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Comparison of Phytochemical, Proximate and Mineral Composition of Fresh and Dried Peppermint (*Mentha piperita*) Leaves

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Abstract: *Mentha piperita* well-known as peppermint is widely cultivated worldwide and used for its medicinal values. The purpose of this research was to evaluate fresh and dried *M. piperita* with the aim of quantifying chemical information, that might serve as a guide to exploit its potential and benefits for human nutrition. The phytochemical screening discovered that all of them possess flavonoids, saponins, alkaloids, tannins, steroid, glycosides and volatile oils. The proximate composition were determined according to the perspectives methods, while mineral elements were determined using EDTA method. Proximate analysis of both samples revealed that it contained 92.31% and 56.31% carbohydrates, 2.19% and 7.69% protein, 0.50% and 5% lipid, 1.5% and 9% fibre, 3.57% and 22%, ash, 89.5% and 9%, moisture respectively. The most predominant mineral found was potassium with a value of 72% and 23%, sodium 13% and 7.75%, and other minerals were found in low values ranging from calcium 0.5% and 0. 045%, magnesium 0.005% and 0.235%, and phosphorus 0.341% and 0.325%, respectively. This study contributes to the development of nutritional database of edible plants worldwide. In conclusion, fresh sample of *M. piperita* can be an excellent source of nutrients and antioxidant components.

Keyword: Medical plants; *Mentha piperita*; peppermint; proximate; nutritional.

1. Introduction

Mentha piperita L., commonly named as a peppermint, (*Mentha* x *piperita L.*), is a cross breeding of spearmint (*Mentha spicata*) and water mint (*Mentha aquatica*). *Mentha* is a variety of plants in the family Lamiaceae (mint family) in the subfamily Nepetoidae, It is assessed that 13 to 18 species exist, and the correct refinement between species is as yet indistinct. It incorporates fragrant herbs of confounding ordered characterization, because of a high variation in morphological characters and numerous hybridisations that happen, both in wild and domisticated. Hybridization between a some of the genus happens naturally, in view of this numerous different species, and in addition various cultivars, are known, According to the most recent ordered arrangement, the class *Mentha* involves 61 species [1-3]. Lamiaceae family is a enormous family of chiefly annual or perennial, herbaceous, 30–100 cm length, members are widely recognised herb with a long tradition of medical use [4]. This plant, indigenous to Europe, is presently far reaching in development through all locales of the world and shows different growth requirements in temperature, humidity, micronutrients and macronutrients, light, among others. Fresh and dried leaves, as well as essential oils extracted from aerial parts of the flowering *M piperita*, are known for the fragrance properties, also used as food components, cosmetic and pharmaceutical products [5, 6].

M. piperita was initially cultivated in the Mediterranean bowl and monetarily developed in England in the late seventeenth century. Wellspring of a significant basic oil utilized as a part of mint-enhanced items, aromas and pharmaceuticals, peppermint generation has expanded in the course of recent decades. Also, an implantation of peppermint leaves and stems is a prevalent drink known for its invigorating taste and superb smell. Peppermint world generation in 2010 was around 81,241.00 tones. Africa was the best maker (71,880.00 tons) [7, 8].

Evaluation of the nutrient composition of plant materials is of paramount importance because of the roles of this plant as a source of food and raw materials for industries; it

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provides both animals and man with food of different forms and ways. Plants are equally important sources of materials for our industries. Besides their use as a source of energy and in general plants are now the primary source of medicine both traditionally and scientifically [9, 10].

The concentration of bioactive compounds in *Mentha* depends on species and in *M. piperita* depends on the plant variety, its maturity, geographical region, climate and processing conditions. *M. piperita* contains menthyl acetate (2-11%), isomenthone (2-8%), 1.2-3.9% (v/w) essential oils composed of menthol (33-60%), menthone (15-32%), eucalyptol (5-13%), menthofuran (1-10%) and limonene (1-7%) [11]. Moreover, *M. piperita* leaves contain 19-23% of polyphenols, which include eriocitrin and rosmarinic acid (59-67%), luteolin 7- orutinoside (7-12%) and hesperidin (6-10%) [12, 13]. *M piperita* contains other bioactive compounds such as bitter substances, caffeic acid, carotenes, tocopherols, betaine, choline and tannins. In a statement by World Health Organization (WHO), it was evaluated that almost 80% of individuals on the planet utilize natural items for health purposes. Natural teas are particularly prevalent because of their low value, simplicity of procurement, and winning conviction that it is innocuous to the human body. A standout among the most well-known types of restorative plants predominant all through the world, in pharmaceutical, corrective, and sustenance industry, is peppermint [14]. Peppermint has a carminative, antispasmodic, and antiseptic properties which make this herb popular for medicinal use for centuries [15].

