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COMPARATIVE PROXIMATE EVALUATION OF PEARL MILLET *(PENNISETUMTYPHOIDES)*, MAIZE *(ZEA MAYS)*, GARLIC *(ALLIUM SATIVUM)*, GINGER*(ZINGEBEROFFICINALE) AND* GREAT MILLET *(SORGHUM BICOLOR)*

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ABSTRACT: *The study covers the comparative proximate assessment of maize, millet, ginger, garlic and sorghum bicolor. The nutritive parameters investigated; Ash, Fat, Fiber, Moisture, Protein and carbohydrate contents. The result of moisture content ranged between sorghum having lowest with 3.00 ± 12 to Ginger having highest with 74.72 ± 1.32, Ash content with Alliums sativum having lowest 1.44 ± 0.01 to sorghum having highest with 3.99 ± 0.91, Fat content Alliums sativum; having lowest 0.76 ± 0.08 to maize having heist 7.00 ± 0.10, fiber content with Alliums sativum lowest 0.69 ± 016 to Ginger having highest 6.07 ± 0.64 protein content with sorghum having highest 13.09 ± 1.23 to maize having lowest 7.05 ± 0.01, carbohydrate content indicated sorghum having highest 72.02 ± 0.05 to Ginger with lowest value; 3.80 ± 0.34. Comparatively, the sorghum bicolor could be recommended against Pennisetum typhoides, Zea mays, Alliums sativum, Zingeber officinale for newly put bed women bodies to be replenish after delivery as best food supplement out of the food samples investigated.*

KEYWORDS: Proximate, Pennisetum Typhoides, Zea Mays, Alliums Sativum, Zingeber Officinale, Sorghum Bicolor

INTRODUCTION

A dietary supplement from the name often referred to as food options that is prepared aimed at providing an alternative to the diet and nutrients such as Vitamins, minerals, fibers, fatty acids, amino acids that may be missing arising from unbalanced diets. These could be of vegetable origin; like Garlic, African Locust Beans, Ginger, Millet, (Baldi, & Mantovani, 2008**;** Burdock, 2001**;** Cade, Burley, Greenwood, 2007**).** Ginger is a rhizome with a sweet, strongly aromatic odour with sharp pungent flavour. It is used as an essential spice in curry powder, ginger bread and in some beers and other drinks. The taste and pungency of ginger increases with the maturity of the plant, thus young rhizomes are juicy and fleshy with a very mild taste while juice from old rhizomes are extremely potent and sharp and is often used as a spice in Chinese cuisines. Ginger is used as ingredient in soups, as a spice in ginger bread and other recipes and can be stewed in boiling water to make ginger tea. It can also be made into candy or used as flavouring for cookies, crackers and cake. It helps to alley motion sickness and is used especially in the Far East as a digestive acid and a food preservative (Burduck, 2001; Ciacci *et al.,* 2007) In Nigeria, ginger is used to flavour a local drink called Kunnu.

Garlic (Alliums sativum) is specie of the onion family and is used for flavouring in cooking and pickling, sometimes in the form of whole or grated cloves and sometimes in the form of a cooked extract, as in sauces and dressing. Garlic has a characteristic pungent spice flavor that mellows and sweetens considerably with cooking (Redmond, 2007).

Locally, in Nigeria garlic is often paired with ginger to make stews and soups. Generally, garlic is used as supplement and on preparation of baked goods, puddings, gravies, soups, stew, meat products, nonalcoholic beverage and soft candy. In medicine, garlic is used as a digestive stimulant, diuretic and anti-spasmodic. Garlic and ginger are two herbs that possess many little-known therapeutic uses and health benefits, alongside their more common uses in the kitchen. Both of these herbs have been studied for their effectiveness in fighting infections, preventing cancer and reducing inflammation and various other applications (Potter and Hothkiss, 1995; Umoh & Oke, 1974; WHO, 1995). African Locust beans (Parkia biglobosa), soya bean etc. are fermented to produce food supplements. Fermented locust beans are a well-known supplement with characteristic ammoniacal odour and flavour which enhance the taste of traditional soups and sauces especially those used as accomplishment to starchy foods. It is known to contribute to the calorie and protein intake. It is generally added to soups as low cost meat substitute by low income families in part of Nigeria. This study was aim to assess the proximate nutritional composition of the light foods consumed commonly as supplements by some women that just put to bed that the foods enhances their breast milk as claimed by communities around Agaie, Lapai, Bida LGA, Niger State, Nigeria: Pearl millet (Pennisetum typhoides), maize (Zea mays), garlic (Alliums sativum), ginger (Zingeber officinale) and great millet (Sorghum bicolor).

