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Studies on nutritional and medicinal properties of chamomile flower, pumpkin fruit and maca root

Andison Joseph[1], Fatokun Ayodeji Olakunle[2]*, Gimba Usman Naji[1], Moses.Tara Langkuk[2]

[1]Department of Biology, University of Abuja, Abuja, Nigeria
[2]Chemisrtry Advanced Research Centre (CARC), *Sheda Science and Technology Complex, Sheda, Abuja, Nigeria*

*Correspondence: olakunlefatokun@yahoo.com

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Abstract

Medicines derived from medicinal plants are effective and safe, providing significant nutritional and therapeutic benefits. The purpose of this study was to determine the nutritional and medicinal values of chamomile flower, pumpkin fruit, and mace root. Standard methods were used to analyze the proximate and mineral compositions. By using the DPPH radical scavenging assay, antioxidant activity was evaluated. The exotic plants showed significant variations in moisture contents: chamomile (14.89%), pumpkin (89.22%), and maca (7.70%). Ash content: chamomile (8.26%), pumpkin (0.79%), and maca (4.39%). Crude fiber content: chamomile (13.89%), pumpkin (0.87%), and maca (4.24%) and Lipid content: chamomile; (10.89%), pumpkin (1.55%), maca (17.39%). Protein content:;: chamomile (19.06%) pumpkin (3.06%) and maca (21.39%). Carbohydrate content: chamomile (33.16%), pumpkin (4.46%) and maca (44.84%), The crude methanol extracts exhibited high antioxidant activity, with IC50 values of 66.75 µg/ml (pumpkin), 32.99µg/ml (chamomile), and 84.55µg/ml (maca). Pumpkin, maca and chamomile powders were rich in essential elements like Na, K, Fe, Ca, Mn and Zn. The study revealed the nutritional and medicinal potential of chamomile, pumpkin and maca powders, making them suitable for practical applications. The detected phyto-constituents may be responsible for the plants' ethno-medicinal properties. These findings provide a scientific basis for the use of these plants in food and pharmaceutical industries.

Keywords: Chamomile flower, DPPH, Maca root, Mineral analysis, Proximate, Pumpkin fruit

1. Introduction

Nutraceuticals and exotic vegetables have garnered increasing attention from health-conscious consumers due to their potential to enhance heart health and immunity (Maoto et al., 2019; Gupta & Jeyaseelan, 2022). Apart from their distinct flavours, textures, and nutritional profiles, exotic vegetables are believed to offer a wider array of nutrients (Dembitsky et al., 2011). Plant-based diets can benefit from exotic vegetables, which are packed with health-enhancing compounds like probiotics, antioxidants, and omega-3 fatty acids. These nutrients offer advantages beyond basic

nutrition, supporting overall wellness. Nutraceuticals, a key component of exotic vegetables, play a vital role in promoting well-being (Malghani et al., 2022). To determine the quality and nutritional value of vegetables, mineral, and proximate analyses are essential tools. Additionally, food and supplement testing (Sarker et al., 2020) provides a comprehensive understanding of vegetable nutrition by evaluating vitamin and mineral content.

2. Literature review

Studies on chamomile flowers (*Matricaria chamomilla*), pumpkin fruit (*Cucurbita maxima*), and maca root (*Lepidium meyenii*), reveal potential health benefits. Chamomile flowers have anti-inflammatory, antioxidant, and antimicrobial properties (Parveen et al., 2023). Pumpkin seeds are a nutritious food source rich in vitamins, minerals, antioxidants, protein, fiber, and healthy fats. (Chuwa & Dhiman, 2023), while maca improves fertility, libido, hormone balance, energy, and mental health. (Gonzales et al., 2009). The chamomile flower (*Matricaria chamomilla*) is native to Europe, North Africa, and Asia. It is being cultivated for its outstanding healing effects (Chauhan et al., 2021). This remarkable plant is valued for its refreshing and revitalizing characteristics, making the tea a popular choice for fostering relaxation and tranquillity. Moreover, the soothing effects on the digestive tract make it an ideal natural medicine for improving digestion, easing stomach symptoms, and enhancing general gut health. Also, its antibacterial and anti-inflammatory qualities make it useful for treating skin diseases while promoting wound healing (Srivastava et al., 2010).

Maca root (*Lepidium meyenii*), a nutrient-rich vegetable from the Andean regions of Peru and Bolivia which for centuries, has been valued for its traditional uses significantly known for its anti-inflammatory properties hormone-balancing and aphrodisiac, all of which can enhance libido and general health (Dini et al.,1994 Cicero et al., 2001; Hermann & Beret, 2009). Additionally, the plant is rich in minerals, vitamins, and fibre. By utilising these qualities, maca root has the potential to improve general wellbeing enhanced vigour and energy besides aid in hormone balance and reproductive health (Bower- Cargill et al., 2022).

