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Comparative Effects of Oven-Drying on Quality of Selected Leafy Spices

#Joel Ndife[1], Stella Ubbor [1], Augusta Chinweikpe[1], and Anselm Onwuzuruike[1]

[1]*Department of Food Science and Technology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.*

#Corresponding author: E-mail address*: ndife.joel@mouau.edu.ng*

Abstract **– There has been increasing interest in culinary spices for their health benefits besides flavour. This study assessed the comparative effect of oven-drying on the chemical composition of selected leafy spices. Fresh *Uziza (Piper guineense)*, Curry (*Murraya koenigii*), *Nchanwu* (*Ocimum gratissimum*), Parsley *(Petroselinum crispum*) and, Mint leaves (*Mentha spicata)* were assessed for proximate composition, then dried in an oven at 65 °C for 25 min. The dried spice leaves were analysed for their proximate composition, mineral contents, phytochemicals, antioxidants, and sensory properties. Proximate analysis showed that moisture content of fresh leafy spices reduced (8.76-10.23%) after drying (3.15 to 5.02%) while fat (1.57-2.83), protein (4.64-5.87%), fibre (1.15-2.83%) and ash (7.89-11.15%) increased after drying. Mineral contents of spices ranged from 7.15-140.05 mg/100g for sodium, 10.04-330.90 mg/100g for potassium and 12.75-305.30 mg/100g for calcium. Parsley spice leaves had the highest concentration of investigated phytochemicals, total polyphenols (43.36 mg/100g) and vitamin C (20.76%). Nchanwu leaves had the highest DPPH activity (75.66%) while Mint leaves had the highest FRAP (µmol/g) and vitamin E (29.98%). The sensory acceptability scores were high (6.95-8.00). The results reveal that oven-drying improved the concentration of nutrients and antioxidant activities and is effective in preserving leafy spices.**

Keywords: **Oven-drying, spices, chemical composition, antioxidant**

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I. INTRODUCTION

Drying is one of the essential unit operations performed to increase the shelf life of agricultural produce and it is one of the most practical methods of preserving food and its quality. Without the drying process growth of microorganisms will take place as a result of the high relative humidity. This often leads to severe deterioration of the quality of the product 1[1]. The quality of the dried product can also be affected by high temperature resulting in off-odour, change of colour and nutrients loss. In spice production, drying is used to prepare the product for the market since the fresh product contains more than 80% water whereas the moisture content in the final product should not exceed 15% and generally is around 5% [2].

Spices are esoteric food adjuncts that are used to enhance the sensory quality of foods [3]. They have been used as food flavourants since ancient times and as medicine and food preservatives in recent decades [4]. Recent research reveal that dietary spices have immense effects on human health by their antioxidant, chemo preventive, anti-mutagenic, anti-inflammatory, immune modulatory effects on cells [3]. Spices can be leafy or seeds. Leafy spices supply some compounds to the diet that are not provided by mainstream fruit and vegetables. Leafy spices are usually consumed fresh or dried with meals. Some leafy spices in Nigeria include scent leaf, uziza, curry leaf and mint leaf, parsley and others.

Scent leaf (*Ocimum gratissimum*) also known as African Basil is commonly cultivated for dietary and medicinal uses, ue to its peculiar and pungent aroma. The used in salads, sauces, soups, and broiled with meat. The pulped foliage is believed to have antiseptic properties. Phytochemical constituents include tannins, flavonoids, terpenoids, saponins and alkaloids [5]. It has been reported to have anti-inflammatory, antibacterial, antifungal, anti-carcinogenic and antioxidant properties [5].

Uziza *(Piper guineense)* belongs to the family *Piperaceae*. It is a West African spice plant commonly called "Ashanti pepper" [6]. Other common names are black pepper, Benin pepper, Guinea pepper and false cubeb [6]. It has high commercial, economical, and medicinal value. Extracts from its leaves, roots and seeds are used for the treatment of bronchitis, gastrointestinal disorders and rheumatism [7]. Uziza has high mineral content of calcium, zinc, magnesium, copper and potassium with appreciable protein and carbohydrate contents [8]. More so, Uziza contains vitamin C, vitamin A and traces of vitamin B_1 and B_2, vitamin E [9].