Health Benefits of Maize

Health benefits of maize includes; controlling diabetes, prevention of heart ailments, lowering hypertension and prevention of neural-tube defects at birth. Maize is one of the most popular cereals in the world and forms the staple food in many countries, including the United States and many African countries. The kernels of maize are what hold the majority of corn's nutrients. The kernels could be in multiple colors, depending on where the maize is grown, species and variety. Another genetic variant, called sweet corn, has more sugar and less starch in the nutritive material, Wikipedia http://en.wikipedia.org/wiki/maize. Maize have been reported not only provides the basic daily energy needs but is also a rich source of vitamin A, vitamin B, Vitamin E and many minerals. Wikipedia http://en.wikipedia.org/ wiki/Garlic. Its high fiber content ensures that it plays a significant rule in the prevention of digestive ailments like constipation and hemorrhoids as well as colorectal cancer. The antioxidants present in corn also act as anti-carcinogenic agents and prevent Alzheimer's diseases.

Maize as a Source of Vitamin

Maize is reported to be rich in vitamin B contents, especially Thiamin and Niacin. Thiamin is reported to be essential for maintaining nerve health and cognitive functions. Niacin deficiency leads to Pellagra; a disease characterized by diarrhea, dementia and dermatitis that is commonly observed in malnourished individuals. Maize is also a good source of Pantothenic acid, which is an essential vitamin for carbohydrates, proteins, and lipids metabolism in the body. Deficiency of folic acid in pregnant women can lead to the birth of underweight infants and may also result in neural tube defections in newborns. Maize is also

reported large percentage of the daily folate requirement, while its kernels are rich in vitamin E, a natural antioxidant that is essential for growth and protection of the body from illness and disease (AOAC, 1984).

Pearl Millets

Although millet is most often associated as the main ingredient in bird seed, it is not just "for the birds." Creamy like mashed potatoes or fluffy like rice, millet is a delicious grain that can accompany many types of food. As with most grains, pearl millet is available in markets throughout the year. Pearl Millet is tiny in size and round in shape and can be white, gray, yellow or red. The most widely available form of millet found in stores is the hulled variety, although traditional couscous made from cracked pearl millet can also be found. The term pearl millet refers to a variety of grains, some of which do not belong to the same genus. Some of the best health benefits of millet include its ability to protect your heart health, protect yourself from diabetes, improve your digestive system, lower your risk of cancer, detoxify the body, boost respiratory health, optimize your immune system, increase your energy levels and improve your muscle and nerve health (Anderson *et al.,* 2000). Pearl millet may not be the most common type of seed crop that you're expecting on your table, but in fact, this group of highly variable seeded grasses are cultivated throughout the world, both for livestock feed and human consumption. It is mainly grown in developing countries, but its quick growing season and ability to grow in relative'' harsh, arid, dry environments make it an ideal crop for many countries. Although there are many different varieties of millet grown around the world, the most common cultivar is *Pennisetumglaucum*, also known as pearl millet. In terms of history, millet likely originated in Africa, but then spread through Asia and the Middle Fast as early as 10,000 years ago, as it seems that millet was already quite spread out by that point in ancient history. Their reliability to survive harsh conditions made them the perfect crop, and they are still preferred for that reason today (FOSTAT, 2014).

These small grain plants are primarily produced in India, who cultivates over 8 million tons every year, followed by a number of larger African countries and China. Pearl millet can be used as a traditional cereal, but can also be used in porridge, snacks, and other breads, as it is very high in starch, like most other grains. Pearl millet is also a very good source of nutrients, vitamins, minerals, and organic compounds that can significantly boost human health in various ways. It is receiving an additional boost of attention in recent years, as Celiác disease seems to be a larger and more well-known condition, Millet is gluten-free, so Celiac sufferers can turn to millet as their source of grains, instead of wheat, in terms of basic food staples that are praised as the simplest and most valuable additions to diets around the world, millet provides the most energy, as well as the most fat and B-vitamins. Pearl millet is more than just an interesting alternative to the more common grains. Our food ranking system qualified it as a good source of some very important nutrients, including copper, manganese, phosphorus, and magnesium (Anderson *et al.,* 2000; FOSTAT, 2014).

