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The Effect of Processing Methods on the Nutritional Quality of *Moringa* Herbal Tea Powder

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ABSTRACT

This study investigates the effect of processing methods on the nutritional quality of *moringa* herbal tea. Fresh *moringa* leaves were harvested and processed to *moringa* tea powders by the following methods: Oven drying (OD), Blanched-oven drying (BODM), Oxidised-Oven drying (OOD), Fermented-oven drying (FOD), and Blanched-fermented-oven drying (BFOD). Analysis carried out includes proximate, micronutrients composition, and sensory evaluation. Results showed that fat content range from1.2±0.24% to 3.11±0.23, fibre 2.5±0.54% to 4.29±0.23%, ash content range from 6.90±0.021% to 8.50±0.77%, Moisture 7.47±0.63% to 10.77±0.77%, proteins range from 25.00±0.40% to 28.71± 0.404%. Vitamins were in the range of 2.85±0.012 mg/100 g to 4.38±0.401 mg/100g for vitamin C, 14. 195±0.008 mg/100 g to 17.823±0.207 mg/100 g for vitamin E. Vitamin B_1 ranges from 0.507± 0.007 mg/100 g to 1.078±0.002 mg/100 g. No significant difference was observed in pro-vitamin A and vitamin E. Mineral composition varies from 4.12±0.00 to 7.00±0.00 mg/100 g (Zn), 105.20±0.00 to 156.15±0.00 mg/100 g (Ca) and 123.85±0.00 to 234.25±0.00 mg/ 100 g (K). The overall acceptability for the sensory attributes of the *moringa* herbal tea, with the sensory score of6.07±1.847 and 6.22±2.006 for sample FOD and BFOD, closed to that of commercial tea with an overall score of 7.44±1.649. Thus it can be concluded that the processing methods of herbal tea, has a significant role in the quality attributes and sensory appeal.

Keywords: Micronutrients, *Moringa*, Proximate Composition, Sensory Evaluation

INTRODUCTION

Moringa oleifera is extensively cultivated among the *moringaceae* family because of its nutritional value. It is a fast-growing and drought-resistant plant (Mgbemena and Obodo 2016). Its origin can be traced back to India. Today, it is widely cultivated in African countries. *M. Oleifera* leaves are versatile and remarkably nutritious with a variety of potential uses. For these reasons, *Moringa* has been processed into products such as *Moringa* Adsorbents (Itodo *et al*., 2018a; Itodo *et al*., 2018b), *Moringa* tablets, *Moringa* soap, and *Moringa* herbal tea (Rodríguez-Pérez *et al*., 2015, Muyong *et al*., 2021).

Tea has been testified to be one of the most widely consumed beverages in the world(Philip *et al.*, 2020). The tea plant, *Camellia sinensis* is known to have been the main plant for commercial teas. But for some time now, there have been an increasing demand and consumption of herbal tea in many tropical and sub-tropical countries (Xiao *et al*., 2020). Herbal teas contain no *Camellia sinensis* leaves at all. Their flavour comes from a combination of herbs, spices, botanicals, and natural flavours. *Moringa* herbal tea has been processed in several ways, due to the wealth of tea components present in *moringa* leaves (Sugahara *et al*., 2018). Some herbal teas include; ginger tea, hibiscus tea, echinacea tea, bidens tea, and lemon balm tea. Most experts agreed, however, that when herbal teas are consumed in reasonable amounts they are considered safe(Encyclopedia of Food and Health, 2021). *Moringa* herbal tea is a product that is currently widely consumed and is gradually gaining preference by some communities because the raw material is very easy to obtain and the benefits are more varied depending on the raw materials used (Asben and Rini 2019).

The different methods of processing tea based on the enzymatic oxidation process have affected the physical and chemical properties of tea leaves due to the enzymatic oxidation resulting in the overhauling of certain compounds. In other to get a characteristic aroma and taste, polyphenols can be oxidized to polyquinone compounds that can give a dark-brownish colour to the tea which can provide a fresh taste (Encyclopedia of Food and Health, 2021). It has been reported that fermented foods are experiencing a rebirth due to the consumers' growing interest in natural foods and health-promoting (Shiferaw *et al*., 2020).A suggestion was made that, fermented *Moringa*

oleifera leaf can be considered as a potential new product of plant calcium supplements(Dai *et al*., 2020). The investigation of the efficacy of fermented *M. oleifera* extract (FM) against high-fat diet (HFD)-induced glucose intolerance and hepatic lipid accumulation have been established (Shiferaw and Augustin, 2020).Recently research has shown that improvement in the nutrient release of *Moringa* leaf via microbial fermentation is a hopeful start and provides a foundation for further product development of *Moringa* leaf (Mengmeng *et al*., 2017).Solid-state fermented *Moringa oleifera* leaves with probiotics microbes have been a potential new product of plant calcium supplements(Mengmeng *et al*,. 2017).