Curry leaf (*Murraya koenigii*)**.** The curry leaf plant is highly valued for its characteristic aroma

and medicinal values. A number of essential oil constituents, carbazole, murrayacine and koenigine alkaloids have been extracted from this plant. Mint leaf (*Mentha spicata*) is a naturally growing herb found especially in western region of Nigeria. It is a popular aromatic and medicinal herb with antimicrobial and antioxidant properties [10].

Parsley (*Petroselinum crispum)* is widely distributed in European, Asian and African countries. It popularly called Ewedu in Yoruba part of Nigeria*. P. crispum* is widely used as an essential spice and vegetable in daily meals and salad ingredients due to its medicinal and pharmacological benefits. Parsley is highly seasonal in nature and is considered a very rich source of vitamins C and E, β-carotene, thiamin, riboflavin and organic minerals [11].

Fresh leafy spices are prone to spoilage especially by fungi, if not adequately preserved. These leafy spices are usually preserved and utilized in dried forms. Various traditional methods are used in drying these leaves with consequent negative effects on quality, hence the need to assess the effect of oven-drying on the nutrient and chemical components and organoleptic acceptance of these important indigenous leafy spices.

II. MATERIALS AND METHODS

2. Materials

2.1 Source of samples

Fresh leaves of scent-leaf (*Ocimum gratissimum*), uziza (*P. guineense)*, curry *(Murraya koenigii),* mint *(Mentha spicata),* and parsley (*Petroselinum crispum)* with their stalks were obtained from local market of Ubani, Umuahia north Local Government Area, Abia state Nigeria.

2.2 Sample preparation

The leaves were carefully cleaned manually to remove dirt and damaged ones, and were destalked, washed and cut into a uniform sizes. Each leafy spice sample was divided into two batches of 500 g each. One batch was assessed for proximate composition of the fresh samples. The other batch was subjected to drying process.

2.3 Drying process

Ten grams (10 g) of each fresh leaf samples were spread on a tray and placed in an oven (Model no.SX3-4.5-15: made in China) and dried for 40 minutes at 65° C. The dried leaves (Plates 1-5) were cooled to room temperature (28 °C), ground to their particulate forms and packaged in an airtight plastic container for further evaluation. *D. 2.4 Methods of analyses*

2.4.1 Proximate analysis

Moisture, ether extract, crude protein, ash and crude fiber contents of samples were determined using the methods described by [12]. Total carbohydrate was calculated by difference [12]. The energy value of the samples was determined by multiplying the protein content by 4, carbohydrate content by 4 and fat content by 9 [12].

2.4.2 Mineral analysis

The mineral content, comprising sodium (Na), potassium (K), Iron (Fe), calcium (Ca) and Zinc (Zn) were estimated using the procedure described by [13].

2.4.3 Vitamin analysis

The method described by [12], was used for the determination of vitamin C content, while the protocol of [13] was used to determine the vitamin E content of the samples.

2.4.4 Phytochemical analysis

Alkaloid was determined according to the method described by [12]. Flavonoid was determined from the method described by [12]. Terpenoid, tannin and saponin determinations were by methods described by [14].

2.4.5 Antioxidant assay

The ferric reducing antioxidant power (FRAP) of the samples was determined using the method described by [15]. Diphenol-2-2- picrylhydroxyl (DPPH) protocol for the samples was adopted as described by [16] with slight modification. Total polyphenol content (TPC) of the sample extracts was determined with the Folin–Ciocalteu (FC) spectrophotometric method adopted from [12], using gallic acid as standard phenolic compound.

2.4.6 Sensory evaluation

Sensory evaluation of cookies for consumer preference and overall acceptability was done using 20 semi-trained panelist which comprised of students and staff of Food Science and Technology Department of Michael Okpara Univeristy of Agriculture, Umudike. The panelists evaluated the sensory properties of appearance, taste, aroma, texture and overall acceptability using a nine-point Hedonic scale [17].