Furthermore, it is well-documented that extracts from some *Mentha* species including *M. piperita* have antimicrobial and cell reinforcement properties. The leaves of *M. piperita* have an extensive variety of culinary utilization its utilization in nourishment arrangement to improve taste and appearance. The flowering aerial parts of *Mentha sp.* have been customarily utilized for their germicide properties for the treatment of irresistible diseases [16-17]. Therefore, the purpose of this research was to evaluate fresh and dried *M. piperita* with the aim of quantifying chemical information that might serve as a guide to exploit its potential and benefits for human nutrition.

2. Materials and Methods

Study area. Sokoto state is situated in the extreme northwest part of Nigeria between longitude 4.8 °E and 6.54°E, and latitude 12°N and 13.58°N. It bonds with the Niger Republic to the North, Zamfara state to the East and Kebbi state to the southwest. The annual rainfall is between 5000mm in the north and 1300mm to the south, which qualifies it to be a Sudan savannah. The mean annual temperature is about 27°C though this may vary from seasonally, and the relative humidity is about 20-49% in January which often rises to 60-80% in July.

Sample collection. Fresh peppermint (*Mentha piperita*) leaves were obtained from a garden in Agaie road, in Sokoto state Nigeria. Fresh peppermint leaves were kept in a clean polythene bag labelled as sample 'A'. 200 g of fresh leaves of *M. piperita* was shade dried for about seven days at 25°C to 30°C temperature range and marked as sample 'B'.

Plant identification. Plants were first identified in the field using morphometric techniques applied in structurally-based research, and further confirmation was done by Prof B.L. Aliero and later by herbarium assistant Mal U. Auwal, at the Herbarium of the Botany Unit of Usmanu Danfodiyo University Sokoto, Nigeria. Other regular data such as location, collector`s name, period of collection, habitat description, vegetation, and plant local name was documented. After that, specimens were prepared for herbarium, and pictures were taken to aid in the validation of the plants [18].

Sample preparation. The fresh sample was crushed to smaller sizes while the dried sample was reduced to powdered form. The samples were separately extracted in 500ml of condensed water at room temperature. The extracts were sifted using Whitman No. 1 filter paper and the solutions were concentrated using water bath at 70°C. The extracts were stored in various labelled containers and kept in polythene bags before analysis. For the phytochemical analysis Trease and Evans (1989) and, Sofowora (1982) methods were used [19].

Proximate composition analysis. Moisture, protein, fat, ash and crude fibre contents were determined by Association of Analytical Communities (AOAC) method (2006) while carbohydrate content was

determined by difference: 100- (% Moisture + % Ash + % Protein + % Fat + % Crude fibre). Nitrogen-free extract (NFE) referred to as soluble carbohydrate was not determined directly but obtained as a difference between crude protein, the sum of crude ash, lipid and crude fibre [20,21]. The moisture content was determined by hot air oven method at 105 °C. The Macro Kjeldahl method was used for the determination of protein content. The fat content was determined by extracting 2 g of the sample with petroleum ether (boiling point of 40°C to 60 °C) using soxhlet extraction method. According to Olajide et al (2011) Ash content was determined by weighing 2 g of dry sample into a tarred porcelain crucible which was burned at 550°C in an ash muffle furnace until ash was obtained. The crude fibre was determined by exhaustive extraction of soluble substances in a sample using 1.25% H_2SO_4 acid and 1.25% NaOH solution after the remainder was ashed and the loss in weight was noted as crude fibre [20-23].

Mineral analysis. The mineral elements determined in this study were: magnesium (Mg), calcium (Ca), sodium (Na), phosphorus (P) and potassium (K) using EDTA Method [24,25].

Sodium and Potassium estimation. Flame photometer was used to obtain sodium (Na) and potassium (K). The flame photometer was set up by inserting appropriate filter usually by 768 mμ for K and 589 mμ wave lengths for Na respectively. This instrument was set to 100 transmittance by taking 2-10 ppm of K and Na solution. The standard curve was prepared by plotting transmittance reading against concentration of standard K and Na solution [26].

Calcium and Magnesium determination. Calcium and Magnesium were determined by EDTA method. Calcium was obtained for each of the samples by pipetting 2 ml aliquots of the sample solution into filtration flask. Three drops each KCH, NH_2**,** OH and triethanolamine were added together with 0.3 g of Murexide, and it was then filtered with EDTA solution to the end point from pink to purple [27].

Phosphorus determination. Phosphorus (P) was determined using a spectrophotometer. (2 ml) of each of the sample was pipette into a 50 ml volumetrically flask separately, then 45 ml of distilled water and 2 ml of Ammonium molybdate solution were added to each of the sample and mixed properly. After that, 1 ml of $5NCl_2$ (Nitrogen chloride) dilute solutions were added and mixed again, after 5 minutes the measure was taken on the electro photometer at the 660mμ wavelength [28].