Sorghum

Sorghum is the fifth largest most important cereal in the world agricultural economy, after wheat, maize, rice and barley, and the second (after maize) in sub-Saharan Africa. In 2013, the global area cropped with sorghum was 42.3 million hectares and the worldwide production was 61.5 million metric tons; the USA, Nigeria, Mexico, India and Ethiopia are the main producers. Together with millet, sorghum represents a main source of energy and

protein for about one billion people in the semi-arid region of tropics and it is part of the staple diet of more than 300 million people in developing countries, representing their major source of energy and nutrients. In particular, in Africa, sorghum is a basic staple food for many rural communities, especially in drought prone areas, characterized by shallow and heavy clay soils; thus, it is a subsistence food crop for many food insecure people (FOSTAT, 2014).

A wide variety of traditional food products and recipes are based on sorghum. The cereal is boiled like rice, brewed for beer production, baked into flatbreads or cracked for porridge preparation. Besides providing calories, sorghum has actual nutritional value in principle, because of its content of protein, vitamins, fat-soluble (D, E and K) and of B group (except for B12), as well as minerals, such as iron, phosphorus and zinc. In particular, a recent study classifies sorghum genotypes as source of vitamin E but highlight how the analyzed genotypes showed low contents of carrotenoids. In composition, sorghum grain compares favorably with some other cereals: it has a similar protein content to wheat but higher than maize and rice, while the essential amino acid composition of sorghum is comparable to maize or wheat due to the limited content of threonine, arginine and especially, lysine; in particular, sorghum's main storage proteins, the kafirins, are devoid of the essential amino acid lysine; thus, the abundance of kafirins in a given sorghum variety has a direct negative impact on its nutritional value. Iron content of sorghum is lower than pearl millet but is higher than wheat, maize and rice. As a further interesting aspect, sorghum is considered suitable for people with coeliac disease and gluten intolerance due to the lack of gluten. Indeed, individuals with coeliac disease may not consume enough dietary fiber; thus, sorghum whole grains could usefully complement their diets. The impact of this aspect, although not currently assessable in developing areas, might be interesting in western populations, where the incidence of coeliac disease and gluten intolerance is an increasing phenomenon. To date, sorghum does not figure among important commodities in the North American and European food basket, but its importance as ingredient in multigrain and gluten-free cereal products is known. Sorghum might provide a good basis for Gluten-Free cookies and bread, thus increasing the range of alternative food products available to people suffering from coeliac disease (Anderson *et al.*, 2000; FOSTAT, 2014).

In this review, refinement of cereal grains, changing of food habits and their implication in general will be discussed. Composition, structure and effect of refinement on maize, sorghum and pearl millet will be reviewed. Starch and factors affecting starch digestibility in general and it's in vitro determination will also be discussed. At this juncture, an attempt will be made to find out if there are any effects of species, variety or refinement on starch digestibility between maize, sorghum and pearl millet (Anderson *et al.*, 2000; FOSTAT, 2014; Kent & Evers, 1994).

Refinement of the Cereal Grains

Refinement of cereal grains includes processes such as milling that separate anatomical parts of the grain to produce a palatable foodstuff. Milling generally involves removal of the material the miller calls bran, i.e., the pericarp, the seed coat, the unicellar epidermis, and the aleurone layer. In addition, the germ is usually removed because it is relatively high in oil, which makes the product become rancid faster, thereby decreasing its palatability (Anon, 1998; Hoseney, 1994; Kent and Evers, 1994). The most palatable (lowest fibre), and most stable (lowest fat) parts of the grains are not necessarily the most nutritious, and if only these

are consumed, much of the potential benefit can be lost (Ken and Evers, 1994). This results from the fact that many nutrients such as vitamins and minerals reside in the embryo and outer parts of the grains (mainly the aleurone tissue) (Kent and Evers, 1994). However, while milling may reduce the mineral and vitamin content of cereal grains, a related concern is that whole cereal grains may contain biologically unavailable forms of these nutrients (Roderuck and Fox, 1987).