In most developing countries, various herbs with applauded nutritive and medicinal benefits that are either prepared as infusions (teas) or decoctions for traditional home use have been reported. Among such herbs is *M. oleifera*. This herb is well known in Nigeria and constitutes domestic spices in several folk delicacies (Yahaya *et al*., 2014).Unfortunately, Brews derived from their decoctions and infusions are not widely consumed as herbal teas despite their nutritive and medicinal benefits highlighted in the literature. This problem has been attributed to the fact that consumers prefer commercial teas like Lipton, Green tea, Black tea, and Oolong tea, with a high sensory appeal compared to most herbal teas irrespective of their nutritional qualities. This present study seeks to determine the effect of multiprocessing methods on the nutritional and sensory appeal of *Moringa* herbal tea.

MATERIALS AND METHODS

All chemicals used were of analytical grade. The equipment and other materials include; electronic balance, electric oven, centrifuge machine (K3,13036-14), Blender (Binatone BLG-452), UV spectrophotometer (2800P, SQP1010095007), measuring cylinder, multipurpose vibrator (HY-2), pH meter (OAKLON, SN:1564140), empty tea bags, aluminium foil, Whatman filter papers, sieve, distilled water.

Sample Collection

A fresh sample of *M. oleifera* leaves was harvested from a *Moringa* farm, located at the entrance of Amla village, Otukpo Local Government Area of Benue State. After collection, authentication was done at the Botany Laboratory, Benue State University Makurdi. The leaves were transported in vegetable baskets. After authentication, the leaves were taken to the Centre for Food Technology and Research (CEFTER) Laboratory for sample preparation.

Processing of Moringa Herbal Tea Powders

In the laboratory, the *M. oleifera* leaves were detached from the stalks, washed thoroughly under tap water, and allowed to drain. After draining properly, the sample was divided into portions of approximately equal weight and processed into *moringa* herbal tea powders (Muyong *et al*., 2021). The preparation of the herbal tea powders was in a way that mimics the processing of green teas, black teas and, Oolong teas powders.

The first portion, Oven-dried *moringa* herbal tea powder (OD) was prepared by blending *moringa* leaves to reduce the particle size, before being oven-dried at 50^{o}C for 16 hours, thereafter, the dried sample was ground to powder with the aid of a blender, sieved and packaged in a plastic transparent airtight container. This was following the method of (Mansour *et al*., 2016). The Blanched-oven dried sample (BODM) was subjected to wet blanching for 3 minutes according to the method described by (Olabode *et al*,. 2015) with modifications. For the preparation of the oxidized sample, the *moringa* leaves were withered and blended to increase the surface area for enzymatic oxidation. The samples were spread on a tray, covered with a white muslin cloth, and kept for 18 hours in a ventilated place for natural oxidation to occur (Okafor and Ogbobe, 2015). Thereafter it was oven-dried at 50^{o}C for 8 hours, processed to powder as sample OD. The fermented-oven dried sample (FOD) and the blanched-fermented-oven dried sample (BFOD) were prepared by solid-state fermentation of *moringa* leaf powder with *saccharomyces cerevisiae* as a starter probiotic microbe for 72 hours(Dai *et al*., 2020, Feitosa *et al*., 2020). Subsequently, the samples were oven-dried at 50^{o}C for 8hours, processed to obtain the fermented *moringa* herbal tea powders. All the powdered samples were packaged in plastic airtight containers, stored in a dry place at room temperature, before analysis.

