PROXIMATE COMPOSITION OF GRUEL PRODUCED FROM SELECTED LOCAL FOOD ITEMS IN NIGERIA.

Okereke, I. F., Ezema, P.N. and Okoye, C.J.

Abstract

The purpose of the study was to produce gruel from selected local food items and determine the proximate composition of the product. The study adopted an experimental design. The gruel was produced from nine local ingredients, which include maize (yellow), millet (brown), sorghum, soyabean, groundnut, tiger-nut, date palm, unripe plantain and crayfish. The proximate properties of the sample determined were moisture, ash, crude protein, fat, carbohydrate, crude fibre and energy (kcal). The result showed that the energy value was high and it was significantly different from the other values. The energy value 0.04 ($p<0.05$) was slightly different from the other values. There was no significant difference in the moisture, fat and crude fibre contents, their ranges were 0.02 ($p<0.05$) while ash had the least value of 0.01 ($p<0.05$). The protein content was also high and this could be attributed to the presence of crayfish, soybean and tiger-nut. In conclusion, formulation of the gruel was found to be nutritionally rich and good for all age groups. Therefore, consumption of this gruel will protect human body from several diseases as the gruel supplies most of the essential nutrients.

Keyword: Gruel, Maize, Millet, Groundnut, Tiger-Nut, Date Palm, Unripe Plantain, Proximate Composition.

Introduction

Gruel is a white thin or cream coloured traditionally prepared food with fermented food products made majorly from cereals especially maize which can be consumed as a whole or using stew or other food products (Abdulrahaman and Kolawole, 2006). It has been observed that the diet of an average Nigerian is deficient in several nutrients notably vitamins and minerals (Ezema and China, 2018). It is commonly consumed in West Africa. Prevalence of malnutrition in children and adults is high due to poor complementary and feeding practices like not getting the proper amount of food nutrient which has resulted to serious issues such as mal-nutrition and stunted growth in infants. This poor feeding practices led to an attempt to formulate the nutritive gruel using nine ingredients: maize (yellow), millet (brown), sorghum, soyabean, groundnut, tiger-nut, date palm, unripe plantain and crayfish. The gruel could be consumed as breakfast by adults; hence it has essential nutrients to meet their daily dietary requirements.

Okudu and Ene-Obong (2015) observed that despite the great studies in agricultural development, hunger, malnutrition and diseases are still prevalent in developing countries as a result of food and nutrient insecurity. Nigeria as a developing nation, is richly blessed with abundant local food resources, if adequately utilized may meet some of the country's basic dietary requirements.

Gruel based fermented foods constitute a major sources of dietary nutrients all over the world although gruels are deficient in some basic components (essential amino acids) (Eke-Ejiofor, 2016). Conventionally, gruel production for daily family use required single cereal such as maize. The high level of its utilization for food has resulted in overdependence in terms of cost. Recent trend has moved towards the combination and fortification of gruel with different locally available food items. The incorporation of other ingredients will enhance the nutrient adequacy of the gruel; hence both infants at this tender age (6 to 12 months) who cannot take solid food at full satisfaction can take the gruel as complementary food after exclusive breastfeeding and adults of all ages as well.

The **World Food Programme (WFP), (2018)** have continued to promote and encourage fortified four blends containing soybean in management of mild conditions of malnutrition especially in children.

According to Okudu *et al.* (2017), some traditional complementary foods are affordable in most cases but are grossly deficient in most key nutrients such as protein, fibre, fat, among others. Hence, this study tends to use combination of nine ingredients to compliment for the less nutrients. The combination of these different local food ingredients used in the study for the formulation of gruel will enhance for higher quality product availability, however, the taste and texture may not be the same as wheat-based cereal products (Juhas *et al*., 2020).

Ingredient for the Gruel and Other Health Benefits

Maize (*Zea maize*): is one of the major cereals across the globe due to its high nutritional significance enriched with abundant amount of macronutrients like starch, fibre, protein and fat along with micronutrients like B-complex, vitamins, B-carotene and essential minerals. Maize products are also used in supplementary nutritional programmes to feed malnourished children and to improve their health status (Obo and Amusan, 2009).

