP20-Schhutzart, Germany). The sample was dried for three hours at 105°C on aluminum dishes after being weighed on the AR3130 KERN®PCB 3500 precision weighing scale (Balingen, Germany). The moisture content was determined as a proportion of the weight loss of the sample. The ash content was determined by weighing about 10 g of the sample into silica crucibles, then drying the sample in an oven for two hours to remove the moisture. The sample was ashed in a muffle furnace at 550±5^{o}C for four hours until it turned into white or gray ash. The amount of fat was determined using solvent extraction according to AOAC (2005) method 960.39a. Approximately 1 g of the sample was packed into thimbles and placed in a Soxhlet extraction equipment with petroleum ether as the solvent. The fiber content was determined by adding about 25ml of H_2SO_4 2.O_4N and 1.78N of KOH to 4g of juice mixed with distilled water, according to AOAC (2005) method 960.39a. After increasing the amount to 200ml, the mixture was left to boil for 30 minutes before filtering through glass wool. The glass wool was dried in an oven for two hours to remove moisture and then placed in a muffle furnace at 550±5^{o}C for four hours. The fiber value was calculated by difference and expressed as mg/100g. Kjeldahl distillatory equipment was used to determine the protein per AOA (2007). About 5ml of juice was digested for 4 hours with 10ml of concentrated H_2S0_4 subscript numerals, then distilled and titrated with 0.1N NaOH in the presence of methyl orange. The outcome was expressed as mg/100g and carried out twice. The carbohydrate content of mango pulp was calculated by difference, where CHO=100-(protein%+moisture%+fiber%+fat%+ash%) using the methods described by (Gul & Safdar, 2009). The outcome was expressed as mg/100g dry weight and carried out twice. Truck et al. (2016) determined the energy by multiplying the Atwater factors for protein, carbohydrates, and fat by 4, 4,

and 9, respectively. The outcome was given in terms of kcal/100g. Duplicated values were calculated for every parameter. Except for moisture, all other characteristics were computed using the dry weight basis method (d.w)

2.5.2. pH and Titratable Acidity

The AOA (2012) method was used to determine the pH using a digital five easy pH-meter, model F20 (Mettle, Toledo, USA), with a few modifications. Two buffer standard acid and alkali solutions, designated 4 and 7, were used to calibrate the pH meter. The pH readings were duplicated after inserting the electrode into 50 ml samples. The titratable acidity was determined using the AOAC (2012). In the presence of phenolphthalein, 10 milliliters of samples were diluted in 50ml of distilled water and titrated with 0.1 N NaOH. The outcome was expressed in mg of citric acid/100g sample. The analysis was carried out in duplicate.

2.5.3. Total Soluble Solid

TSS was measured using a hand-held refractometer according to the AOAC (2012) method using a refractometer (SK106-SATO, Japan). The degree of Brix measurement was obtained immediately after a sample drop was put on the refractometer's display. The readings were done in duplicate.

2.5.4. Vitamin C Content

The AOAC 967.2 (2005) method of converting 2,6-standardized dichlorophenolindophenol (DCPIP) solution to a colorless dye was duplicated to determine vitamin C content. Titrations with a standardized ascorbic acid solution in triplicate were used to standardize the DCPIP solution. In a 50 ml volumetric flask, 10 g of the sample was weighed and filled to volume with a 5% trichloroacetic acid (TCA) solution. Ten (10 mL) of the solution was titrated against the DCPIP solution in duplicate. The vitamin C content was expressed as mg/100g of sample dry weight.

