ABSTRACT

Proximate analysis of garlic, ginger, bell pepper, scotch bonnet pepper and onion (spices) samples was carried out using various AOAC (2006) methods. The percentage parameters ranges in the order: 5.1% in ginger to 9.3% in onion for moisture content; 5.8 % in scotch bonnet pepper to 9.7% in bell pepper for ash content; 3.3% in ginger and garlic to 13.3% in bell pepper for crude lipid; 7.7% in ginger to 10.7% in onion for crude protein and 61% in bell pepper to 76% in ginger for total carbohydrate content the result showed that all samples have moderately high percentage of carbohydrate in them. This agrees with the fact that spices generally are mostly used as mere food adjuncts, used to give piquancy to tasteless food. Thus they serve mainly to add flavour, aroma and taste to food and dishes.

Introduction

A spice is a dried seed, fruit, root, bark or vegetative substance primarily used for flavouring, colouring or preserving food. Sometimes a spice is used to hide other flavours (Terenece, 1995). Spices are distinguished from herbs, which are part of leafy green plants used for flavouring or as garnish. Many spices have antimicrobial properties. This may explain why spices are commonly used in warmer climates which have more infectious disease and why use of spices is especially prominent in meat, which is particularly susceptible to spoilage (Fredrick et al., 2012). A spice may be available in many forms; whole dried or pre-ground dried. A whole dried spice has the longest shelf life, so it can be purchased and stored in a larger amount, making it cheaper on a preserving basis. Some spices are rarely available either fresh or whole, for example turmeric and must be purchased in dried form. Small seeds such as fennel and mustard seeds are used both whole and in powdered form. The flavor of a spice is derived in part from compounds that oxidize or evaporate when exposed to air grinding a spice greatly increase its surface area and so increases rate of oxidation and evaporation. Thus flavor is maximized by storing a spice whole and grinding when needed. The shelf life of a whole spice is roughly two years: of a ground spice roughly six months (Czarra, 2009). Spices come in various forms, whole or ground
or as extractives. The extractives are essential oils and oleoresins. These extractives are reformulated to produce secondary products such as essences, emulsions, liquid soluble spices, dry soluble spices encapsulated spices, heat resistant spices and fat based spices (Heath and Reineccius, 1986). The use to which a spice material is put as a spice is dictated primarily by its content of essential oils oleoresins (Hill, 1952 and Dziezak, 1989). In culinary concerns, spices give piquancy to tasteless served in homes, cafés and restaurants. This use is based on the ability of spices to impart flavour and aroma to food. Spices are often referred to as food accessories or adjuncts because of their ability to stimulate appetite and increase the flow of gastric juice (Dziezak, 1989). These species are the major sources of powder and/or seeds used in cooking and have strong taste and smell. Apart from their nutritional and medicinal importance, spices like the other non timber products have significant potentials in terms of employment opportunity (Soladoye and Sonibare, 2003). Spices were among of the most demanded and expensive products available in Europe, in the middle ages, the most common being black pepper, cinnamon (and the cheaper alternative cassia), cumin, nutmeg, ginger, and cloves. Spices and herbs were indispensable to balance ‘humors’ in food (Civitello, 2007), a daily basis for good health at a time of recurrent pandemics. Spices were all imported from plantations in Asia and Africa, which made them expensive. In the food processing industries, spices are employed in the preparation of numerous products including processed meat, sausages, sauces, vinegar, mustard, pickles, chutneys, preserves, salad dressing, biscuits, cookies, cakes, confectioneries and beverages. Spices and herbs (or their oils) where processing temperature permits, also go into preparation of a number of liqueurs. Both herbs and spices contain essential oils, which are the flavouring components of extracts and they are employed in the production of perfumes, cosmetics, toiletries, lotions, hair products, tooth paste and soaps. These essential oils and oleoresins are the basis of a number of spice flavourings and seasoning employed in food manufacturing. Turmeric is a well known remedy in ancient Indian medicine and cosmetics. It serves as remedy for practitioner of Ayurveda, Siddha, Unani and traditional Chinese medicine (Sakarka et al., 2006). Garlic is utilized as a dietary component and as substrate for the production of medicines. It possesses strong antimicrobial properties (Baasinska, 2004). Ginger has antibacterial, antifungal, anti-parasitic, antiviral, anti-diabetic, anti-inflammatory, antioxidant and anti-hypercholesterolaemic properties (Baasinska, 2004).