Millet (*Penniselu glacum*): is a whole grain that is packed with protein, antioxidant and nutrients. It has numerous health benefits, such as helping lower blood sugar and cholesterol levels. Is gluten free which makes it good for people who have celiac disease (Rose and Zannun, 2021).

Sorghum (*Sorghum bicolor*): also called guinea corn, another cereal that is low in simple carbohydrates and higher in complex carbohydrate, making it a low-glycemic index (GI) food. This means that it can keep blood sugar from spiking after eating which makes it suitable for the diabetes. According to Obo and Amusam (2009). Sorghum had relatively high antioxidant activity level.

Soya bean (*Glycine max*): is a specie of legume of the pea family. It is economically the most important bean in the world, providing vegetable protein for millions of people (www.britannica.com). Soyabean can be taken in various ways such as milk or in form of supplements (Megan metropolis, 2019).

Groundnut (*Arachishypogaca*): this is a self - pollinating, annual herbaceous legume. It is rich in protein, fat and other healthy nutrients such as amino acids and B-vitamins. Studies show that groundnut may even be useful for weight loss and are linked to a reduced risk of heart disease (Arnarsum, 2019).

Tiger nut (*Cyperus esculenta*): is an edible perennial grass-like plant native to the world and is a lesser known as "earth almonds) (Adejutan, 2011). In Nigeria, the Hausas call it Aya, Yorubas- Imumu, Igbo- Aki-awusa, Tiv - shoho. It is an under-utilized crop which has a sweet and nutty taste (Ayo *et al.,* 2016). They are also rich in heart-healthy fats. They may improve vein and artery flexibility and blood circulation, which may reduce the risk of heart diseases. They are rich in vitamin E and C. Tiger nut combat hypertension and cholesterol. According to Abiodun *et al.* (2018) tiger-nut is non- allergic and has been reported to be high in dietary fiber which is effective in the prevention and treatment of illnesses such as colon, gastrointestinal disorders, obesity and diabetes. All these qualities make it suitable for use in making higher fibre gruel. It is also a good substitute for lactose intolerant individuals (www.tigernut.com).

Date palm (*Phoenix dactyifera*): this is a fruit that contains fibre and other chemicals that might help with digestion. It is a rich source of vitamin B and C, iron, zinc, potassium, calcium, phosphorus, thiamine and riboflavin. It is a high energy value crop with a good nutritional value compared with tropical and sub-tropical fruits (Abdullahi *et al*., 2012).

Unripe plantain (*Musa paradiasica*): is a natural source of resistant starch that helps to reduce blood glucose level, so it is considered an excellent ingredient for people with anemia, diabetes, hypertension, pregnant and is a gentle weaning food for babies (Obidike, 2021). They are gentle on the stomach and can be combined with grains like millet and sorghum, it also prevent anaemia and great for weaning babies (www.healthfullwonders.com).

Crayfish: this sometimes called craw fish are fresh water crustacean resembling small lobsters (Ahmed *et al.,* 2013). Crayfish serves as a very good ingredient for weight loss because it contains low fats as well as traces of carbohydrates. It aids in bone formation, brain development, smooth skin and prevents depression (Adekanye, 2019). All these health benefits make it suitable for all age groups that take this gruel.

Purpose of the Study

The purpose of this study was to produce gruel from the blends of maize, millet, sorghum, soyabeans, groundnut, tiger nut, date palm, unripe plantain and crayfish.

Specifically, the study sought to:

Determine the proximate composition of the blends.

Materials and Methods

Materials: maize, millet, sorghum, soyabeans, groundnut, tiger-nut, date palm, unripe plantain and crayfish and other utensils like pots, basin, spoons among others used were obtained from Ogbete Main Market, Enugu State of Nigeria. They were all purchased in March, 2021.

Sample Preparation

Maize, millet, sorghum, soyabeans, groundnut, tiger nut, date palm were all sorted manually, weighed to 1500g, washed, sundried and roasted.

