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Research Article

PROXIMATE COMPOSITION OF GINGER, CLOVE, TURMERIC AND THYME

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ABSTRACT

Ginger, clove, turmeric and thyme are different plant materials that are widely used in different forms by indigenes of many countries, especially in nutrition. They are believed to have many nutritional, medicinal and pharmaceutical uses. This study evaluated the proximate composition of ginger, clove, turmeric and thyme. The ginger, clove, turmeric and thyme were obtained at New Market, Wukari, Nigeria. They were cleaned to remove dirt and dried. The dried plant samples were milled to a powder which was used for the determination of their respective proximate compositions. Determination of the proximate composition parameters was done using the official methods of proximate analysis of Association of Official Analytical Chemists. The results showed that moisture, ash and crude protein contents are higher in clove and lower in ginger than in turmeric and thyme. There is no significant difference ($p>0.05$) in the levels of moisture, ash, crude fibre and crude protein in turmeric and thyme. There is a statistically significant differences ($p<0.05$) in the levels of lipid among the four different plant samples. Lipid is higher in ginger and lower in turmeric than in clove and thyme. Crude fibre is higher in thyme and lower in clove than in ginger and turmeric. There is no statistical difference ($p>0.05$) in the level of crude fibre in ginger and clove, and in turmeric and thyme. Carbohydrate is significantly higher ($p<0.05$) in turmeric than in clove, thyme and ginger. There is no statistical difference ($p>0.05$) in the level of carbohydrate between clove and thyme. This study showed that ginger, clove, turmeric and thyme contain appreciable levels of some proximate composition parameters. They may be good sources of energy and could play certain immunological, physiological and nutritional roles.

KEYWORDS: Clove, Ginger, Nutrition, Proximate composition, Thyme, Turmeric.

INTRODUCTION

Plants have been reported to have very great potential for the treatment and management of some disease conditions. Many plants have been used by tribal and folklore: in different countries for the treatment of various diseases[1] and in nutrition. The medicinal value of plants was reported to lie in their bioactive phytochemical constituents. Aside from the primary use of spices as organoleptic enhancers in food preparation, they are increasingly finding other useful roles in animal health care. Currently, many spices and herbs are being investigated for their potential effects in health care. In literatures, there exist many reported findings on medicinal properties of certain spices. The rise in interest on medicinal properties of herbs and spices is consequent on the failing efficacy and toxicity associated with conventional drugs and their inaccessibility to poor rural dwellers or low-income earners. For a long time, there has been a resurgence of interest in the investigation of natural materials as a source of potential drug substance.[2]

Spices as clove, oregano, mint, thyme and cinnamon, have been employed for centuries as food preservatives and as medicinal plants mainly due to their antioxidant and antimicrobial activities. Nowadays, many reports confirm the antibacterial, antifungal, antiviral and anticarcinogenic properties of spice plants. Clove in particular has attracted attention due to its potent antioxidant and antimicrobial activities standing out among the other spices.[3]

Herbs and spices are among the natural compounds that are currently being used as food preservatives, which contain compounds with marked antioxidant and antimicrobial properties.[4] Plant extracts have been used for hundreds of years to improve the organoleptic

properties of food, but further to this, Chipault *et al*.[5] reported that plant extracts also have preservative properties in different types of spices, and there is currently a lot of information about the compounds and mechanisms involved in the inhibition of lipid peroxidation[6]. They are considered to be generally recognized as safe, which makes consumers and regulatory agencies regard them as more appropriate for use in food than artificial compounds. Material plants, such as herbs of the Labiatae family, have been some of the most studied for their preservative properties[7]. Together with their antimicrobial and antioxidant activity, natural extracts have other applications, such as anti-inflammatory, immunomodulatory, spasmolytic and sedative purposes. Natural extracts often owe their biological activity to the synergism between their various compounds since their separate activities are much lower than their combined activity.

Proximate analysis refers to the quantitative analysis of macromolecules in food. A combination of different techniques, such as extraction, Kjeldahl, NIR are used to determine protein, fat, moisture, ash, fibre and carbohydrates levels. Proximate composition is the term usually used in the field of feed/food and means the six components of moisture, crude protein, ether extract, crude fibre, crude ash and nitrogen free extracts, which are expressed as the content (%) in the feed/food.

The measured values of these six components in feed are important factors to understand the nature and the properties of the subject feed. Moisture content is the amount of water content in a given sample. Moisture content influences the physical properties of a substance such as weight, and it shows whether a product intended for production and marketing has standard properties such as storability, microbiological stability, nutritional value of the product and so on. The ash of biological material is an analytical term for inorganic residue that remains after the organic matter has been burnt off. The ash is not usually the same as the inorganic matter present in the original food since there may be loss due to chemical interaction between constituents. Fat is an oily matter that makes up the bulk of adipose tissue and often abundant in seeds. It is soluble in certain inorganic solvent and insoluble or partially soluble in water. Crude fibre is the portion of the total carbohydrate of a food that is resistant to acid and alkali treatment. It can also be called dietary fibre. The protein content of foods may be estimate from the organic nitrogen content determined by the Kjeldahl procedure. The carbohydrate content is determined by calculation using: % carbohydrate = 100 – (% moisture + % ash + % lipid + % crude fibre + % Crude protein).

