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Research Article

Chemical and Nutritional Compositions of Hydroethanol Leave Extract of *Mentha piperita*

***Said Sani Said[1], Sabiu Murtala Dambazau [2], Abdullahi Muhammad Abdu[1], Mukhtar Aliyu[1], Ali Ahmad[1] and Idris Auwal[1]**

[1]Department of Biochemistry and Molecular Biology, Faculty of Life Sciences, Federal University, Dutsin-Ma, Nigeria
[2]Department of Biochemistry, Federal University Dutse, Jigawa State, Nigeria
***Corresponding Author:** saidsaidsani9@gmail.com; **Phone:** +2348060974046

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ABSTRACT

Mentha which is also famous as mint is a genus of plants fit in the Lamiaceae family. *M. piperita* well known as peppermint is widely cultivated worldwide and used for its medicinal values. The aim was to evaluate the chemical and nutritional compositions of hydroethanol leave extracts of *M. Piperita*. The proximate composition were determined according to the perspectives methods, while mineral elements were determined using EDTA method. The moisture content (80.5%), the ash content (60.2%), the level of fat content (95.0%), crude protein (65.8%) and carbohydrate content (94.5%). The result indicates higher content of fat, carbohydrate and moisture in the leaf of *M. piperita* and a moderate content of ash and protein. The most predominant mineral found was iron with a value of 2.26ppm, sodium (2.1mg/l), and potassium (1.02mg/l), other minerals were found in low values ranging from Zinc 0.5ppm, Cobalt (0.28ppm), manganese and chromium (0.22ppm) each, phosphorus (0.1mg/l), and cadmium 0.02ppm respectively. The Fourier Transform Infrared (FTIR) analysis of the crude extract showed that the compounds contain the functional groups like–CO, Nitro, -OH, and other compounds, while its Gas chromatography-Mass spectroscopy (GC-MS) analysis contains, fatty acids, carbohydrate and other compounds. In conclusion, *M. Piperita* can be an excellent source of nutrients and mineral.

Keywords: *Mentha piperita*; peppermint; proximate; GC-MS, FTIR

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INTRODUCTION

The use of a particular species of plant for a specific ailment are similar across a geographical region and today, a large population of certain countries still depends on herbal remedies for their healthcare needs [Shabir *et al.*, 2020]. The aerial part of the plant is commonly used in different parts of the world for the treatment of various diseases; kill germs, stop itching, relieve pain, prevent or reduce vomiting, reduce muscle spasms and reduce flatulence [Nilo *et al.,* 2017]. *M. piperita* is known in Hausa as Na'a Na'a and commonly called peppermint. Peppermint has naturalized and can be found growing wild in North Nigeria. Peppermint plant grow between 18-36 inches tall and 24 inches wide. Peppermint is a herb used for cooking food, making Tea and medicinal purpose, the plant has a strongly aromatic scent. This plant has a high nutritive value in Africa, the leaf extract is used to relieve pain and anti-inflammatory [Hudz *et al.,* 2023].

Mentha species are famous as therapeutic herbs and have long served as natural herbal formulations. *M. piperita* L. (peppermint) is regarded as one of the

best potential sources of biologically active substances for the food, cosmetics, and pharmaceutical industries [El-lateef *et al.,* 2013; Wu *et al.,* 2019; Aldoghachi *et al.,* 2023]. *M. piperita* a hybrid mint, is a cross-species between water mint (*Mentha aquatica L*.) and spearmint (*Mentha spicata L.)* [Sun *et al.,* 2014; Li *et al.,* 2017]. Other *Mentha* species are also cultivated around the world for essential oil production [Li *et al.,* 2017; Wu *et al.,* 2019; Abbas *et al.,* 2022].

The commercial growth and study of essential oil-bearing plants as sources of natural antioxidants and antimicrobial substances for food preservation and producing food and medicinal products for enhancing health are topical issues for agriculture, food chemistry, pharmaceuticals, and medicine. Such interest came from the studies related to the lower risk of developing cancer and cardiovascular diseases (CVDs) after the consumption of plant food, and to the microorganisms' resistance to antimicrobial drugs [Barbalho *et al.,* 2011; Ahmad *et al.,* 2014; Zaidi and Dahiya, 2015]. In addition, peppermint is a rich source of essential oils with major food values and which has spasmolytic, antibacterial, and digestive boosting properties in terms of pharmaceutical use (Uribe *et al,* 2016). In traditional medicine, peppermint is used as a stomach booster, pain reliever, anticonvulsant, and tranquilizer.