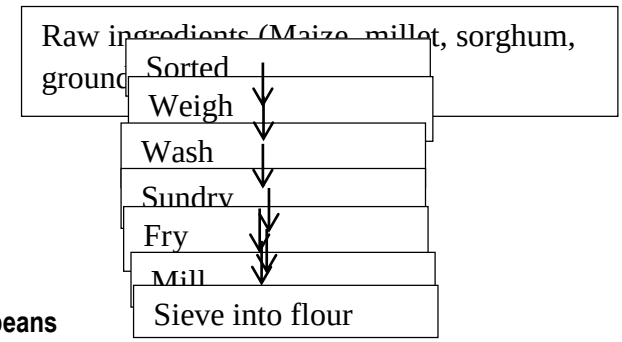
Soyabeans were also sorted manually, boiled for 45minutes, mashed and washed out, sundried and fried.

Unripe plantain was washed, peeled, thinly sliced and sundried.

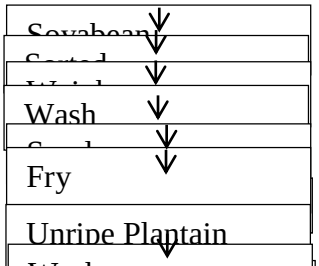
Crayfish was sorted, washed and sundried. All these local ingredients were weighed to 1500g each and were milled together with a hammer mill of EL-max 524 model and were sieved into flour.

The flour mixture that was produced was then prepared by dissolving in cold water and thickened with hot water into gruel or added to tea or consumed (licked) that way.

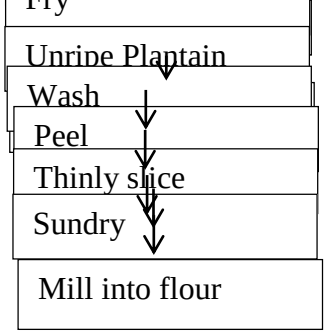
Flow chart of the ingredients



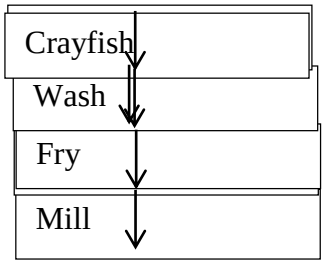
Flow chart for soyabeans



Flow chart for unripe plantain



Flow chart for crayfish



Proximate composition of the gruel

Sample	MC %	CP %	% fat	% CF	%Ash	% CHO	Kcal Energy
Mixed gruel	7.89±0.02	45.63±0.02	20.21±0.02	6.89 ±0.02	8.06±0.01	11.34±0.04	409.76± 0.14

Discussions

The moisture, ash, crude protein, crude fibre and fat were determined according to AOAC (2010) while carbohydrate was determined by difference.

Proximate composition showed that the energy value contents of the gruel had the highest value and was significantly different from the other values, the energy value was at 0.014g/100g. This makes the gruel to be

an energy-giving food for all age groups especially the vulnerable for example the elderly. This is in agreement with Arlene (2020) that combination of all these nutrients makes gruel a perfect food for sustained energy release. The carbohydrate was slightly different from other values with the range of 0.04g/100g ($P<0.05$). The low in value of carbohydrate could be attributed to high protein from other crops. The protein content was high and this suggests valuable contribution in combating Protein Energy Malnutrition (PEM) especially for low income earners. The value of fat which was high might be due to the presence of concentrated fat resulting from hydrogenation (Adie *et al.,* 2020).

There was no significant difference among the ash, fat and crude fibre; they ranged 0.02 while the least value from the ash content which ranged 0.01g/100g and it agrees with 0.01 as reported by Amenan *et al.* (2014). The low in value for these nutrients could also result from loss of nutrients during sieving. The combination of these local ingredients enriched the gruel and at the same time increased the energy value compared to pap made with maize alone.

Conclusion

Maize is deficient in most essential nutrients, especially essential amino acids, vitamins and minerals but it constitutes more than 90% of the cereals consumed in many developing countries.

The study has shown that the combination of these nine local ingredients to produce gruel made the gruel to be enriched with appreciable amount of nutrients. This can help in dealing with problem of malnutrition for all age groups.

This gruel can be consumed mainly as breakfast by adults and as complementary food by young children. Apart from energy, the cereal gruel used as weaning foods are usually inadequate in other nutrients, leading to widespread of protein energy malnutrition and its complications during the weaning periods. It was concluded that the gruel analysed was nutritionally rich and the composition can prevent some diseases and contribute in combating Protein Energy Malnutrition especially for low income earners.