2.4.7 Statistical analysis

The experimental set-up was a completely randomized design. All determinations were done in triplicates and the results presented as mean ± standard deviations. The data obtained from the various analyses were subjected to analysis of variance (ANOVA) for comparison of the means. Differences between means were considered to be significant at $p<0.05$. [17]. Statistical package for social sciences version 16.0 was used for data analysis.

III. RESULTS AND DISCUSSION

Physical appearance of dried spice leaf samples is shown in Plates 1-5.

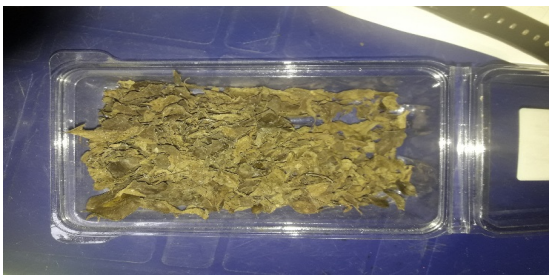

Plate 1: Dried Curry leaves

Plate 2: Dried *Nchanwu* leaves

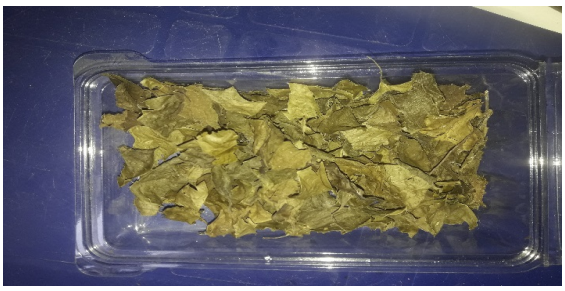

Plate 3: Dried *Uziza* leaves

Plate 4: Dried Parsley leaves

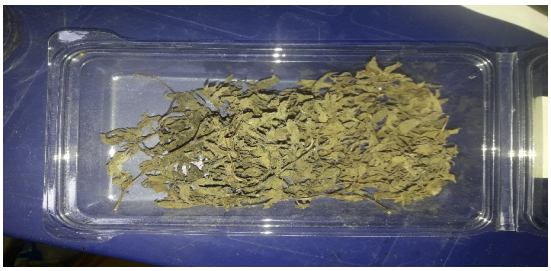

Plate 5: Dried Mint leaves

3.1 Proximate composition and energy values of fresh and dried leafy spices

The result of the proximate composition and energy values of the fresh samples is presented in Table 1. The moisture content of the fresh leaves was considerably high (8.76-10.23%) which is synonymous with fresh foods and reduced after drying (3.15-5.02%) in the dried samples. The moisture content differs significantly ($p<0.05$) among the samples. The moisture content is an index of water activity and stability of foods. [12] reported that water loss from leaves is influenced by the drying method used. High moisture content has been associated with short shelf life as they encourage microbial proliferation that lead to spoilage [18]. It could be remarked that the fresh leafy spices would have a lower shelf stability compared to the dry leafy spices.

The protein content of fresh leafy spices samples (1.89-6.43%) increased after drying (2.45-8.13%). Significant difference ($p<0.05$) was recorded among the samples. Uziza leaves had higher protein for fresh (6.43%) and dried (8.13%) samples compared to other leafy spices. The protein content of the samples were generally low. Thus, the leafy spices might not contribute significantly to the protein requirement of the human body.

The fat content of the samples ranged from 0.56 to 2.87% and from 0.75 to 5.04% for fresh and dried leafy spices respectively. There were significant differences ($p<0.05$) between the samples and an appreciable increase after drying. Mint leaves had the highest fat content in the fresh (2.87%) and dried (5.04%) samples, hence might contain higher fatty acids esters responsible for

strong aroma and palatability in foods. The fat contents of the spice leaves explain the reason for their aroma intensity. More so, the lipid content of the samples is quite low which might result to increased keeping quality as a result of decreased susceptibility to rancidity [18].