MATERIALS AND METHODS

Sample Collection and Preparation

Fresh peppermint leaves were collected from Central market Katsina State, Nigeria, washed and dried at room temperature, finely ground and stored in an air tight container. For the preparation of hydro-ethanol (solvent) solution for extraction, 100g of the powdered leaves sample of *M. Piperita* was weighed using an analytical balance, then soaked in 50% ethanol and water of ratio 1:1 for a period of 48hours.The extract obtained was then further subjected to evaporation in an oven at 70°C for concentration. The extracts were stored in various labelled containers and kept in polythene bags before analysis.

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). 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 ASTM, D2939.The 2g of dry sample was weighed 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 shed and the loss in weight was noted as crude fibre [Vega-Galvez *et al.,* 2010; Gomes *et al.,* 2010; Olajide *et al.,* 2011; Erukainure *et al.,* 2011].

Mineral Analysis

All mineral elements were determined using EDTA. The mineral elements determined were: cadmium (Cd), zinc (Zn), manganese (Mn), iron (Fe), cobalt (Co), chromium (Cr), magnesium (Mg), sodium (Na), phosphorus (P),and potassium (K), [Khoddami *et al.,* 2013; Emmanuel-Ikpeme *et al.,* 2014].

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. This instrument was set to 100 transmittance by taking 2-10 ppm of K and Na solution [Singh *et al.,* 2012].

Calcium and Magnesium Determination

Calcium and Magnesium were determined by EDTA method. Calcium was obtained by pipetting 2 ml aliquots of the sample solution into filtration flask. Three drops each KCH (2-(5-azanyl-2-oxidanyl-phenyl)pyridine-4-carboxylic acid), NH_2, OH and triethanolamine were added together with 0.3g of murexide indicator and it was then filtered with EDTA solution to the end point [Jatto *et al.,* 2010].

Phosphorus Determination

Phosphorus (P) was determined using a spectrophotometer. The 2 ml 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 measurement of P

was taken on the electro photometer at the 660nm wavelength [Pytlakowska*et al.,* 2012].

RESULTS AND DISCUSSION

Result from the GC-MS analysis (Table 1) of *M. piperita* leave extract showed 28 compounds possessing nutritional potentials. GC-MS analysis also indicated that there is high quality and retention factor of hexadecanoic acid (97), Methyl stearate (95) and Oleic Acid (95) which are unsaturated fatty acids with high energy content. There was presence of alcoholic group with strong intensity (Table 2) and carboxylic group with fairer intensity. Table 3 shows that all the selected minerals were present at certain concentrations with only magnesium over-range.

The highest mineral content detected was iron (2.26ppm) and the lowest was cadmium (0.02ppm). Minerals are of critical importance in the diet, even though they comprise only 4–6% of the human body. Their excess or deficiency in organs and tissues leads to diseases. It is very important to know the possible influence of metals on pharmacological properties of herbal infusions [Ahmad *et al*., 2014]. Minerals play vital and important role in our body; sodium and potassium normalize acid base balance and osmotic pressure of body fluid [Bashir & Ali, 2013]. Calcium, a macro-mineral, is vital for bones and teeth health. It is needed for cardiac muscles and nerve impulses, blood and milk clotting [Muhammad *et al.,* 2013; Mainasara *et al.,* 2018]. Zinc is required for wound healing, normal growth, normal insulin secretion, behavioral development and brain health. The permissible limit for edible plants is 27.4 ppm (Muhammad *et al.,* 2013). Manganese play a very important function during biological process because this element is a part as well as enhancer of some enzymes [Naseem *et al.,* 2012; Singh *et al*., 2015]. Copper is also an essential micro-mineral but may be toxic if taken in large amount. The permissible amount to be present in edible plants is 3ppm (Muhammad *et al.,* 2013). Iron is an important trace element. It is part of hemoglobin and plays role in the metabolism of lipids, carbohydrates and protein. Its deficiency can lead to anemia [Naseem *et al.,* 2012; Zaidi and Dahiya*,* 2015].