Traditionally maize grain and sorghum and millet grains are decorticated partially or completely by traditional methods before further processing and consumption. Whole grains of sorghum and millet are also directly dry-milled to fine flour (Hoseney, Andrews and Clark, 1987; Murty and Kumar, 1995). Foods rich in fiber and other factors such as enzymes inhibitors, tannins, starch-protein and starch-lipid interactions which reduce the rates of both digestion and glycemic responses, have been consumed in relatively large amounts in the diets of more primitive cultures. However, these types of foods have been reduced in concentration both by processing and by food preferences in the Western diet (Jenkins, Taylor and Wolever, 1982a). Groups consuming high-fiber diets in Africa were found to have lower prevalence of diabetes than groups consuming diets with lower levels of fiber (Walker, Walker and Richardson, 1970). The dietary fiber and the starch from cereals have several health benefits; firstly is the fermentation by microbial enzyme in the large gut, providing inter alia acetate, propionate and butyrate which are believed to protect against colon cancer by inhibiting the growth and proliferation of tumour cells; secondly is the absorption of the short chain fatty acids formed as energy; thirdly is to increase the stool bulk and decrease intestinal transit time which contribute to the lowering of risk for colon cancer; fourthly is the protection from excessive glucose (NRC, 1989).

Determination of Moisture Content

Moisture content was determined by heating 2.0 g of each fresh sample to a constant weight in a crucible placed in an oven maintained at 105^0C. The ash content was determined by the incineration of 1.5 g samples placed in a muffle furnace maintained at 550^0C for 5-8 hrs. The crude fiber was obtained by digesting 2 g of the samples with H_2 SO_4 and NaOH and incinerating the residue in a muffle furnace maintained at 550^0C for 5 -8 hrs. The crude protein (% total nitrogen X 6.25) was determined by Kjeldahl method, using 2 g of the samples. Each analysis was carried out in triplicates. The carbohydrate content was determined by the difference i.e. deducing the sum of the percentage (moisture, ash, fiber, fat, and protein) from 100.

Proximate Analysis

The analyses included in this group, also known as Weende proximate analyses, are applied firstly to materials to be used in formulating a diet as a protein or energy source and to finished feedstuffs, as a control to check that they meet the specifications or requirements established during formulation. These analyses will show the moisture, crude protein, (total nitrogen), crude fibre, crude lipids, ash and nitrogen-free extract content of the sample. (Osborne and Vogt, 1978); MAFF (1982); AOAC (1984).

RESULTS AND DISCUSSION

Table 1: Proximate Composition (%) of Pearl millets, Sorghum, Maize, Garlic and Ginger

Parameters	Moisture	Ash	Fat	Fibre	Protein	Carbohydrate
Millet Pennisetum typhoides	8.05±0.39	2.49±0.08	4.39±0.39	5.02±0.24	12.09±0.31	67.8±0.05
Maize Zea mays	9.05±1.20	1.50±0.10	7.00±0.10	4.68±0.49	7.05±0.01	71.21±0.05
Sorghum bicolor	3.00±0.12	3.99±0.91	4.09±0.31	4.01±0.01	13.09±1.23	72.00±1.44
Garlic Allium sativum (wet)	68.09±1.49	1.44±0.01	0.76±0.08	0.69±0.16	8.54±0.66	19.48±1.43
Ginger Zingeber officinale(wet)	74.72±1.32	2.92±0.14	4.92±0.61	6.07±0.64	7.57±0.59	3.80±0.34