Proximate Analysis of Moringa Herbal Tea Powders

The proximate analysis was carried out according to the standard method described by AOAC (AOAC, 2010). The percentage moisture content was determined at 105^{o}C.The approximation of nitrogen was done using micro-Kjeldahl method for crude protein. Crude fat was extracted using Soxhlet apparatus and n-hexane as solvent. The sequential acid and alkaline hydrolysis were adopted for the crude fibre determination followed by ignition of the hydrolysate as described by AOAC (AOAC, 2010). The ash content was estimated with the aid of a muffle furnace at 500^{o}C.The difference; that is, the sum of all the percentages of moisture, fat, crude protein, ash, and crude fibre was subtracted from 100% to account for the carbohydrate content. The energy value (caloric value) of the samples was calculated using the "Atwater factor" by multiplying the values of the crude protein, lipid, and carbohydrate by 3.99, 9.1, 3.99, respectively, and taking the sum of the product expressed in kcal (Sultana, 2020).

Determination of Vitamins of Moringa Herbal Tea Powders

i. Determination of Vitamin A

Pro-vitamin A was quantified using a UV-Visible spectrophotometer as documented by (Omoboyowa, 2015). One gram of sample was extracted in 20 mL of petroleum ether and then evaporated to dryness. Chloroform acetic anhydride (2 mL) was added and 2 mL of TCA chloroform was added and the absorbance was measured at 620nm. The calibration curve was prepared using β-carotene as standard.

ii. Determination of Vitamin C

Ascorbic acid was determined by titration using Standard indophenol solution (Olukayode and Adebayo 2010). Indophenol solution was prepared by dissolving 0.05 g of 2, 6-dichloro indophenol in water and diluted to 100 mL. Titration was done with the indophenols solution till a faint pink colour persists for 15seconds.

iii. Determination of Vitamin E

Vitamin E was determined as described by the Association of Official Analytical Chemists (AOAC, 2010). One gram of each sample was weighed, macerated with 20 mL of n-hexane in a test tube for 10 minutes, and centrifuged for 10 minutes at 5000 rpm. The solution was filtered with Whatman filter paper; 3mL of each filtrate was transferred into dry test tubes and evaporated to dryness in a boiling water bath. Following this, 2 mL of 0.5N alcoholic potassium hydroxide was added and boiled for 30 minutes in a water bath, and then 3 mL of n-hexane was added and shaken vigorously, 2 mL of ethanol was added to the residue, and 1mL of 0.2% ferric chloride in ethanol also added. Then 1mL of 0.5% 1,1- dipyridyl in ethanol was added followed by the addition of 1mL of ethanol. The solution was gently mixed and absorbance was taken at 520 nm against the blank.

iv. Determination of Vitamin B_1 (thiamine)

The UV-Visible spectrophotometric method was used for the determination of thiamine described by(Omoboyowa, 2015). Five grams of the sample was homogenized in 50 mL ethanolic sodium hydroxide (1N solution). The extraction was done for 1hour. The Extract was filtered and the filtrate was used for analysis. An equal volume of 10 mL extract was added to an equal volume of 0.1N $K_2Cr_2O_7$ solution. Standard thiamine solution was prepared similarly. The absorbance of the sample and the standard solutions were measured using a spectrophotometer at a wavelength of 360 nm.

v. Determination of Riboflavin (Vitamin B_2)

Riboflavin, vitamin B_2 was determined spectrophotometrically by macerating 5 g of *moringa* herbal powder in 100 mL of 50% ethanol solution and for 1 hour. The extract was filtered with the aid of a filter paper into a 100 ml flask; 10 ml of the extract was pipetted into a 50 mL volumetric flask, 10 mL of 5% potassium permanganate and 10 mL of 30% H_2O_2 were added and allowed to stand for 30 minutes in a water bath, 2 mL of 40% of Sodium sulphate was added. The solution was made up to 50 mL mark with distilled water and the absorbance was measured at 510 nm in a spectrophotometer (Omoboyowa, 2015). The standard Riboflavin was prepared similarly for the preparation of the calibration curve.

vi. Determination of Niacin (Vitamin B3)

Five grams of sample was treated with 50 ml of 1N sulphuric acid (H_2SO_4 solution) for 30 minutes. The mixture was treated further with 3 drops of aqueous ammonia and filtered. The filtrate (extract) was used for the analysis. Standard niacin (nicotinic acid) solution was prepared and diluted as desired. 10 mL portion of the standard solution, sample extract, and 10 mL of the acid solution (treated with a drop of ammonia) was dispensed into separate flasks to serve as standard, the sample, and reagent blank respectively. Each of them was treated with 5 mL of normal potassium cyanide solution and acidified using 5 mL of 0.02 NH_2SO_4 solutions; in each case, the absorbance value was read at a wavelength of 470 nm. The reagent blank was used to calibrate the instrument at zero. Niacin content was estimated from the calibration curve(Omoboyowa, 2015).