Pumpkin (*Cucurbita maxima*), a food from the Cucurbita family that is highly nutritious and low in calories, offers a wealth of health benefits. A previous investigation revealed that the plant is a good source of fibre, vitamin A, and vitamin C, as well as beta-carotene, a powerful antioxidant protecting cells. As a result of its high potassium and magnesium content, pumpkin has a positive effect on overall health (Aziz et al., 2023; Chuwa & Dhiman, 2023). As a result, the immune system is enhanced, improving wound healing and anti-inflammatory effects (de Oliveira et al., 2013). The above properties make it an important ingredient in a balanced and healthy diet. The purpose of this study was to investigate the nutritional and medicinal properties of chamomile flowers, pumpkin fruit, and maca root.

Plate 1: Chamomile flower

Plate 2: Pumpkin fruit

Plate 3: Maca root

3. Research methodology

3.1. Materials

All reagents were of analytical grade and used without further purification. Also, solutions were prepared using distilled water.

3.2. Collection of various plants

Exotic plant varieties were collected from various geographical places and identified at the National Institute of Pharmaceutical Research and Development (NIPRD), Idu Abuja Herbarium section, before being assigned voucher numbers. *Matricaria chamomile* (chamomiole flower) NIPRD/7436 was obtained fresh from a local market in Kano State, northwest Nigeria, and dried under ambient conditions. *Lepidium meyenii* (maca root) NIPRD/H/7437 was harvested from Aso B village in Karu Local Government Area. Nasarawa State, Nigeria. It was dried for 16 hours to keep its nutrients, and then processed into the finest powder. Fresh pumpkin fruit (*Mucurbita maxima)* NIPRD /H/7438 was obtained from local farmers in Gwala Prambe Song, Adamawa State, Nigeria, and processed and dehydrated via freezing. They were sun-dried at low temperatures for 18 hours. The dried samples were stored in a warm environment before being used.

3.3. Extraction

The air-dried crispy samples of various samples chamomile flower. pumpkin fruit and maca root (100g)each were separately extracted via the maceration method for duration of 48 hours with 95% ethanol and later filtered. The extracts were concentrated using rotary evaporator at 40°C and then air-dried to give the crude ethanol extracts in preparation for antioxidant activities.

3.4. Proximate analysis

Proximate analysis of test plants is based on the chemical properties of the compounds, this method partitions compounds in feeds into six categories to determine their nutritional value. The six categories are ashes, moisture, crude fiber, lipids, proteins, and carbohydrates. A detailed

composition analysis and informed decision-making regarding their use are the objectives of this analysis (AOAC, 1990).

3.5. DPPH radical scavenging assay

The methanol extract's antioxidant activity was assessed using a UV-Visible Spectrophotometer at 517 nm (Olutayo *et al.,* 2013). The radical scavenging activity (RSA) was determined by measuring the percentage inhibition of DPPH (Sigma-Aldrich) discoloration, calculated using the following equation.

$$\% \ Inhibition = \frac{Ab - A}{Ab} * 100$$

Ab is the absorption of the blank sample (without the extract) and *Aa* is the absorption of the extract.

4. Data analysis

Table 1: Proximate Composition of Chamomile Flower

Parameter	% Composition
Moisture	14.89
Ash	8.26
Fibre	13.89
Lipid	10.89
Protein	3.06
carbohydrate	33.16

Table 2: Proximate Composition of Pumpkin Fruit

Parameter	% Composition
Moisture	89.22
Ash	0.79
Fibre	0.87
Lipid	1.55
Protein	3.06
carbohydrate	4.46

Table 2: Proximate Composition of Maca root

Parameter	% Composition
Moisture	7.70
Ash	4.39
Fibre	4.24
Lipid	17.39
Protein	21.39
carbohydrate	44.84