Table 1. Gas chromatography-mass spectroscopy (GC-MS) analysis of peppermint extract

S/N	RT	Name of compounds	MF	AREA	QUALITY
1	5.336	1H-Indene	C_9H_8	3.91	42
2	5.757	1,4 –Pentadiene	C_5H_8	0.99	43
3	6.198	2,3-Dimethylhydroquinone	$C_8H_{10}O_2$	22.14	64
4	7.441	3,4 –Otadiene	C_8H_{14}	0.42	49
5	7.780	3 –Nonyne -1 – ol	$C_9H_{18}O$	0.77	72
6	8.235	2,5 – Cyclohexadiene – 1,4 – dione	$C_{18}H_{12}O_2$	0.26	40
7	8.601	Formaldehyde	CH_2O	0.05	49
8	8.778	Bicyclo (3.1.1) heptanes	$C_7H_{11}Br$	4.14	90
9	9.009	3 – Eicosyne	C_20H_{38}	1.78	93
10	9.301	Hexadecanoic acid	$C_{16}H_{32}O_2$	3.63	97
11	9.627	Tetradecane	$C_{14}H_30$	0.36	48
12	9.810	2 – Piperidinone	C_5H_9NO	0.23	25
13	10.271	Methyl stearate	$C_{19}H_{38}O_2$	14.34	95
14	11.045	11 – Octadecynoic acid	$C_{18}H_{32}O_2$	4.17	55
15	11.174	Methyl 18 – methyl nonadecanoate	$C_{21}H_{42}O_2$	3.50	48
16	11.412	Tetradecanal	$C_{14}H_{28}O$	6.32	55
17	11.921	1 – pentadecene	$C_{15}H_30$	2.44	80
18	12.118	Docosanoic acid	$C_{22}H_{44}O_2$	8.54	60
19	13.096	1 – Octadecanesulphonyl chloride	$C_{18}H_{37}ClO_2S$	2.00	76
20	13.374	Oleic acid	$C_{18}H_{34}O_2$	1.46	53
21	13.591	Oleic acid	$C_{18}H_{34}O_2$	1.48	95
22	13.856	2 – Methyl – z ,z -3,13 – Octadecadienol	$C_{19}H_{36}O$	2.43	56
23	14.413	Oleic acid	$C_{18}H_{34}O_2$	1.44	53
24	14.813	1 – Octadecanesulphonyl chloride docosane	$C_{22}H_{46}$	3.20	83

25	15.404	7,11-Hexadecadienal	$C_{16}H_{28}O$	1.57	91
26	15.994	Oleic acid	$C_{18}H_{34}O_2$	1.89	91
27	16.877	Oleic acid	$C_{18}H_{34}O2$	2.82	91
28	17.495	Tetradecane	$C1_4H_{30}$	3.71	81

KEYS: RT (Retention time), MF (Molecular formula)