Determination of Minerals

Four macro (Ca, Na, K, Mg) and four trace minerals (Fe, Cu, Mn, and Zn) were determined by Atomic Absorption Spectrophotometer. The optimum range for each element was prepared and all the operational instruction for setting up the instrument for the analysis of specific element was strictly followed(AOAC, 2010).The ash residue of each sample was digested with 5 mL of concentrated nitric acid, filtered and the filtrate transferred to 100 mL volumetric flask and diluted with distilled water to 100 mL, stored at room temperature while awaiting AAS analysis.

Sensory Evaluation of the Moringa Herbal Teas

Sensory evaluation of the *moringa* herbal tea was carried out following a 9 –point hedonic scale(Wickramasinghe *et al*., 2020). Empty bags of size 60 x 60 mm, environmentally friendly food-grade filter paper was purchased from Jumia online shopping mall, to serve as teabags. Two grams of herbal tea powder were measured in each tea bag. A total of 30 panelists consisting of Post-Graduate students and some staff of Benue State University (BSU) took part in the sensory evaluation. One tea bag of herbal was submerged in 100 mL of hot water for 3 minutes and Panelists were required to

evaluate the organoleptic properties (appearance, aroma, taste, and general acceptability) using a nine-point Hedonic scale with 1, 2, 3, 4, 5, 6, 7, 8 and 9 being disliked extremely, dislike very much, dislike moderately, dislike slightly, 5 = neither like nor a dislike, like slightly, like moderately, like very much and like extremely respectively.

Statistical Analysis

Values were reported as mean values ± SD and levels of significance were tested using the one-way analysis of variance (ANOVA) using Statistical Package Social Science (SPSS) version 23.0 software. The ANOVA and PosthocTukey Alpha Test (0.05) were used to compare the mean values among groups.

RESULTS AND DISCUSSION

The results of the proximate composition are reported in Table1. The percentage moisture content of the various powdered samples varied significantly. Sample OD recorded the highest moisture content of 10.77±0.75% and FOD had the lowest moisture content of 7.47 ± 0.63 %. It was observed that as the processing methods advance, the moisture content reduces. It was also noticed that blanched samples have a lower moisture content compared to others. The low moisture content in sample FOD and BFOD can be attributed to solid-state fermentation. All the moisture content was within the permissible limits for herbal tea powders and within that reported in commercial tea(Okafor and Ogbobe 2015; Shaizad *et al*., 2020). The low moisture content of *moringa* tea samples is anticipated as it contributes to being agood storage quality of *moringa* tea. The percentage fat content was generally low for all the samples. This is because *moringa* leaves contain less fat compared to the seeds. The lowest value was 1.86±0.03% recoded in sample OOD. The fat contents deviated from some reported in the literature (Okiki *et al.*, 2015). The crude protein content was observed to agree with most reports in the literature, supporting the fact that *moringa* leaf is a good source of protein (Okiki *et al,*. 2015). The protein content of the OD sample was 28.71±0.404 %, higher than others, which can be attributed to the fact that this sample was subjected to fewer processing steps. About 25.00±0.40% was recorded in BOD and the decrease observed here can be attributed to wet blanching. Some proteins might have leached into the water during wet Blanching. The results suggest that *moringa* herbal powder can be explored for addressing protein and energy malnutrition. Ash content was as high as 8.8±0.0296 % for BFOD to 7.3±0.02 % for OOD compared to that of commercial tea and other herbal tea powders. The ash content was in the range of some reported literature(Okiki *et al*, 2015,;Wickramasinghe *et al*., 2020). This is an indication of the rich mineral content of the *moringa* leaf.

The processing methods significantly affected the vitamin B_2 and B_3content of the *moringa* herbal tea powders except for pro-vitamin A and Vitamin E (fat-soluble vitamins). Vitamin C was greater in the OD sample (4.38 ±0.041 mg/100 g) and least in the BOOD sample (1.135 ±0.07 mg/100 g) Table 2. Pro-vitamin A and vitamin E were not statistically different from one sample to another. The vitamin C was lower than 17.3 mg /100 g in dried moriga leaves reported in the literature, which can be attributed to geographical location and processing methods(Lamidi *et al*., 2017). Among the B complexes, vitamin B_2 was the most abundant ranging from 5.566±0.063 mg/100g to 6.537±0.069 mg/100 g. Vitamins are organic compounds present in trace amounts in our foods. Functions include growth, coordination, and development (Prasanth *etal*., 2019).