Recommendations

Based on the findings of this study, the following recommendations were made;

1. An assistance by the government at all levels should encourage farmers through loans to include some of these crops as part of the crops they will be planting in their farms so that it would be readily available even at off seasons
2. The health benefits of this gruel for example; prevention of anemia, maintenance of good health, etc. should be made known to the general public through the media (health journals, radio and television stations, magazines, etc).
3. It can be recommended that further researches are to be carried out on this gruel to know how effective it would be in the management of health issues example diabetes, hypertension and many other disease

References

Abdulahama, A.A., and Kolawole, A. (2006). Preparations and uses of maize in Nigeria. www.semanticscholar.org. Accessed on 29/7/2021.

Abiodun, O. A., Oladeinde, O.O., Funmilola, K. L., Deborah, O. A. and Samuel, O. A. (2017). Production and acceptability of chin-chin snacks made from wheat and tiger-nut (*Cyperus esculentus*) flour. *Cogent Food and Agriculture*. 3(1): 128-185.

Adejutan, J.A. (2011). Tigernut processing: its food used and health benefits. *American Journal of Food Technology; 6: 197 – 201.*

Adekanye, M. (2019). 5 health benefits of crayfish.www.healthguide.com Accessed 29/7/2021

Adie, P. A., Enenche, D. E., Atsen, T. M. and Ikese, C. O. (2020). Physicochemical and sensory evaluation of cookies produced by partial substitution of margarine with avocado (*Persia americana*) pulp. *Asian Food Science Journal*. 18(2): 41-47.

Ahmad, S. M., Barmn-Yaun, U. A., Bagudo, B. U., Sahabi, D. M. (2013).Comparative analysis on the nutritional values of crayfish and some insects. *Journal of Food Science and Technology*. 4(1):442.

Alldrick, A. J. (2017). Food safety aspects of grain and cereals product quality. www.sciencedirect.com

Amanan, A. S, Brou, K., Kousemim, M., Oje, K. M. (2014). Proximate composition and microbiological quality of millet gruels sold in Abidjan (Cote d'Ivoire). *Journal of Agricultural Innovations and Research*, 2(4): 2319-1473.

AOAC, (2010). Official Methods of Analytics (13th Ed). Association of Analytical Chemists. Washington DC.

Arlene, S. (2020). 27 foods that can give you more energy.www.healthlinee.com. Accessed on 12/1012021.

Arnarson, A. (2019). Peanuts 101: nutrition facts and health benefits. www.healthline.come

Ayo, J. A., Adedeji, O. E. and Ishaya, G. (2016). Phytochemical composition and functional properties of flour produced from two varieties of tigernuts. FUW Trends in Science and Technology Journal. (Federal University Wukari based Journal), 1(1): 261- 263).

Eke-Ejiofor, J., Obinna-Echem, P., Wordu, G. O., and Vito, M. B. (2016). Physicochemical, functional and pasting properties of orange-flesh sweet potato.

Juhasz. A., Michella, L., Colgrave, Crispin, A. and Howih (2020). Developing gluten-free cereal and the role of proteomics in product safety.

Obidike, J. (2021). Unripe plantain: nutrition, health benefits, recipes and side effects. www.healthfulwonders.com. Accessed on 13/9/2021

Obo, G. and Amusan, T. V. (2009). Nutritive value and antioxidant properties of cereal gruel produced from fermented maize and sorghum. *Journal of Food Biotechnology*, 23(1):17. Dio 10.1080/0890543

Okudu, H. O., Ojinnaka, M. C. and Kalu, M. O. (2017). Chemical and sensory properties of complementary food produced from (*Sorghum bicolor L.*), Pigeon pea (*Cajanus cajan*) and carrot (*Daucus carrota*) blends. *African Journal of Food Science and Technology* 8(4).Doi: http:idx.doi.org/10.14303.

Rose, C. and Zannun, E. (2021). Gluten-free cereal. *Journal of Cereal Science;* www.weblight.com.

Shikhon, B., Manpreet, J. and Ramapyit, K. (2019). Nutritive value of maize. www.intechopen.com. Doi:10.5772/intechopen.88963.

World Food Programme, (2018). www.wfp.org.