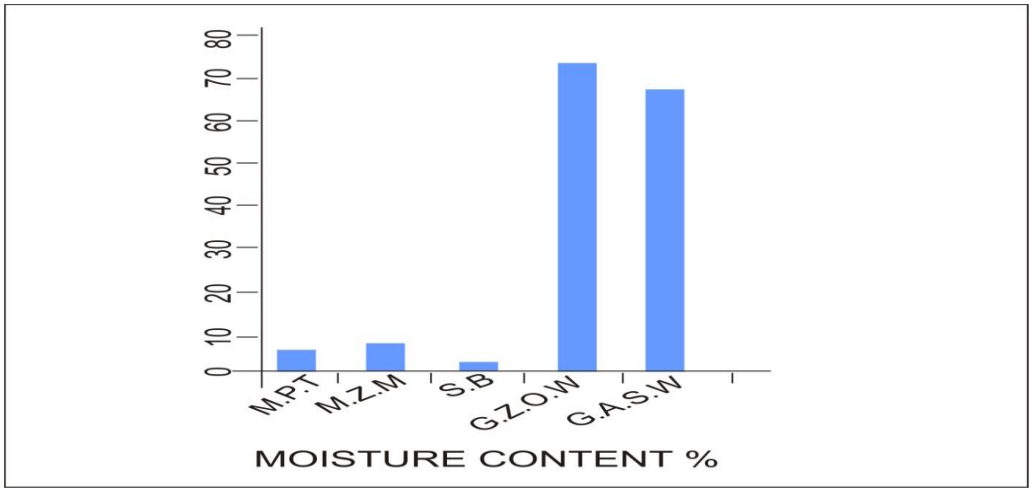
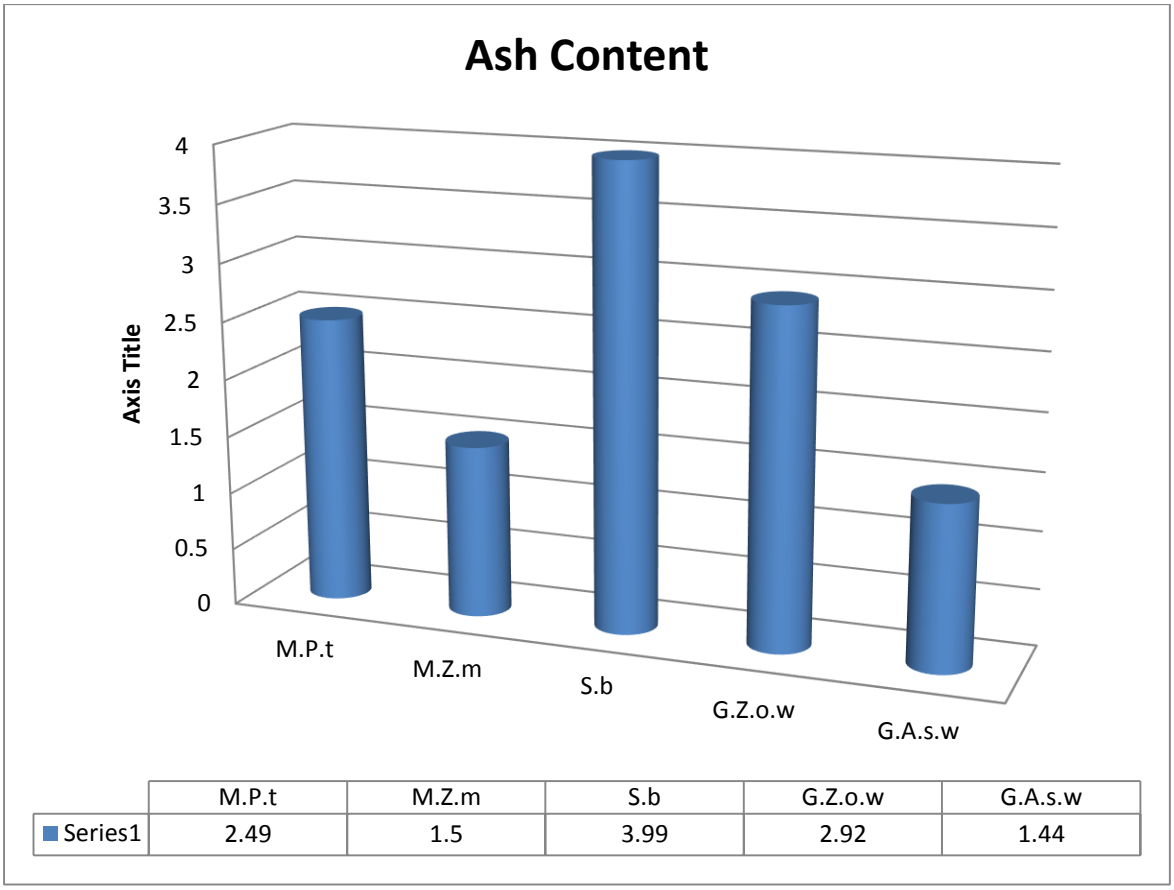


Figure 1: Moisture Content (%)

Statistical Analysis of the Results

From the figure 1 above one could inferred that both the samples of ginger and garlic had the highest moisture content but significantly close in ranges which are self-explanatory since they were analyzed in their wet state.