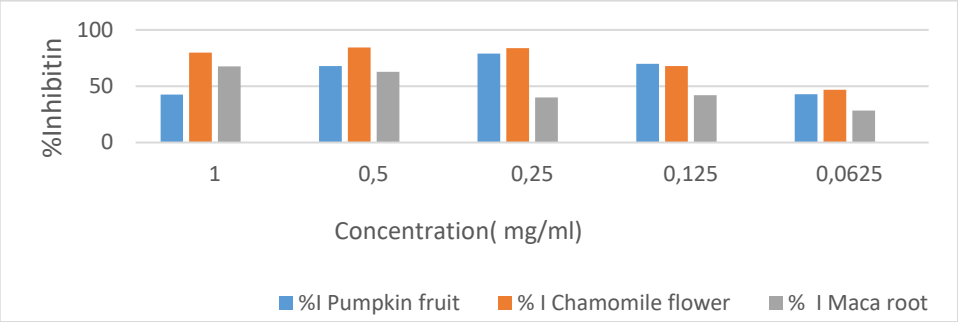
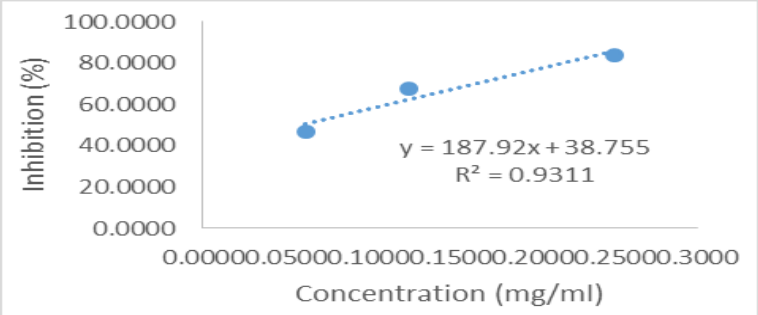
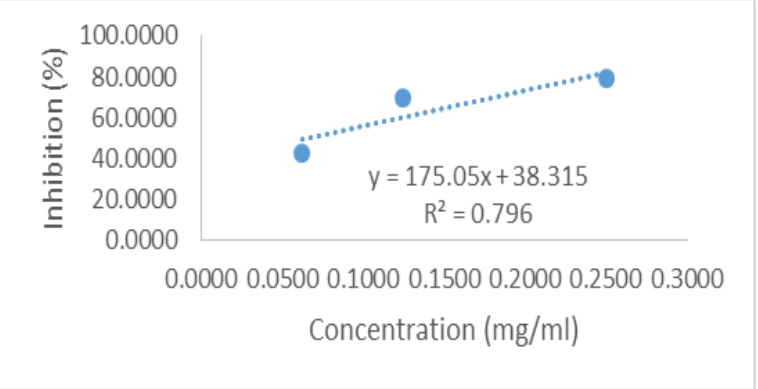


Figure 1: Variation of % inhibition with increasing concentration of plant extract



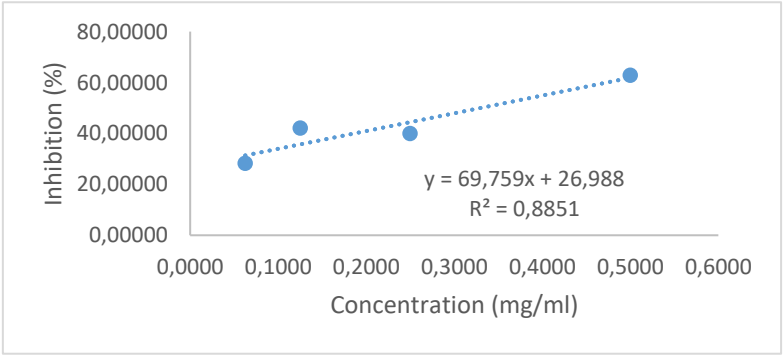
IC_{50} = 0.05984 mg/ml (59.84 µg/ml)

Figure 2: Graph of % inhibition against concentration of chamomile flower extract



IC_{50} = 0.06675 mg/ml (66.75 µg/ml)

Figure 3: Graph of % Inhibition against Concentration of Pumpkin Fruit Extract



IC_{50} = 0.3299 mg/ml (329.90 µg/ml)

Figure 4: Graph of % Inhibition against Concentration of Maca Root Extract

Table 4: Mineral Composition of Plants (mg/kg)

Elements	Pumpkin	Chamomile	Maca
Na	2.267	48.42	42.04
K	772.61	1272.21	1131.07
Fe	20.90	10.49	3.72
Ca	BD	BD	21.92
Mn	0.43	BD	5.40
Zn	1.79	1.65	18.39

5. Results and discussions

Several tests were conducted on the proximate composition and mineral content of dried pumpkin, maca and chamomile powders in order to determine scientific guidelines for their dry utilization (Table 1-3), a significant aspect of food analysis is the moisture content, which influences stability, freshness, quality, shelf life and microbial growth (Singh et al., 2011). In this study, chamomile, pumpkin and maca were found to have varying moisture contents moisture (7.70-89.22%), pumpkins exhibited the highest moisture content, necessitating caution to prevent spoilage. Analyses confirmed the presence of significant amounts of minerals based on the ash content in the samples (0.79-8.26%), with Chamomile having the highest ash content, indicating the importance of assaying for mineral content and purity. Chamomile, pumpkin, and maca displayed nutritional quality and safety, with crude fibre (0.87-13.89%), it is essential as it indicated dietary fibre content, influencing digestive health, satiety and nutrient absorption (Brownlee, 2011). A variety of lipid profiles (1.55-17.39%), can affect a dish's taste, texture, and sensory quality, and they provide energy, support vitamin absorption, and maintain the health of cellular hormone, immune, hair and skin systems (Millward, 2004; Cullerre et al., 2018; Tu et al., 2021). Proteins and carbohydrates are essential macronutrients and provide energy. A range of 3.06% to 21.39% of the protein content contributed over 12% of the calorific value, making them significant sources of protein (Effiong et al., 2009; Aberoumand, 2010).