2.5.5. B-Carotene (Pro-Vitamin A) Content

Utilizing modified spectrophotometric methods as Mustapha and Babura (2009) described, provitamin (vitamin A) levels were measured. A standard curve was created using a Hitachi 2900 UV/VIS spectrophotometer (Tokyo, Japan) calibrated to 450 nm and beta-carotene standards with concentrations of 0-2.4 g/mL. A mortar and pestle were used to combine one gram of each dry sample with small amounts of acetone until a colorless residue was produced. The acetone was then evaporated at 60°C in a water bath, with 25 mL of the extract added to a flask with a circular bottom. A 25 mL volumetric flask was used to hold the evaporated material after it had been dissolved in 1 mL of petroleum ether and eluted with pet ether. After measuring the absorbance at 450 nanometers using a standard curve created using a Hitachi 2900 UV/VIS spectrophotometer (Tokyo, Japan) against pet-ether as a blank, the provitamin A concentrations were estimated. The output from the two extractions was displayed as mg per 100 g of the sample's dry weight.

2.5.6. Minerals Content

Calcium, zinc, and iron content were determined using a Buck Scientific model 210 VGP atomic absorption spectrophotometer (Fort Point, USA) per the AOA (2012) method, with minor modifications. Approximately 10g of the sample was dried in an oven for two hours before being put in a muffle furnace set at 550±5^{o}C for four hours. Then, 10 ml of HCL (20%) was used for digestion, and 50 ml of distilled water was added to the digested sample. The value was given as mg/100 g dry weight.

2.5.7. Total Phenolic Content

The total phenolic content was determined using a modified Folin-Ciocalteu technique, as Prior et al. (2005) reported. The samples (2 mL) were centrifuged (vortex, 3000g) overnight after being combined with 10 mL of 80% methanol. 2.5 ml of folic was added to one (1 ml) of the mixture. Two (2ml) of a 5% w/v sodium carbonate solution were added. The resulting solution's volume was increased to a final value of 10 mL by adding distilled water. At 45°C, the mixture was incubated for 15 minutes. The absorbance was measured at 765 nm wavelength using a UV-VIS spectrophotometer (Tokyo, Japan) - A standard calibration curve by obtaining readings to measure the sample total phenolics concentration. The results were expressed as Gallic acid equivalents (GAE)/100 mg dry weight.

2.5.8. Total Flavonoids Content

The flavonoid content was assessed using a colorimetric approach proposed by Naksuriya and Okonogi (2015). Ten (10 mL) of methanol (80%) and two (2 mL) samples were combined, stirred, and centrifuged overnight. One (1 mL) sample and 4 mL of distilled water were combined and let to stand for 15 minutes. After 15 minutes, 2 mL of NaOH (1 M), 0.3 mL of aluminum chloride ($AlCl_3$) (1% t/wv), and 0.3 mL of sodium nitrite ($NaNO_2$) (5% w/v) were added to the mixture. The volume was then upped to 10 ml using distilled water. Absorbance was then read at 510nm using a Hitachi 2900 UV/VIS spectrophotometer (Tokyo, Japan) against a blank reagent (distilled water). The flavonoid content in the sample was calculated by projecting the standard calibration curve and expressed as mg of Quercetin equivalents per 100g of dry weight (QE mg/100g).

2.6. Data Analysis

Statistical Analysis was done using computer Stata software to analyze the proximate composition, vitamins C and A, mineral content, phytochemical, TSS, TTA, and pH. The analysis was done by application of one-way analysis of variance (ANOVA) at 0.05 significance level.

3. Results and Discussion

3.1. Proximate Composition of Mango Pulp

The nutritional content of mango pulp is characterized in terms of moisture, ash, protein, fiber, fat, carbohydrate, and energy content (Table 1). The results showed a statistically significant (P<0.0001) difference between the pulp samples, with apple mango pulp having significantly higher moisture (86.26±0.18 and 85.28±0.3), ash (1.45±0.12 and 1.11±0.06), fiber (7.92±0.07 and 7.26±0.1), protein (4.85±0.04 and 4.72±0.13) and energy (415.80±0.67 and 415.733±0.25) than Tommy Atkin mango pulp, with the exception of fat (0.47±0.006 and 0.25±0.07) and carbohydrate content (82.57±0.58 and 81.35±0.05).