	M.P.t	M.Z.m	S.b	G.Z.o.w	G.A.s.w
Series1	2.49	1.5	3.99	2.92	1.44

Figure 2: Ash Content (%)

Figure 2 investigates ginger as having the highest ash value follow by maize which is closely followed by garlic(wet) shows a reasonably low ash content.

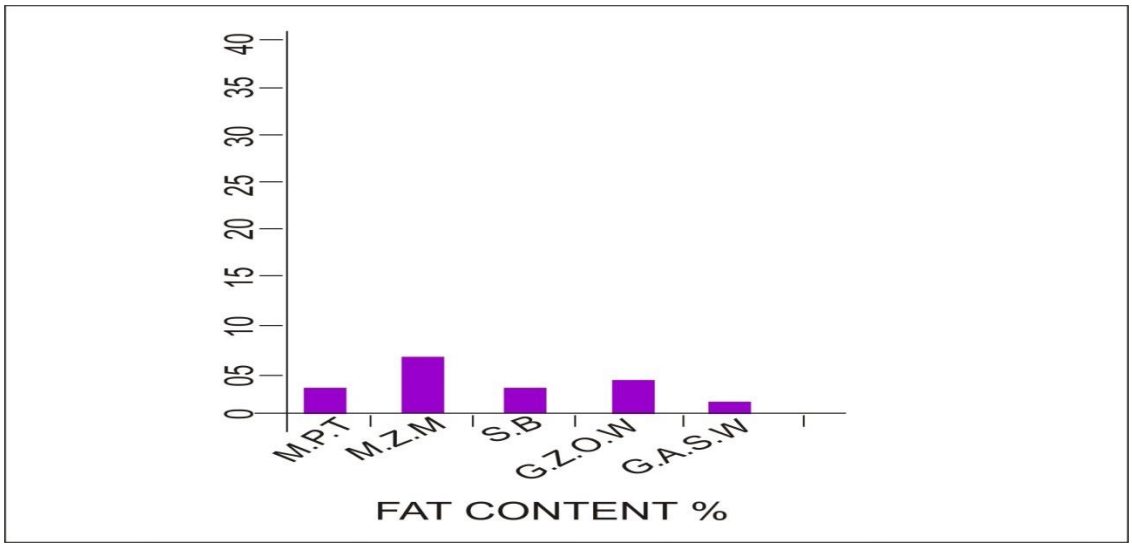


Figure 3: Fat Content (%)

Figure 3 highlights maize as having the highest fat content, follow by ginger (wet) and garlic has the lowest fat content.

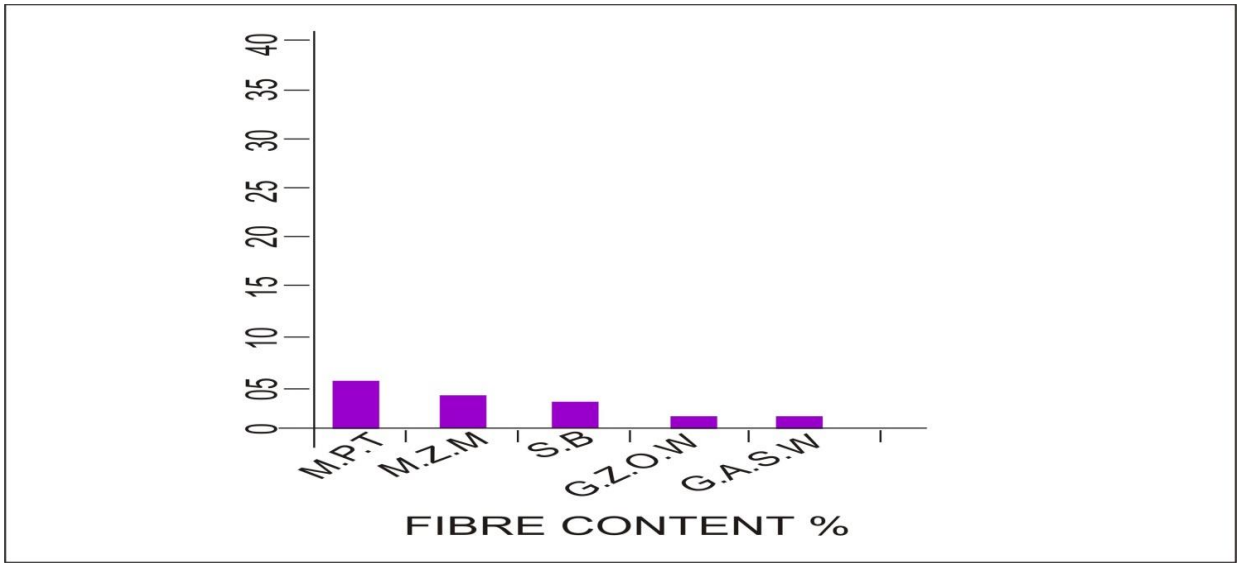


Figure 4: Fibre Content (%)