The highest protein content was found in maca root and chamomile flower, while carbohydrate (4.46% - 44.84 %). Carbohydrates found in chamomile, pumpkin, and maca signify their importance in meeting human nutritional and medicinal needs. Figure 1-4 indicated that the ethanol extracts of chamomile flower (IC50: 59.84 µg/ml), pumpkin fruit (IC50: 66.75 µg/ml) and maca (IC50: 329.90 µg/ml) exhibited strong antioxidant properties, effectively scavenging 1, 1-diphenyl-2-picryl hydrazyl (DPPH), free radicals. The IC50, which represents the concentration at which a plant extract inhibits 50% of free radicals, is a crucial measure of the plant's free radical scavenging power. A low IC50 value indicates a stronger free radical scavenging power (Lima et al., 2021). By counteracting the negative effects of free radicals, these plants could potentially enhance the health of healthy cells. Mineral analysis (Table 4) showed Pumpkin: Na (2.267mg/kg), K (772.60mg/kg), Fe (20.90mg/kg) Mn (0.425mg/kg), Zn (1.79mg/kg), Chamomile: Na (48.42mg/kg), K (1272.21), Fe (10.49mg/kg), Zn (1.65 mg/kg), Maca: Na (42.04mg/kg), K (1131.07mg/kg), Fe (3.72mg/kg), Ca (21.92 mg/kg), Mn (5.40mg/kg), Zn (18.36mg/kg). The presence of sodium and potassium, are important electrolytes required for a variety of biological activities. Sodium helps to maintain fluid equilibrium, whereas potassium helps nerve signaling and muscular actions (Kamel et al., 2010; Pohl et al., 2013; Preuss

2020; Wang et al., 2023). Incorporating these powders into recipes and products can help individuals meet their nutritional needs and support overall wellness (Arnaud & Sanchez, 1991; Kozak et al., 2016; Shukla, 2020). Iron is essential for oxygen transport, energy production, neurotransmitter synthesis, immune cell proliferation, and metabolic processes (Gozzelino & Arosio, 2016; Jomova et al., 2022). Pumpkin exhibited the highest value, enhancing anti-inflammatory properties, regulating blood sugar, protecting cells from oxidative stress, promoting relaxation, stress relief, and sleep, and supporting the immune system, energy production, and cellular function (Jin, *et al.,* 2024). As an essential component of bone strength and muscle function, calcium was not indicated in other supplements except maca (Peacock, 2010; Krupa-Kozak & Drabińska, 2016; Li et al., 2019). Manganese found only in pumpkin and maca, is a crucial nutrient for maintaining health, especially the immune system (Bresciani et al., 2015; Silva et al., 2019). Zinc was detected in all the exotic plants with maca indicating the highest amount, Among its many functions, zinc is vital to the immune system, reproduction, fertility, and infant development. Bhowmik et al. (2010) that adequate intake is crucial during pregnancy, lactation, and childhood to prevent deficiency and support overall health.

6. Implications of the study

This study highlights the potential of chamomile flower, pumpkin fruit, and maca root as valuable ingredients in food, pharmaceuticals, and cosmetics. Their nutritional and medicinal properties make them suitable for functional foods, dietary supplements, and natural remedies.

7. Recommendations

The study should explore the bioavailability and pharmacokinetics of chamomile flower, pumpkin fruit, and maca root's bioactive compounds, their traditional health benefits, modern medicine applications, sustainability, and environmental impact, while also conducting comparative studies with other plant species.

8. Conclusion

This study has shown that the ashing, moisture content, and lipid profile analysis are crucial in proximate analysis, providing essential information about food product nutritional composition, safety, stability, and sensory attributes, aiding informed decision-making In Nigeria, there is a rising interest in chamomile flowers, pumpkin fruits and maca as valuable fruits and vegetables. To capitalize on these emerging market trends, increasing public knowledge about the nutritional advantages of these plants is advised to enhance their popularity and broader adoption.

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ORCID

Andison Joseph https://orcid.org/0009-0002-2319-9414
Fatokun Olakunle Ayodeji https://orcid.org/0000-0001-6581-9699
Gimba Usman Naji https://orcid.org/0000-0003-4183-1284

Moses Tara Langukuk https://://orcid.org/0000-0002-6533-842X

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