Pulp	Moisture (%)	Ash (%)	Fat (%)	Fiber (%)	Protein (%)	Carbohydrates (%)	Energy (kcal/100g)
Apple mango	86.29±0.18^{b}	1.45±0.12^{b}	0.25±0.007^{a}	7.92± 0.07^{a}	4.85±0.04^{a}	81.35±0.05^{a}	415.80±0.67^{b}
Tommy pulp	85.28±0.30^{a}	1.11±0.06^{a}	0.47±0.006^{b}	7.26± 0.10^{a}	4.72±0.13^{a}	82.57±0.58^{a}	415.733±0.25^{b}
P value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Table 1: Proximate Composition of Apple and Tommy Atkin Mango Pulp

Values are means ± Standard deviation. Means with different superscript letters along the columns are significantly different at p<0.05 (Bonferroni's test)

3.2. Physicochemical, Mineral, and Phytochemical Content of Apple and Tommy Atkin Mango Pulp

The chemical, mineral, and phytochemical were statistically significance (p<0.0001) differences among the mango pulp sample. Table 2 shows the chemical, mineral, and phytochemical composition of mango pulp. The pH (4.66±0.1), vitamin C (75.81±0.28mg/100g), vitamin A (10.12±0.28mg/100), total phenolics (31.468±79.47 mg GAE/100g), flavonoids (11.457±21.00mg QE/100g), calcium 48.05±0.24 mg/100g), and zinc (4.42±0.07 mg/100g) of apple mango pulp were significantly higher than the pH (4.42±0.2), vitamin C (22.69 mg/100g), vitamin A (2.65±0.13 mg/100g), total phenolics (28.378±15.61 mg GAE/100g), flavonoids (9.427±10.08 mg QE/100g), calcium (33.20±1.53mg/100g), and zinc (4.17±0.58mg/100g) of Tommy Atkin mango pulp. However, Tommy Atkin mango pulp had high TTA (0.48±0.004%), TSS (14.1±0^{0}Brix), and Iron (9.36±0.96mg/100g) compared to apple mango pulp TTA (0.31±0.001%), TSS (13.2±0.1^{0}Brix) and Iron (5.22±0.14mg/100g).

Pulp	pH	TTA (g/lactic acid)	TSS brix	Vitamin C (mg/100g)	Vitamin A (mg/100g)	Calcium (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)	Total phenol (mg GAE/100g)	Flavanoids (mg QE/100g)
Apple pulp	4.66±0.1^{b}	0.31±0.001^{a}	13.2±0.1^{b}	75.81±0.28^{b}	10.12±0.96^{b}	48.05±0.24^{b}	5.22±0.14^{a}	4.42±0.07^{a}	31.468±79.47^{b}	11.457±21.00^{b}
Tommy pulp	4.42±0.02^{a}	0.48±0.004^{b}	14.1±0^{c}	22.69±1.13^{a}	2.65±0.13^{a}	33.20±1.53^{a}	9.36±0.96^{b}	4.17±0.58^{a}	28.378±15.61^{a}	9.427±10.08^{a}
P value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Table 2: Physicochemical, Mineral, and Phytochemical Content of Apple and Tommy Atkin Mango Pulp

Values are means ± Standard deviation. Means with different superscript letters along the columns are significantly different at p<0.05 (Bonferroni's test)

4. Discussion

4.1. Proximate Composition

The moisture content of both mango pulp was more significant than those reported by Armel Fabrice et al. (2021) in Northern Côte d'Ivoire, which reported that moisture content of mango pulp from Amelie and Kent to be 83.34 and 77.34 %, but slightly lower than the result reported by Herath1 (2019), who found a moisture content of 94.70.76% in Karthakolomban variety mango pulp in Sri Lanka. However, the current result on moisture content was similar to those of Okoth et al. (2013), who reported a moisture content range from 79.96±0.045 to 86.32±0.4% for apple and Kent ripened mango in the eastern province of Kenya. The high moisture content of Apple mango pulp might make it prone to dehydration and spreading germs, which could reduce its shelf life; hence, it must be stored in appropriate circumstances. In addition, this high moisture content might be advantageous for the therapeutic use of these mangos as a diuretic (Armel et al., 2021). Therefore, mango pulp from Tommy Atkin mango fruit could have more shelf life and stability than apple mango pulp fruit varieties.