From fig.4 indicates Ginger as having the highest crude fibre content; follow by pearl millet, maize, sorghum and garlic(wet) having the lowest values.

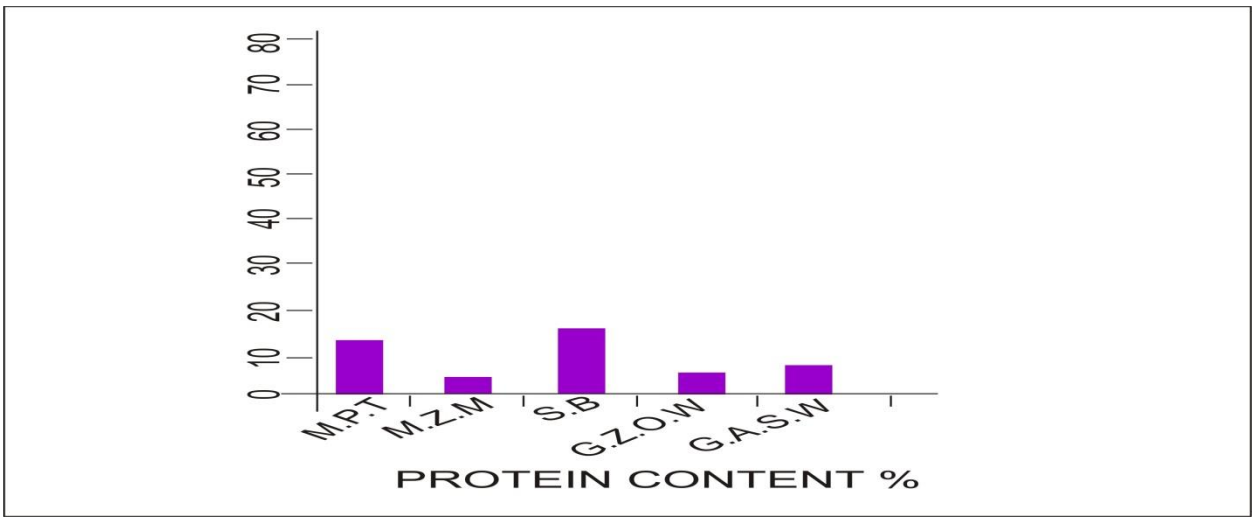


Figure 5: Protein Content (%)

From fig. 5, we can deduce that sorghum has the highest protein value followed by pearl millet, garlic, ginger and maizehaving the lowest values.