3. Results and Discussion

The medicinal value of plants used in traditional medicine derives from the presence of phytochemical principles, which are found in certain parts of the plants. Therapeutic plants contain naturally dynamic synthetic substances, for example, saponins, tannins, fundamental oils, flavonoids, alkaloids and other chemical compounds that poses remedial properties [29,30]. In this study, the phytochemical analysis was carried out by using water extraction method. Table 1 below shows the presence of some secondary metabolites that were tannins, alkaloids, saponins glycosides, steroids and volatile oils, while balsams were found to be absent. Alkaloids, flavonoids, steroids and volatile oils were found in high quantity in fresh sample while moderately present in dried sample which is in line with similar findings of previous reports [21, 31-33]. Tannins, saponins and glycosides was found to be moderately present which correlate with [34], and finally, balsams were not detected from the two samples.

Table 1 Phytochemical constituents of fresh and dried water extracts of *M. piperita*

Constituents	Samples	
	Fresh	Dried
Alkaloids	+++	+++
Saponins	++	++
Glycosides	+	+
Tannins	++	++
Volatile Oils	+++	+++
Saponins Glycosides	++	+
Flavonoids	+++	++

Balsams	-	-
Steroids	+++	++
Cardiac Glycosides	++	+

Key: +++ = present in high amount, ++ = moderately present, + = Trace amounts, - = absent

Minerals are incredibly important for health and to prevent chronic disease, without it, you may end up feeling tired and even have trouble thinking straight. Their superfluous or shortage in organs and tissues leads to diseases. It is essential to know their possible impact [35].

Table 2 indicates the proximate composition analysis of the fresh and dried sample. The results clearly shown that moisture contents was high (89.5%) when compared to 19% in dried sample. The percentage of crude fat content was higher in dried leaves (5%) than its fresh leaves (0.5%). The amount of crude fat present in both samples seems to be moderate and may be adequate for consumption without any health threat. This observation agreed with the earlier report of James & Emmanuel who noted that excess fat consumption was implicated in certain cardiovascular disorders such as atherosclerosis, cancer and ageing [36]. The percentage crude protein in the dried sample (7.69%) is higher than in fresh (2.19%), which is a close agreement with previous results [37]. However, the percentage of ash content was much lower in fresh leaves than dried leaves (3.5% & 22% respectively). The higher ash content was also reported in *Alternanthera sessilis* red (ASR) and green (ASG) and twenty-seven vegetables usually included in the daily schedule of diet respectively [37,38]. The percentage crude fibre is higher in dried sample (9.0%) than fresh leaves (1.5%), while fresh leaves have 92.31% of carbohydrate which is higher than the dried leaves (56.31%) when compared to some vegetables the carbohydrate content are higher in fresh than dried leaves such as *Telfaria occidentalis* & *Talinum triangulare* [39].

Table 2 Proximate composition analysis of the fresh and dried samples

Sample	Fresh (%)	Dried (%)
Moisture	89.50	19.00
Ash	3.50	22.00
Fiber	1.50	9.00
Lipids	0.50	5.00
Proteins	2.19	7.69
Carbohydrates	92.31	56.31

Table 3 shows the comparison of concentrations of minerals (sodium, magnesium, calcium, and potassium). The potassium content showed in the result was relatively small compared to the one reported previously [37]. The phosphorus content obtained in this study for the two samples was in agreement with that obtained by previous report [33], while the values of sodium, calcium and magnesium content where higher than those reported by Erukainure *et al.* [21]. In general, the most abundant elements in both fresh and dried herbs are potassium, calcium, sodium, magnesium and phosphorus minerals. Potassium was the most abundant element present in both fresh and dried sample respectively (23.0% and 72.0 %), followed by sodium (7.75% and 13.0%) and phosphorus (0.341% and 0.325%). The lowest mineral content detected was calcium (0.05% and 0.045%). Iron was found not detected in both samples.

Table 3 Comparison of elemental concentrations (%) for two samples

Sample	Fresh (%)	Dried (%)
Calcium	0.050	0.045
Magnesium	0.005	0.235
Potassium	23.000	72.000
Sodium	7.750	13.000
Phosphorus	0.341	0.325

4. Conclusion

Mint species are utilized generally all through the world as a critical therapeutic plant. The analysis shows that both samples contain important phytochemicals and nutrient that are needed by the body. However, the nutrient content is higher in fresh sample of *M. piperita* as compared to the dried sample. Thus may be due to moisture content in the fresh sample which yielded the concentration of constituent present to be higher. On the other hand, the high moisture content increases the concentration of the nutrient and mineral component present in the fresh sample. Therefore, this indicates that the fresh leaves of this peppermint plants have higher nutrient content than the dried leaves.

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