The protein content of different cultivars of mangoes showed that mango pulps collected from Peru (1.5 to 5.5 %), Java (1 to 2 %), and India (0.5 to 1%) were low in protein compared to those found in the current study (Dar et al., 2016). The protein content of this study was in agreement with those of Ibiyem (1990), who reported that the protein content of

mango pulp ranged from 3.99 to 4.96%. Moreover, the result in this study was significantly lower than those reported by Arumuga (2011), which reported that the protein content of mango pulp fruit cultivars from Ethiopia was 7.96%. According to Odio's (2020) findings, a variation in the protein content of the mangoes from four different markets ranged from 2.39±0.03 to 7.03±0.05%, similar to our findings. The high protein content in mango pulp fruits indicates that such pulp can process healthy beverages to promote metabolism and immunity. This variance might be attributable to differences in sample sources, environmental conditions, and cultural practices (Ishu, 2013).

The fiber content of mango pulp was significantly low compared to the findings of Leguizamon-Delgado et al. (2019), who found a total fiber of 21.12±0.46% in Colombia Tommy Atkin cultivar. However, the fiber content of this finding was more remarkable than those reported by Ubwa et al. (2014), who reported that the fiber content of three Nigerian mango fruit varieties ranged from 0.84 to 1.11%.

The ash content was more significant than the findings of Bello et al. (2016), who found an ash content that ranged from 0.05 to 0.49% of five local varieties of mango pulp in Kano state, Nigeria, but lower than those findings by Dyab et al., (2016), who found an ash content of 3.25% DW of Zebra cultivar mango pulp.

The result of the fat content was in line with those reported by Akther et al. (2020), who found fat content of 0.48±0.01% in Amropali fresh mango pulp, but close to the findings of Kansci et al. (2008), who found a fat content ranged between 0.17 and 0.33 g/100 g FW. Nevertheless, the fat content revealed in this work was lower than that reported by Arumugan and Manikandan (2011), who found 1.48% crude fat in Ethiopian mango fruit pulp. The fat levels reported in this study were lower than the NAFDAC maximum limit of 0.5 g/100g for fat-free meals and the EU/WHO standard of 0.25 g/100g for fruit groups (NAFDAC, 2013).

The Carbohydrate content reported in this work was lower than that reported by Bello-Pérez et al. (2007), who found that the carbohydrate content varies by mango variety and ranges from 90.1 to 93.6% DW, with a caloric supply ranging from 62 to 68 Kcal.

4.2. Chemical, Mineral, and Phytochemical Content of Apple and Tommy Atkin Mango Pulp

The chemical, mineral, and phytochemical composition of mango pulp differed significantly ($P<0.05$) among mango fruit pulp varieties. Apple and Tommy Atkin mango pulp had a higher pH than the findings reported by Vijayanand et al. (2015), who found that Totapuri, Malika, and Sindhura mango pulp have varying pH values of 3.9, 4, and 4.2, respectively. This result was less than Rodrguez Pleguezuelo et al. (2012) reported for Tommy Atkins (4.9). This study, however, agrees with the studies conducted by Minuye and Ali (2020), who reported that the pH of four mango cultivars in Ethiopia varied from 3.86 to 4.73 apple and Tommy Atkin. Fruit pulp with the lowest pH value is preserved longer than fruit pulp with a higher pH value, indicating that the mango pulp in this research had a longer shelf life and did not need pH adjustment. Minuye and Ali (2020) found that the titratable acidity (citric acid level) of the four mango varieties varied between 3.48 and 6.40 g/L, significantly higher than our findings. Despite this, Vijayanand et al. (2015) found that four mango cultivars' titratable acidity varied from 0.27 to 0.48, consistent with our findings.