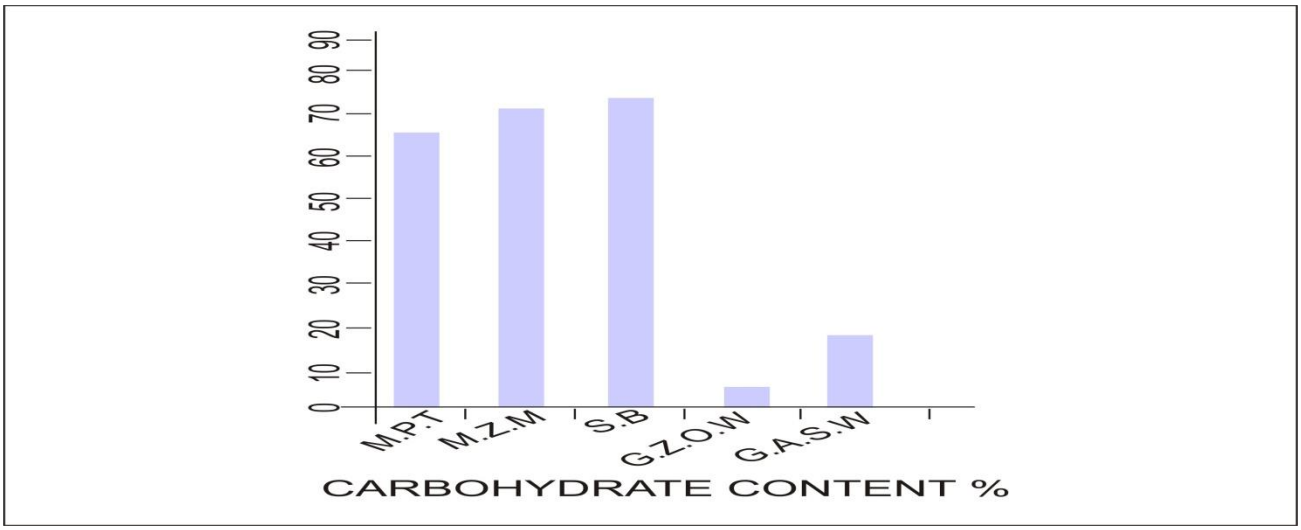


Figure 6: Carbohydrate Content (%).

From fig. 6, we can see that sorghum has the highest value closely followed by maize, pearl millet, garlic (dry) and ginger (dry) following closely with high values of carbohydrate, also while ginger (wet) has a very least carbohydrate content.

M.P.T-Millet; M.Z.M-Maize;S-Sorghum; G.A.S.W-Wet garlic; G.Z.O.W-Wet ginger;

DISCUSSION

The proximate composition (%) of the nutrients in Millets, Sorghum, Maize, Garlic and Ginger are presented in Table 1. Wet Ginger 74.72% indicates the highest content compare to all other samples, next is that of wet garlic 68.09%, followed by Maize while the least is on the Sorghum and millet have the value of 3% and 8.05%respectively. Sorghum is high with 3.99% closely followed by Ginger 2.92% closely followed by Millet with 2.49% respectively with the least value been Maize and Garlic. Maize with 7.00% has the highest fat content followed by Millet 4.39%, Sorghum 4.09% while Garlic is having 0.76% Ginger has 0.83%. Ginger is higher with 6.07% followed by Millet with 5.02%, followed by Maize 4.68% followed by Sorghum with 4.09% followed by Garlic having the least Fibre which is 0.79%. Sorghum is higher with 13.09% closely followed by Millet with 12.09% followed by Garlic with 8.54% followed by Maize with 7.05% the least been Ginger which has 6.56%. Sorghum has the highest value of carbohydrate content with 72%, closely followed by Maize with 71.21%, the next is Millet with 67.8%, and followedby Garlic with 19.48%, the least been Ginger with 3.80%.

CONCLUSION AND RECOMMENDATIONS

The present study has provided some comparative information on the proximate analysis of Millets, Maize, Sorghum, Ginger and Garlic species found in many Nigerian markets. These

food supplements indicate that all of them are good sources of Nutrients and therefore, their use as nutritional or food supplements are highly promising which can contribute significantly to the daily human requirement of Nutrients.

A high rate of starch digestibility translates into high glycaemic response, which is associated with the risk factor for chronic diseases such as diabetes mellitus. This might be one of the reasons for the increased incidence of diabetes mellitus among people who are changing from unrefined to refined flours and also changing from sorghum and pearl millet to maize.

The content of maize, millet, sorghum bicolor, ginger and garlic have shown that, they are a good source of nutrient which help to enrich the body with nutrients that might be missing in the food.

RECOMMENDATION

One of the problems most often encountered in evaluating crude fibre is filter blockage, this is why in some cases it is recommended to substitute a piece of cotton fabric for filter paper [step (iv)]. To avoid saturation of the filter crucible [step (vi)], tilt it slightly and add the material to be filtered very slowly so that it covers the filtering surface little by little.

Filtration crucibles tend to block up with use. To clean, calcine them at 500°C and force water through in reverse. When they are blocked with mineral particles, prepare a solution containing 20% KOH, 5% Na_3PO_4 and 0.5% EDTA sodium salt; heat and force through the crucible in reverse. This treatment erodes the glass filter.

It could be recommended that these food supplements should be used by humans as consumables so as to replenish lost nutrients from human bodies. Also recommend that garlic and ginger should be used as spices in our daily food. Furthermore, I recommend that food supplement should be properly fed on, as to provide the body with appropriate nutrient required by the body.

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