The crude fiber content of the samples ranged from 2.76 to 8.75% for fresh samples and 4.54 to 11.87% for dried samples. There was significant ($p<0.05$) difference among the samples after drying as a result of increase in dry matter content. Uziza and Mint leaves had higher fibre in fresh (8.75 and 6.57%) and dried (11.87 and 9.11%) samples respectively. The high fibre values obtained will contribute to reducing risks of low-density lipoprotein cholesterol in the blood, by binding with bile's acids [19] and other disease such as diabetes, obesity, cardiovascular disease and diverticulitis [3].

The ash content of the spice leaves also increased in the dried samples (7.52-15.77%) compared to fresh samples (5.16-9.69%). Mint leaves had highest ash content (15.77%) in the dried samples followed by Nchanwu leaves (11.45%). There was significant ($p<0.05$) difference among the leafy spices as influenced by the structure and composition of the spice leaves. Ash content represents a viable tool for nutritional evaluation of mineral. The higher ash content obtained in the dried samples might be due to increased concentration of nutrient at the expulsion of moisture.

The carbohydrate content of the fresh samples ranged from 64.39 to 76.59% for fresh samples and 64.00 to 76.69% in dried leafy spices. These are quite high. The results implied that the leafy spices are good sources of carbohydrates. Consequently, the energy values of the samples ranged from 307.75 to 330.94 Kcal for fresh samples and 305.58 to 342.07 Kcal for dried samples. The highest energy values were obtained in Curry (342.07Kcal) and Nchanwu (328.52Kcal) leaves respectively, which reflects their likely contribution to energy needs of the body.

Table 1: Proximate composition (%) and energy values (Kcal) of dried leafy spices

Sample	Moisture	Protein	Fat	Fiber	Ash	Carbohydrate	Energy
Fresh							
Parsley	10.23^{a}±0.03	2.63^{c}±0.02	0.56^{d}±0.01	4.82^{c}±0.03	5.16^{d}±0.02	76.59^{a}±0.01	321.98^{c}±0.01
Curry	8.76^{c}±0.04	5.94^{b}±0.02	1.38^{c}±0.02	2.76^{d}±0.01	7.47^{c}±0.03	73.71^{c}±0.02	330.94^{a}±0.19
Nchanwu	9.71^{b}±0.02	1.89^{d}±0.01	1.96^{b}±0.02	2.83^{d}±0.03	8.25^{b}±0.01	75.37^{b}±0.03	326.64^{b}±0.25
Uziza	7.81^{d}±0.03	6.43^{a}±0.02	1.09^{c}±0.01	8.75^{a}±0.02	7.87^{c}±0.03	68.06^{d}±0.03	307.75^{d}±0.07
Mint	10.18^{a}±0.03	6.31^{b}±0.02	2.87^{a}±0.01	6.57^{b}±0.03	9.69^{a}±0.02	64.39^{e}±0.02	308.59^{d}±0.04
Dried							
Parsley	4.02^{c}±0.01	3.05^{c}±0.01	0.75^{d}±0.02	7.98^{c}±0.02	7.52^{d}±0.01	76.69^{a}±0.01	325.67^{c}±0.19
Curry	4.84^{b}±0.01	7.68^{b}±0.02	3.95^{b}±0.01	4.54^{d}±0.02	10.05^{d}±0.02	68.96^{c}±0.02	342.07^{a}±0.30
Nchanwu	5.02^{a}±0.01	2.45^{d}±0.02	2.52^{c}±0.02	4.55^{d}±0.03	11.45^{b}±0.03	74.02^{b}±0.01	328.50^{b}±0.16
Uziza	3.15^{d}±0.04	8.13^{a}±0.02	1.90^{c}±0.01	11.87^{a}±0.03	10.97^{d}±0.02	64.00^{d}±0.02	305.58^{d}±0.04
Mint	4.97^{a}±0.04	8.02^{a}±0.02	5.04^{a}±0.01	9.11^{b}±0.01	15.77^{a}±0.01	57.10^{e}±0.00	305.82^{d}±0.21

Values are means ± standard deviation of duplicate determinations of the samples. Mean values in the same column with different superscript are significantly different ($p < 0.05$)

3.2 Mineral content of dried leafy spices

Table 2 shows the results of mineral analysis of dried leafy spices. Nchanwu (140.52%) had significantly ($p< 0.05$) higher concentration of sodium followed by parsley (33.64%). Sodium is important in the maintenance of osmotic balance between cells and interstitial fluids. High intake of sodium increase the risk of hypertension. An adult needs about 5 g per day of sodium [20].