The TSS in this research was similar to those reported by Kansci et al. (2008), who found TSS ranging from 9.43 to 15.16°Brix. According to Rodriquez Pleguezuelo et al. (2012), TSS varied from 15.7 to 20.0°Brix, which was higher than the findings of this research. Mango pulp with higher sugar content is suitable for food processing since it needs less sugar. Tommy Atkin may have an advantage due to its high TSS. This fluctuation might be attributed to genetic differences and changing environmental conditions.

Vitamin C is well-known for its antioxidant effects, protecting cells from free radicals and involvement in iron absorption (Ma et al., 2011). Rebeir (2007) reported that the vitamin C concentration of Tommy Atkin and Uba mango cultivars varied from 9.79 to 77.71 mg/100 g, which was comparable to our findings. However, Regina et al. (2004) found that the vitamin C content of Tommy Atkin and Palmer mango fruit pulp ranged from 31.7 to 56.7 mg/100g. According to Lee and Kader (2000), vitamin C concentration varies depending on mango fruit variety and region, environment, maturation stage, and post-harvest handling, which may be the case in our current study. This high content could be due to mangos' stage of maturity because vitamin C decreases during maturity and post-harvest treatment in fruits (Lee & Kader, 2000).

The vitamin A content of apple and mango pulp was higher compared to the findings of Farina et al. (2020) and Maldonado-Celis et al. (2019), which found a range of 0.854 to 1.089 mg/100 and 0.3 to 1.8 mg/100g FW. However, these results were comparable to Tommy Atkin's vitamin A reported in the current study. Mango pulp variations concerning vitamin A content may be related to variety, soil, and climate.

The mineral content results indicated that the Calcium and Zinc levels in this research were lower than those reported by Ma et al. (2017), with calcium levels ranging from 31.4±1.6 to 708.4±7.2 and zinc levels from 0.23±0.1 to 5. 3±0.9 in five mango pulp fruits; nevertheless, iron ranged from 0.35±0.000 to 0.61±0.1, which is much lower than this study reported. This mineral is needed for bone growth, vitamin D absorption, and the creation of cellular energy (Armel et al., 2021a).

In addition to vitamins C, E, and carotenoids, phenolic compounds, known as secondary metabolites, are the primary antioxidants in plants. With its high polyphenol content, the apple variety might be advised to prevent cardiovascular illnesses (Armel et al., 2021b). The total phenolics content in the current study is low in comparison to the findings of Bm and Bhattacherjee (2019) but similar to those reported by Ma et al. (2017). Ribeiro et al. (2007) found a total phenolics content that varies across the four mango varieties, with Uba pulp having the greatest (approximately 200 mg GAE/100 g) and Tommy Atkins pulp having the lowest (50 mg GAE/100 g), which were similar to the findings of the current study. According to Palafox-Carlos et al. (2012), the phenolic content of ripe Ataulfo mango pulp was 174 mg GAE/100 g FW. The flavonoid content was consistent with the research done by Bm and Bhattacherjee (2019). According

to the results, the variation in the total phenolics and flavonoid content of mango pulp may be related to the various mango pulp-producing varieties.

5. Conclusion

The chemical, proximate, and phytochemical characteristics of the two mango cultivars varied considerably at $p < 0.05$. Apple mango pulp exhibited the highest nutritional value concerning higher protein, vitamins A and C, phenolics, and flavonoid content than Tommy Atkin mango pulp. Mango pulp in both varieties may be utilized as a source of functional nutrients and natural antioxidants in the food industry.

6. Acknowledgments

The authors would like to acknowledge financial support from the SAP project. We express gratitude to the Department of Food Science, Nutrition, and Technology, for the technological collaboration during this study.

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