Research has reported that *moringa* leaves contain a wealth of minerals. Among all the samples of *moringa* tea powders, calcium (155.15±0.00 mg/100 g) and potassium (234.25±0.00) were the most abundant (Table 3). As opposed to other researches, potassium was the most abundant mineral present rather than calcium(Prasanth *et al*., 2019). Processing methods affected the mineral content of the herbal tea powders in various ways. The high zinc content in OD, FOD, and BFOD is an indication that it can play an important role in the management of diabetes (Prasanth *et al*., 2019). This is also in the affirmation that fermented *moringa* is known to better manage diabetes than unfermented *moringa*. Iron is an important mineral in the prevention of anemia found in a reasonable amount in all the samples (Okiki *et al., 2015)***.**The high mineral composition of Ca, K, and Zn was in line with that reported in almond-carrot fortified cookies for the purposed of micronutrient enrichment (Guyih *et a*l,. 2020).These minerals are important co-factors found in the structure of certain enzymes and are indispensable in numerous biochemical pathways (Soetan *et al.,* 2016).

The score from the sensory evaluation (Table 4) shows that commercial tea had a better score for general acceptability compared to all the herbal tea samples. Other parameters like appearance, taste, and aroma, shows that panelist preferred Lipton to the *moringa* herbal tea. Among the *moringa* herbal tea samples, OD had the poorest taste score of 4.63±1.69 compared to FOD and BFOD with a score of 5.81±2.149 and 6.04±1.971 respectively. They were no significant difference for an appearance at $P<0.05$. The fermented sample has a score similar to Lipton tea. Sensory evaluation data differ from that earlier reported which stated that panelists preferred *moringa* to Lipton tea (Madukwe *et al.*,2013).

Table 1: Proximate composition and energy values of *moringa* herbal tea powders processed using varying methods

Parameters	Values				
	OD	BODM	OOD	FOD	BFOD
Moisture (%)	$10.77^{a} \pm 0.75$	$9.98^{b} \pm 1.22$	$9.71^{c} \pm 0.8$	$8.107^{d} \pm 0.10$	$7.47^{d} \pm 0.63$
Ash (%)	$8.5^{abd} \pm 0.77$	$8.20^{abce} \pm 0.8$	$7.30^{bcd} \pm 0.2$	$6.9bd^{e} \pm 0.021$	$8.8d^{e} \pm 0.29$
Fat (%)	$3.11^{ab} \pm 0.23$	$2.761^{b} \pm 0.33$	$2.47^{a} \pm 0.093$	$1.20^{ab} \pm 0.24$	$1.4^{a} \pm 0.66$
Protein (%)	$28.71^{a} \pm 0.404$	$25.00^{ab} \pm 0.40$	$27.215^{a} \pm 0.40$	$28.81^{a} \pm 0.40$	$27.89^{d} \pm 0.04$
Fibre (%)	$4.29^{a} \pm 0.23$	$3.152^{b} \pm 0.36$	$3.03^{c} \pm 0.07$	$3.40^{e} \pm 0.12$	$2.50^{a} \pm 0.54$
Carbohydrate (%)	$44.47^{ab} \pm 0.43$	$50.79^{ab} \pm 1.86$	$50.2^{ac} \pm 0.25$	$51.40^{ae} \pm 0.13$	$51.95^{a} \pm 1.05$
En. Val(Kcal)	$320.30^{a} \pm 0.09$	$327.52^{b} \pm 5.26$	$331.43^{c} \pm 4.72$	$331.41^{e} \pm 0.36$	$331.9^{e} \pm 3.80$

OD = Oven-dried *moringa* herbal tea powder, BODM = Blanched-oven dried *Moringa* herbal tea powder, OOD= Oxidised-oven dried *moringa* herbal tea powder, FOD= Fermented-oven dried *Moringa* herbal tea powder, BFOD= Blanched-Fermented-Oven dried *moringa* herbal tea powder. Values represent the mean with ±SD. Different Super scripts represent values significantly different at $p < 0.05$

Table 2: Vitamins content in *Moringa* herbal tea powders processed using varying methods