The potassium content of the samples ranged from 0.04 to 330.90%. There was significant difference ($p<0.05$) in potassium of the spices. Parsley (330.90%) had the highest concentration of potassium content followed by Uziza (96.51%). Potassium is necessary for the normal functioning of all cells. It regulates the heartbeat, ensure proper function of the muscles and nerves.

The Ca content ranged from 12.75 to 305.30% in the leaves. Uziza (305.30%) had the highest calcium content followed by parsley (82.10%). Calcium is important in the formation of teeth and bones. Although the samples contain appreciable amount of calcium, but are below the recommended minimum calcium daily intake of 450 mg [20]. The spices should be used in combination with other foods with appreciable calcium content to make up for the lack.

The Iron and zinc contents of the samples ranged from 0.16-4.72 and 0.04-1.84% with significant ($p<0.05$) differences existing among the samples. Highest amount of iron (4.72%) and zinc (1.84%) were obtained in Nchanwu leaves compared to other samples. Curry leaves had the lowest Iron (0.16%) and Zinc (0.04%) contents. Iron is required for the synthesis of hemoglobin and myoglobin,

which are oxygen carriers in the blood and muscle respectively. Zinc is essential for immune function and blood [20].

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Table 2: Mineral content (%) of dried leafy spices.

Sample	Sodium	Zinc	Iron	Calcium	Potassium
Parsley	33.64^{b}±0.02	0.18^{d}±0.01	3.75^{b}±0.02	82.01^{b}±0.01	330.90^{a}±1.05
Curry	16.50^{c}±0.21	0.04^{e}±0.01	0.16^{d}±0.01	19.73^{c}±0.02	10.04^{e}±0.01
Nchanwu	140.05^{a}±0.03	1.84^{a}±0.01	4.72^{a}±0.03	12.75^{e}±0.03	18.50^{d}±0.03
Uziza	12.94^{d}±0.05	0.39^{c}±0.01	3.12^{c}±0.01	305.30^{a}±0.04	96.51^{b}±0.01
Mint	7.15^{e}±0.10	0.49^{b}±0.06	2.90^{c}±0.03	13.45^{d}±0.05	24.30^{d}±0.04

Values are means ± standard deviation of duplicate determinations of the samples. Mean values in the same column with different superscript are significantly different ($p < 0.05$)

3.3 Phytochemical composition of dried leafy spices

The phytochemical content of dried leafy spices is shown in Table 3. The tannin content in the spices ranged from 0.37-95.98 mg/100g. Parsley (95.98 mg/100g) and curry (95.63 mg/100g) had the highest concentration of tannin that are not significantly ($p<0.05$) differerent. Uziza (0.37 mg/100g) and mint (1.57 mg/100g) spices had the lowest concentrations of tanning. The values obtained in this study were higher than the values reported by [21] in *G.latifolium and O.gratissimum* leaves extract. Tannins decrease protein digestibility in animals and humans and inhibit the activities of trypsin, chemotrypsin, amylase and lipase. However tannins are good antioxidants [22].

Parsley had the highest of alkaloid content (7.91 mg/100g) followed by curry (79.45 mg/100 g). Nchanwu (2.17 mg/100g) and Uziza (1.85 mg/100g) had lowest values. Parsley and curry leaves are good sources of alkaloids which have been reported to function as analgesic and anti-inflammatory [23].

Terpenoid content ranged from 0.25 (Uziza) to 75.02 mg/100 (Parsley). The leafy spice samples differ significantly ($p<0.05$) from each other. Terpenoid have been reported to possess medicinal properties such as anti-carcinogenic, antimalarial, anti-ulcer, antimicrobial or diuretic activity [3, 24], hence, Parsley could be used in ethno medicine in the management of various ailments due to the presence of these terpenes.