Many people use ginger, clove, turmeric and thyme because of their acclaimed nutritional and medicinal properties. Most of the consumers do not know their nutritional compositions to enable them ascertain if truly they possess the acclaimed nutritional properties. Also, paucity of information on the comparative proximate compositions of the four spices warrants research into this research study. Hence, the need to evaluate the proximate composition of ginger, clove, turmeric and thyme. The knowledge of the constituents of plant materials aids proper decision of suitable conditions to use or apply them. Hence, this study is significant because it revealed and compared the proximate compositions of ginger, clove, turmeric and thyme.

MATERIALS AND METHODS

List of Materials and Equipment Used

The materials and equipment used in this study include the following: Rhizomes of ginger, Flower buds of clove, Rhizomes of turmeric, Thyme, Reagents of analytical grade, Mortar and pestle, Fume cupboard, Glassware, Soxhlet extraction apparatus, Water bath, Muffle furnace, Oven, Analytical balance, Electro-thermal digester and Markham distillation apparatus.

Plant Materials Used

The ginger (rhizome), clove (flower buds), turmeric (rhizomes) and thyme were obtained at New Market, Wukari, Nigeira. They were cleaned to remove dirt and dried. The dried plant samples were milled to a powder which was used for the determination of their respective proximate compositions at the Central Laboratory, Federal University Wukari, Nigeria.

Determination of Proximate Compositions of Ginger, Clove, Turmeric and Thyme

The moisture content, total ash, fat (lipid), crude fibre and crude protein levels in ginger, clove, turmeric and thyme were determined using the method of AOAC[8]. Thereafter, the carbohydrate content was determined by calculation using the following formula: % carbohydrate = 100 – (% moisture + % ash + % lipid + % crude fibre + % Crude protein).

Statistical analysis

Statistical analysis was carried out on the results with the use of One-Way Analysis of Variance (ANOVA) and further with least significant difference (LSD), using Statistical Package for Social Sciences (SPSS) version 23. The results were presented as mean ± standard deviation. The mean determinations of each parameter were compared for significance at $p<0.05$.

RESULTS

The results of this study are presented in the table below.

Table 1: Proximate Composition of Turmeric, Clove, Thyme and Ginger (%).

Sample	Moisture	Ash	Lipid	Crude fiber	Crude protein	Carbohydrate	Dry matter
Turmeric	9.22 ^{b}	7.29^{b}	7.21^{a}	2.70^{a}	10.68^{bc}	62.90^{b}	90.78^{b}
Clove	12.43^{c}	9.65^{c}	9.19^{b}	2.14^{a}	11.46^{c}	55.13^{a}	87.57^{a}
Thyme	9.37^{b}	6.92^{b}	14.65^{c}	3.04^{a}	10.41^{b}	55.61^{a}	90.63^{b}
Ginger	6.61^{a}	4.67^{a}	22.35^{d}	2.31^{a}	6.56^{a}	57.50^{a}	93.39^{c}

Values are mean of triplicate determinations.
Mean in the same column, having different letters of the alphabet are statistically significant ($p<0.05$).
The results of the proximate analysis of the spices are presented in Table 1. The results showed significant differences ($p<0.05$) among moisture%, Ash%, Lipid% Crude Protein%, and organic matter% contents. However, statistical similarities ($p>0.05$) existed among turmeric and thyme for moisture%, ash% and organic matter% and turmeric and clove for crude protein. However, carbohydrates% were significantly different ($p<0.05$) between turmeric and clove, while thyme and ginger were similar ($p>0.05$). There were similarities ($p>0.05$) across the turmeric, clove, thyme and ginger for percentage crude fibre content.

DISCUSSION

The results showed that percentage moisture content was significantly ($p<0.05$) higher in clove than in ginger, turmeric and thyme. Ginger was the lowest in moisture content. This means that ginger will have higher dry matter than the three other plant materials, especially, clove. The high moisture content of the clove implies that it may have a shorter shelf-life than ginger, turmeric and thyme. It suggests that clove may decay earlier than the ginger, turmeric and thyme if they are stored. This is because moisture could encourage some activities of microorganisms which may reduce the quality of the plant material and its overall acceptability.

The amount of ash in the plant samples revealed the corresponding amount of minerals in the samples. The results showed that percentage ash content was significantly ($p<0.05$) higher in clove than in ginger, turmeric and thyme. The ash content, as seen to be highest in clove, followed by turmeric, thyme, then ginger showed that their mineral content levels may be in the same order. It means that clove may contain more mineral elements (in amount) than ginger, turmeric and thyme. Although mineral elements do not yield energy, but they are essential for the proper functioning of human immune system and for sustaining life[9]. Consumption of food materials rich in minerals aid in supplying the individual mineral elements that may help boost the immune system and sustain life. Availability of some mineral element could help in regulation of homeostatic balance. This will aid the proper functioning of bodily cells, nerves, bones and muscles[9]. Therefore, the appreciable levels of ash in ginger, clove, turmeric and thyme shows they may be reliable sources of some minerals necessary for proper body functioning. The ash content of turmeric obtained in this study was 7.29%, this was in line with the report of Ikpeama *et al.*[10] who stated that turmeric (Haldi) powder should not contain total ash of more than 9.0% by weight on a dry basis. Ikpeama *et al.*[10] and Imoru *et al.*[11] found 2.85% and 2.76 % ash content, which was lower than this present finding of 7.29%.