Materials and Methods

Sampling

Garlic, ginger, onion, bell pepper and scotch bonnet pepper samples were obtained from Zango Kataf Local Government Area of Kaduna State. All samples were in their fresh state except for the garlic that was obtained in its dried state. The light scaly covering on the onion bulbs and garlic cloves were removed and naked bulbs and cloves washed with tap water and rinsed with distilled water before being chopped into tiny pieces. The ginger light skin of the ginger rhizomes scraped off using a blunt knife and cut into smaller pieces. Bell pepper and scotch
bonnet pepper were also washed and carefully cut into smaller pieces as well. All samples were
dried at room temperature for at least three weeks and later dried in an air circulating oven in the
laboratory to complete dryness. The dried samples were ground manually to powdered form
using a manual grinder. The powder of each sample was sieved through a mesh of 300 micro
meters to obtain a smooth powder suitable for the analysis and store in an air tight cellophane
bag as stock sample and kept until required for analysis.

**Proximate Analysis**
The proximate composition of each sample was determined using the methods of Association of

**Determination of Moisture Content**
Thermal drying method was used in the determination of moisture content of the samples. 
Exactly 1.0g of the dried sample was weighed in triplicate and placed in washed, dried and
weighed crucible. This was placed in an oven and dried at 105°C for three hours to complete
dryness. The sample was allowed to cool in a desiccator and then reweighed. The percentage
moisture content was calculated by computing or expressing the loss in weight on drying as a
fraction of the initial weight of sample used and multiplied by 100.

\[
MC (\%) = \frac{W_o}{W_i} \times 100
\]

Where \(W_o\) = loss in weight (g) on drying and \(W_i\) = initial weight of sample (g)

**Determination of Ash Content**
The ash content was determined using the ignition method. The crucibles used were thoroughly
washed and pre-heated a muffle furnace at 500°C. Exactly 1.0g of the oven-dried sample used in
moisture determination were weighed in triplicate and placed in the pre-heated, cooled and
weighed crucible and then reweighed. The crucible was covered with its lid, the number noted
and then placed in a cold muffle furnace. The temperature was allowed to rise to 500°C and the
ashing carried on for three hours at this temperature. The crucible was removed from the
furnace, allowed to cool in a desiccator, and reweighed. The percentage ash content was
calculated using the formula:

\[
Ash (\%) = \frac{M_a}{M_s} \times 100
\]

Where \(M_a\) = Mass of ash (g) and \(M_s\) = Mass of sample used (g)

**Determination of Crude protein**
This was done by first of all determining the total organic nitrogen using the macro-Kjeldhal method. This involved digestion, distillation and titration. One gram (1.0g) of the sample was weighed in triplicate and placed in digestion flasks. Few granules of anti-bumps and about 3.0g of copper catalyst mixture (96% anhydrous sodium sulphate, 3.5% copper sulphate and 0.5% selenium dioxide) were added to each of the flasks. Digestion was then commenced by adding (to each flask) 20cm$^3$ concentrated sulphuric acids and heating on a heating mantle. Digestion was continued until a clear solution was obtained and then the flask was allowed to cool. The digest was then filtered and made up to 100cm$^3$ with distilled water. Exactly 20cm$^3$ of the diluted digest was pipette into round-bottomed flasks and used in the distillation step.

**Distillation**

A round-bottomed flask was set on a heating mantle and connected, using a Liebig condenser, to a beaker (receiver flask) containing 20cm$^3$ of 2% boric acid with screened methylred indicator. The condenser was submerged in the boric acid by the use of a Buchner funnel. Exactly 30cm$^3$ of 40% sodium hydroxide was then injected into the flask and distillation of the ammonia formed commenced by heating the flask. The distillation was continued until the boric acid solution completely changed from purple to greenish – yellow. The boric acid mixture (containing the ammonium borate complex formed) was then titrated with 0.1mol/dm$^3$ HCl to colourless end point and the titre noted. The total organic nitrogen was then calculated using the formula:

$$\% \text{ TON} = \frac{TV \times NE \times TV_d}{M_s \times V_d} \times 100$$

Where TV = Titre value, NE = mg nitrogen equivalent to molarity of acid, $TV_d$ = total volume to which digest was diluted, $M_s$ = mass of sample (g) and $V_d$ = volume of digest distilled.