FTIR analysis result of *Mentha piperita* leave extracts

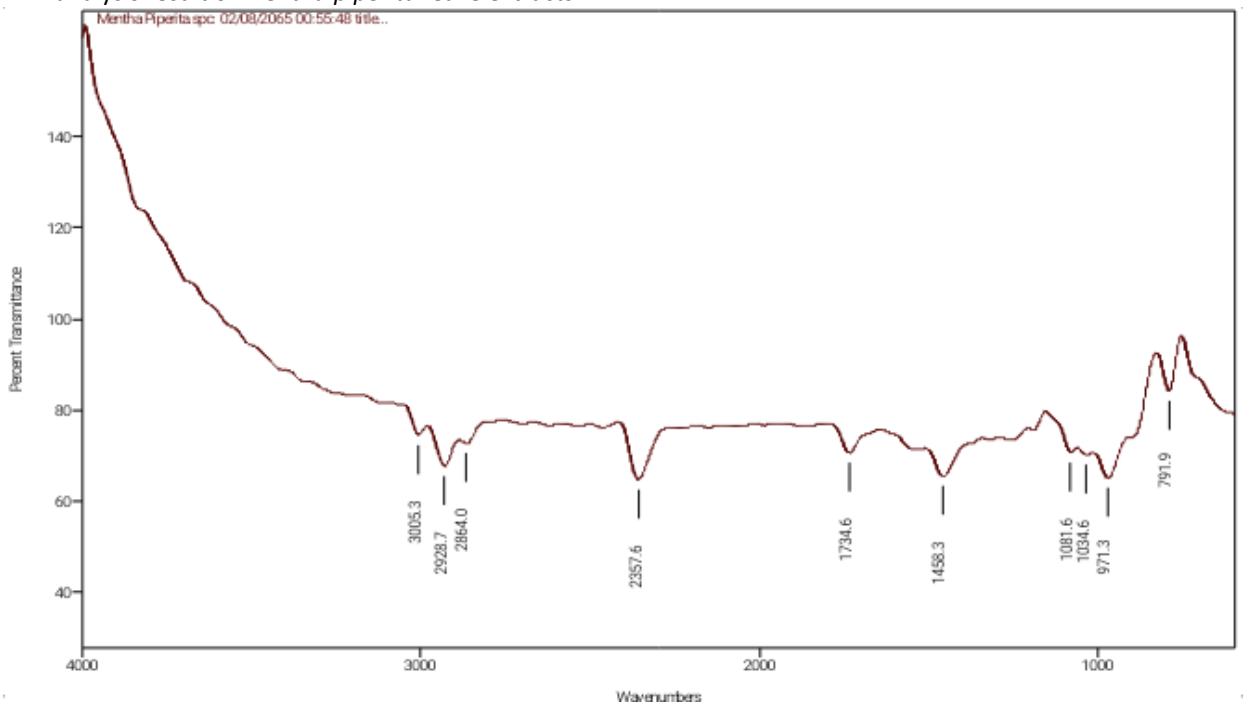

Figure 1. Absorption Spectra results of *M. piperita* extracts.

Table 2. Absorption band infrared spectra region of *M. piperita* extract.

Wave number	**Functional group**	**Infrared**
3200-2600	-O-H(acidic)	very strong intensity than OH
1800-1400	NH	Weaker Intensity and less broad than O-H;NH_2 show two band, NH show one band
1100-900	OH	strong intensity
800-300	C=O	Fairly narrow peak

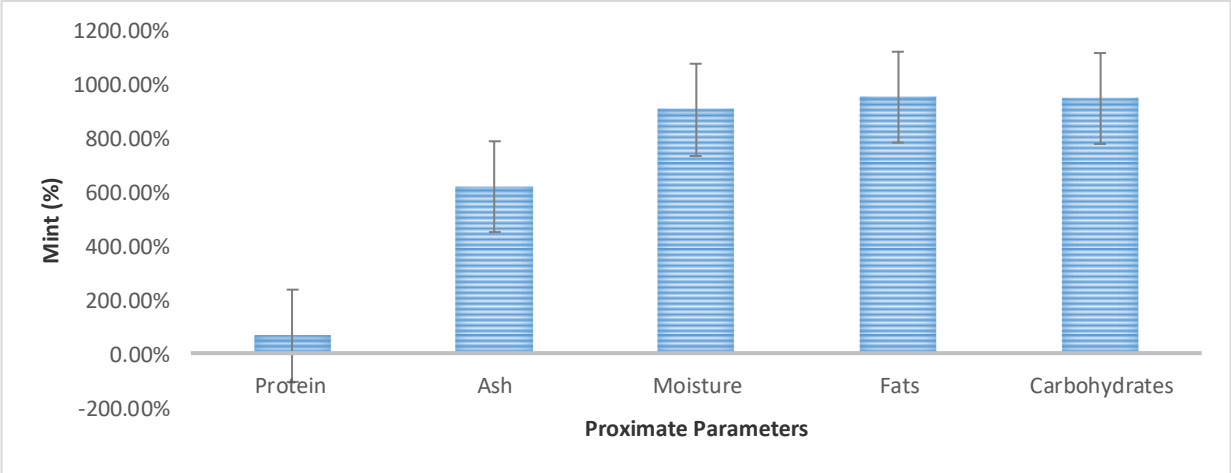

Figure 2. Bar Chart illustration of Proximate Parameters Content of *M. piperita*

Table 3. Results showing the mineral composition of hydro-ethanol leave extract of *M. Piperita*

Minerals	Concentrations (ppm)
Cd	0.02
Zn	0.50
Mn	0.22
Fe	2.26
Co	0.28
Cr	0.22
Mg	Over-range
P	0.10
Na	2.10
K	1.02

CONCLUSION

The analysis shows that *M. piperita* contain important chemicals and nutrient that are needed by the body. The plant leave have higher fats, carbohydrate and moisture content than ash and protein. Therefore, the dried leaves of this peppermint plants could have nutritional value due to higher nutrient content and chemical compositions.

CONFLICTS OF INTEREST

Authors declared that there is no conflict of interest

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