There is statistically significant differences in the levels of lipid among the four different plant samples. Lipid was higher in ginger and lower in turmeric than in clove and thyme. The high amounts of lipids may contribute to the nutritional and medicinal reasons for the widely use of ginger in nutrition and medicine all over the world, since some lipids play important roles in driving many important biological processes. Also, the high lipid contents of ginger, followed by thyme showed that they could be important for the synthesis of certain hormones of lipid origin and could also help in proper utilization of some fat-soluble vitamins[12]. However, as spices, clove and turmeric also have appreciable level of lipids.

The amount of crude fibre was higher in thyme and lower in clove than in ginger and turmeric. There was no statistical difference ($p>0.05$) in the level of crude fibre in ginger and clove, and in turmeric and thyme. Among the proximate parameters determined in the four plant samples, crude fibre was the least in percentage when compared with the levels of other parameters. Thyme and turmeric were higher in crude fibre than ginger and clove. This suggests they may help in reducing constipation and therefore may enhance frequent elimination of bowel content more than ginger and clove. If diet that contains little fibre is eaten, the faces may be hard, dry and concentrated. Although, a very high fibre level in food sample may cause intestinal irritation, lower digestibility and decrease nutrient utilization[13]. This is because a very high fibre level in food can promote the constant elimination of bowel content. This can be detrimental since constant elimination of bowel content could result to a decrease in digestibility and utilization of nutrients[12].

Crude protein content was higher in clove and lower in ginger than in turmeric and thyme. Proteins are reportedly known to have diverse physiological and pharmacological roles in the biological systems. Comparing the levels of crude protein among the four plant samples, this study result suggests that clove may be a better source of proteins, followed by turmeric, thyme and then ginger. The protein content of some of the plant samples (especially clove, turmeric and thyme) showed they may contain certain important amino acids which may play vital immunological, physiological, nutritional and pharmacological roles. Proteins have been reported by Imo

et al.[12] to aid in growth regulation and in catalytic activities of certain enzymes. Proteins from clove, turmeric, thyme and ginger could aid in these functions thereby improving human and other animals' health system when they are used in nutrition.

Carbohydrate was significantly higher in turmeric than in clove, thyme and ginger. There is no statistical difference in the level of carbohydrate among clove, ginger and thyme. The result of this study showed that the four spices are rich in carbohydrate, but turmeric could be a better source of carbohydrate when compared with clove, thyme and ginger. This means that the spices may aid in growth and provision of energy when used in nutrition. It has been reported that carbohydrate acts as a mild natural laxative for humans and adds to the bulk of diet. It is essential for the nourishment of plants and animals which aids growth of plants and animals by providing energy[14]. Further research to determine the types of carbohydrates present in the plant samples will be important in order to ascertain the areas of life they may be of beneficial use. It is possible that the high amounts of carbohydrates in the four spices may also contribute to the reasons for their widely use as spices in nutrition all over the world, since they may be a source of ATP for driving many important biological processes. Gamaliel *et al*.[15] reported clove's carbohydrate composition as 36.02% which is lower than the value obtained in this study (55.15); 68.6% was obtained by Ogunka-Nnoka and Mepba[16] and 77.18% obtained from study by Umar *et al*.[17]. The result of this study also showed that beside the common or regular use of turmeric, clove, thyme and ginger as spices in nutrition, they possess other important nutritional properties which may have been neglected by some users or consumers. The findings of this study on the proximate composition of ginger agreed with earlier reports of Nwinuka *et al*.[18]. Ugwoke and Nzekwe[19] stated that the results of the proximate analysis of the ginger rhizome showed that ginger contains mostly carbohydrates (72.38%), crude protein (8.83%) and crude fat content of 5.71%.

CONCLUSION

This study showed that moisture content was higher in clove than in ginger, turmeric and thyme which implies that clove may have a shorter shelf-life than ginger, turmeric and thyme. The ash content, as seen to be highest in clove, followed by turmeric, thyme, then ginger showed that their mineral content levels will be in the same order. Lipid was higher in ginger and lower in turmeric than in clove and thyme. Among the proximate parameters determined in the four plant samples, crude fibre was the least in percentage when compared with the levels of other parameters. Thyme and turmeric were higher in crude fibre than in ginger and clove. This suggests they may help in reducing constipation and therefore may enhance frequent elimination of bowel content more than ginger and clove. Clove is be a better source of proteins, followed by turmeric, thyme and ginger. The four spices are rich in carbohydrate, but turmeric could be a better source of carbohydrate when compared with clove, thyme and ginger.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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