Flavonoid content of the dried leafy spices ranged from 2.02 to 19.56 mg/100g. Curry had the highest flavonoids (19.56 mg/100g) followed by Parley (3.93 mg/100g). Flavonoids are strong antioxidants, and are effective antimicrobial substances. They have been reported to possess substantial anti-carcinogenic and anti-mutagenic activities due to their antioxidant and anti-inflammatory properties [3].

The Saponin content (0.02-7.97 mg/100g) differ significantly ($p<0.05$) among the samples with parsley spice having the highest content (7.97 mg/100g) while Currie spice had the lowest (0.02 mg/100g). Saponins reduce the bioavailability of nutrients and decrease enzyme activity [24].

Table 3: Phytochemical content (mg/100 g) of dried leafy spices

Sample	Tannin	Alkaloids	Terpenoid	Flavonoid	Saponin
Parsley	95.98^{a}±0.01	98.65^{a}±0.03	75.02^{a}±0.02	3.93^{b}±0.02	7.97^{a}±0.03
Curry	95.63^{a}±0.03	79.45^{b}±0.03	1.03^{c}±0.02	19.56^{a}±0.03	0.02^{e}±0.01
Nchanwu	2.44^{b}±0.03	2.17^{d}±0.02	2.98^{b}±0.01	2.08^{c}±0.02	3.06^{b}±0.02
Uziza	0.37^{d}±0.01	1.85^{e}±0.01	0.25^{d}±0.01	2.09^{c}±0.03	1.36^{d}±0.02
Mint	1.57^{c}±0.01	3.05^{c}±0.02	1.44^{c}±0.03	2.02^{d}±0.01	2.48^{c}±0.02

Values are means ± standard deviation of duplicate determinations of the samples. Mean values in the same column with different superscript are significantly different ($p < 0.05$).

3.4 Antioxidant properties of dried leafy spices

The results of the antioxidant activity of selected leafy spices are presented in Table 4. The DPPH antioxidant activity ranged from 20.84 to 75.66% in the spices. There were significant ($p<0.05$) differences among the samples. Nchanwu (75.66%) had the highest antioxidant activity followed by mint leaves (63.11%). The values obtained for Curry, Parsley and Uziza leaves were lower than the values reported by [25] for cinnamon and cumin (42.55 and 14.75%) respectively.

The ferric reducing antioxidant power (FRAP) of the spices ranged from 11.02 in Nchanwu to 39.08 umol/g in Mint. Mint (39.08 umol/g) and Uziza (34.12 umol/g) leaves had the highest FRAP. Thus, it could be inferred that the spices are good sources of antioxidants and possess free radical scavenging activity that can inhibit the oxidative degradation of cells [25, 26].

The difference in total polyphenol content (TPC) was significant ($p< 0.05$) among the dried samples. Parsley had the highest TPC value (43.36 mg/100g) followed by

Curry spice (36.52 mg/100g). It has been reported that the activity of polyphenol oxidase and thermal processing causes a decline of the TPC before its total inactivation [16], hence their low values (10.73-43.36 mg/100g).

Vitamin C content of the samples ranged from 0.44-20.76% and the vitamin E content ranged from 0.07-29.98%. The vitamin C contents of parsley (20.76%) and mint leaves (20.54%) did not differ from each other significantly ($p<0.05$). Mint spice had the highest vitamin E (29.96%). However, the vitamin C values obtained are considerably lower than the value for *Piper guineense* (292.62%) reported by [6]. Vitamins C and E are capable of fighting radicals in the human body as antioxidants [26].