Samples	Values(mg /100 g)					
	Vit C	**vitB_1**	**Vit B_2**	**Vit B_3**	**Pro-Vit A**	**Vit E**
OD	$4.38^{a} \pm 0.041$	$1.009^{a} \pm 0.001$	$5.566^{a} \pm 0.063$	$0.107^{a} \pm 0.00$	$13.169^{a} \pm 0.05$	$14.195^{a} \pm 0.008$
BOD	$3.514b \pm 0.043$	$1.078^{a} \pm 0.002$	$6.537^{a} \pm 0.069$	$0.114^{b} \pm 0.00$	$15.881^{b} \pm 0.043$	$15.502^{a} \pm 0.033$
OOD	$2.850^{a} \pm 0.012$	$0.507^{a} \pm 0.007$	$5.217^{b} \pm 0.032$	$0.141^{c} \pm 0.000$	$16.734^{a} \pm 0.322$	$18.499^{a} \pm 0.046$
FOD	$3.684^{a} \pm 0.061$	$0.084^{b} \pm 0.006$	$5.063^{a} \pm 0.005$	$0.121^{d} \pm 0.028$	$16.662^{a} \pm 0.016$	$17.823^{a} \pm 0.207$
BFOD	$3.466^{a} \pm 0.056$	$0.850^{a} \pm 0.016$	$5.329^{a} \pm 0.700$	$0.140^{d} \pm 0.000$	$15.484^{a} \pm 0.136$	$13.307^{a} \pm 0.238$

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Table 3: Mineral composition of *Moringa* herbal tea powders processed using varying methods.

	Minerals (mg/100 g)							
Samples	**Zn**	**Na**	**Mg**	**Cu**	**Mn**	**Fe**	**Ca**	**K**
OD	6.45^{a}±3.5	65.12^{a}±0.00	71.00^{a}±0.00	1.75^{a}±0.00	14.29^{a}±0.01	1.65^{a}±0.00	125.14^{a}±0.01	234.25^{a}±0.00
BODM	4.12^{b}±0.0	48.85^{b}±0.00	75.87^{b}±0.00	1.95^{b}±0.00	15.35^{b}±0.01	2.01^{b}±0.01	155.15^{b}±0.00	19562^{a}±0.00
OOD	4.55c±0.0	70.01^{a}±0.00	81.02^{b}±0.01	2.16^{b}±0.00	16.25^{b}±0.00	2.45^{c}±0.00	156.15^{b}±0.00	155.25^{a}±0.00
FOD	6.96^{d}±0.0	50.55^{a}±0.00	70.55^{b}±0.01	2.65^{a}±0.00	23.39^{a}±0.01	4.13^{b}±0.01	125.32^{b}±0.00	123.85^{b}±0.00
BFOD	7.00^{d}±0.0	42.66^{a}±0.04	65.95^{a}±0.00	2.65^{a}±0.00	33.09^{c}±0.02	5.06^{d}±0.02	105.20^{b}±0.00	119.04^{b}±0.00

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Table 4: Sensory evaluation of *moringa* herbal tea

	Parameters			
Samples	**Taste**	**Aroma**	**Appearance**	**Overall Acceptability**
OD	4.63^{a}±2.169	4.63^{a}±2.097	6.26^{a}±1.810	5.48^{a}±1.847
BODM	5.59^{ab}±2.080	5.07^{a}±2.129	6.19^{a}±2.131	6.07^{ab}±2.093
OOD	5.48^{ab}±2.260	5.44^{a}±1.908	6.63^{a}±2.041	6.07^{ab}±2.093
FOD	5.81^{ab}±2.149	5.78^{a}±1.948	6.07^{a}±2.018	5.89^{ab}±1.867
BFOD	6.04^{ab}±1.971	5.96^{ab}±1.891	6.33^{a}±2.000	6.22^{ab}±2.006
LPT	6.48^{b}±2.242	7.33^{b}±1.074	7.52^{a}±1.528	7.44^{b}±1.649

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CONCLUSION

The study revealed that different multiprocessing methods of *moringa* leaves into herbal tea have significant quality attributes and sensory appeal. *Moringa* herbal tea can serve as a substitute for Lipton tea. Its nutritional value exceeds Lipton tea and this makes it suitable for all age groups. The combination of wet blanching, oxidation, and solid-state fermentation in the processing of *moringa* oleifera into herbal tea revealed that the solid-state fermentation process is the most promising processing method among other methods studied.

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