% crude protein = % TON x 6.25

**Determination of Crude Lipid**

Determination of crude lipid content of the samples was done using soxhlet type of the direct solvent extraction method. The solvent used was petroleum ether (boiling range 40°C - 60°C). Exactly 3.0g of the dried sample was weighed in triplicate and secured in soxhlet extraction thimble. The thimble was then put into 20cm$^3$ capacity soxhlet extractor. A washed, oven-dried 100cm$^3$ round-bottomed flask was weighed and approximately 60cm$^3$ of the 40-60°C boiling range petroleum ether added to it. The flask was then mounted on the heating mantle and connected to the extractor (with condenser). The condenser and heating mantle were then activated and extraction carried on for four hours. At the end of the extraction, the solvent was evaporated and the flask dried in the oven (at 60°C). The flask was then cooled and reweighed. The percentage crude lipid was calculated using the formula:
Where \( M_{ex} \) = mass of extract (g) and \( M_s \) = Mass of sample used (g)

**Determination of Carbohydrate Content**

Total carbohydrate content of each sample was estimated by the ‘difference’in the equation below. In this, the sum of the percentages of all the other proximate components was subtracted from 100 i.e total carbohydrate (%) = 100 – (% moisture + % crude protein + % crude lipid + % ash).

**Results**

The analysis results for moisture, ash, crude lipid, crude protein and total carbohydrate content in ginger, scotch bonnet pepper, garlic, bell pepper and onion samples in percentage are as presented in table 1 below.

**Table 1: Proximate Composition of Samples**

<table>
<thead>
<tr>
<th></th>
<th>GINGER</th>
<th>SCOTCH BONNET</th>
<th>GARLIC</th>
<th>BELL PEPPER</th>
<th>ONIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC</td>
<td>5.7</td>
<td>5.1</td>
<td>6.8</td>
<td>6.1</td>
<td>9.3</td>
</tr>
<tr>
<td>AC</td>
<td>7.4</td>
<td>5.8</td>
<td>9.0</td>
<td>9.7</td>
<td>6.1</td>
</tr>
<tr>
<td>CL</td>
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<td>6.7</td>
<td>3.3</td>
<td>13.3</td>
<td>10.6</td>
</tr>
<tr>
<td>PC</td>
<td>7.7</td>
<td>9.2</td>
<td>8.3</td>
<td>9.6</td>
<td>10.7</td>
</tr>
<tr>
<td>TC</td>
<td>76</td>
<td>73</td>
<td>73</td>
<td>61</td>
<td>64</td>
</tr>
</tbody>
</table>

**Key**

MC = Moisture Content  
AC = Ash Content  
CL = Crude Lipid  
PC = Protein Content  
TC = Total Carbohydrate

**Discussion**

The proximate composition of ginger, scotch bonnet pepper, garlic, bell pepper and onion samples on dry weight basis studied are shown in the table 1. The results showed that all samples have significantly different nutritional compositions. The moisture content ranging from 5.1% in scotch bonnet pepper to 9.3% in onions which makes them more stable when dried during storage and packaging and falls below and between the range values 8 to 14% as reported by Tchiegang and Mbougueng (2005), the ash content ranging between 5.8% in scotch bonnet pepper to 9.7% in bell pepper- a range that is much higher than 2 to 9 % reported by Tchiegang.
and Mbougueng (2005). This difference may probably reflect the difference in the origin and varieties of the samples. The highest value of all the parameters was carbohydrate content which ranged from 61% in bell pepper to 76% in ginger. Although the results showed that these samples accumulate sugar in them but cannot be considered as carbohydrate sources as compared to tubers and cereals which are spread throughout the world (Jayakody, et al., 2005). The lowest percentage of lipids was found to be 3.3% in ginger and garlic while the highest value in bell pepper with 13.3% which is lower compared to higher value of 47.5% reported by Tchiegang and Mbougueng (2005), this may be attributed to the difference in the extraction method which in this case, soxlet is known to be destructive. However, this does not however portray bell pepper as an oil seed. All samples contain protein below 20% with the range 7.7% in ginger to 10.7% in onions. This shows the relative dietary importance of these spices to the improvement of protein content of food. The samples were found to be relatively good dietary component of carbohydrate, lipids and protein. The crude lipid concentration in bell pepper was not enough to be called oil seed. This may be why these samples are used as mere spices and not as major sources of food nutrients. These findings agree with the fact that spices are mere food adjuncts used to give piquancy to tasteless food dished up in homes cafes and restaurant (Dziezak, 1989). Thus they serve mainly to add flavour, aroma and taste to food and dishes.

Conclusion
This work has shown that, while providing flavour, aroma and enhancing taste of food, these spices also serve as sources of some essential nutrients which are naturally present in them even though not in high concentration.

Recommendation
It is recommended that spices should be used as dietary component and not only as mere food adjuncts.

References