Table 4: Antioxidants properties of dried leafy spices

Sample	DPPH (% inhibition)	FRAP (µmol/g)	TPC (mg/100g)	Vitamin C (%)	Vitamin E (%)
Parsley	20.84^{e}±0.02	14.62^{c}±0.01	43.36^{a}±0.01	20.76^{a}±0.02	0.22^{c}±0.01
Curry	51.95^{c}±0.01	13.07^{c}±0.03	36.52^{b}±0.01	10.44^{d}±0.02	1.07^{d}±0.01
Nchanwu	75.66^{a}±0.03	11.02^{d}±0.02	10.73^{e}±0.01	11.78^{b}±0.02	0.07^{d}±0.03
Uziza	22.93^{d}±0.02	34.12^{b}±0.01	11.98^{d}±0.02	12.18^{c}±0.01	0.08^{d}±0.02
Mint	63.11^{b}±0.01	39.08^{a}±0.02	15.02^{c}±0.01	20.54^{a}±0.03	29.98^{a}±0.02

Values are means ± standard deviation of duplicate determinations of the samples. Mean values in the same column with different superscript are significantly different ($p < 0.05$). DPPH: 1, 1-diphenyl-2-pycrylhydrazyl; TPC: Total polyphenol content. FRAP: Ferric reducing antioxidative power**.**

3.5 *Sensory quality of dried leafy spices*

The sensory assessment of dried leafy spices are shown in Table 5. The panelists' scores for the spices ranged from 5.40 to 7.60. Parsley had the highest appearance score (7.60) followed by Uziza (5.40). There was no significant ($p>0.05$) difference in the appearance scores among Curry, Uziza and Nchanwu. The change in appearance was probably due to heat degradation of chlorophyll. Some literatures reported that the reduction of green shade in the leaves was also due to undesirable enzymatic browning reactions of polyphenol oxidase (PPO) [3, 19].

The Judges scores for aroma and taste were quite high, which ranged from 7.30-8.50 and 6.55-7.70) respectively. Parsley had the lowest scores for aroma (7.30) and taste (6.55) while Mint had the highest score in aroma (8.50) and Curry for taste (7.70). Drying can cause a great reduction in the amount of essential oil, responsible for volatile aroma and impartation of taste, in many types of herbs and spices, even at room temperature [3, 26].

Oven-drying did not cause significant ($p> 0.05$) reduction in texture (7.20-7.90) of dried leafy spices except in Parsley (6.51). In general acceptability Curry had the highest score (8.00) followed by Nchanwu (7.80) while Uziza (6.90) and Parsley (6.75) were scored the least. Thus, the spices were generally acceptable considering the high favourable sensory scores, the thermal effects of oven-drying notwithstanding.

Table 5: Sensory scores of dried leafy spices

Sample	Appearance	Aroma	Taste	Texture	Acceptability
Parsley	7.60^{a} ±1.60	7.30^{c}±1.66	6.55^{b}±1.70	6.51^{c}±1.50	6.75^{c}±1.07
Curry	6.70^{ab} ±1.03	8.40^{a}±0.82	7.90^{a}±1.33	7.90^{a}±0.97	8.00^{a}±1.03
Nchanwu	5.80^{bc}±2.04	7.70^{b}±1.30	6.80^{b}±0.41	7.60^{ab}±1.23	7.80^{a}±1.11
Uziza	7.00^{b}±1.30	7.60^{b}±1.05	6.80^{b}±0.89	7.20^{b}±1.36	6.90^{c}±1.33
Mint	5.40^{c}±1.05	8.50^{a}±0.69	7.70^{a}±0.47	7.90^{a}±0.85	7.20^{bc}±0.77

Values are means ± standard deviation of duplicate determinations of the samples.
Mean values in the same column with different superscript are significantly different ($p < 0.05$)

IV. CONCLUSION

The comparative effects of oven-drying on the nutrient content and sensory quality of selected leafy spices showed that moisture content in the fresh leaves reduced after drying while crude protein, fat, fibre and ash increased after drying. Mineral analysis showed that, dried Nchanwu spice was richest in sodium, zinc and iron. Uzizia had the highest calcium and Parsley had the highest potassium content. Parsley spice had the richest concentrations of investigated phytochemicals, total polyphenols and vitamin C contents. In antioxidant potential, DPPH activity was most pronounced in Nchanwu while Mint leaves had the highest FRAP and vitamin E content. This study affirmed the significant nutritive values of these leaves and also suggests that oven-drying would improve the concentration of both organic and elemental constituents of leafy spices.

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