Agrosearch, 22(2), 50-61, (2024) https://dx.doi.org/10.4314/agrosh.v22i2.5

Proximate Composition and Consumer Acceptability of Powdered Fermented Locust Bean and Soybean Condiments

Alabi, D. L*. and Napoleon, R. B.
Department of Agricultural Extension and Rural Development, Obafemi Awolowo University, Ile – Ife, Nigeria

*Corresponding Author: alabidorcas@oauife.edu.ng

Abstract

Most rural households in Nigeria are more familiar with the use of the traditional locust bean condiment in meal preparation than that of the soybean. This study was carried out to improve the shelf life of the condiments, increase the consumption of soybean for enhanced nutrition among the resource poor rural households and determine consumers' acceptability of the powdered locust bean and soybean condiments. Three samples were developed namely: powdered fermented locust bean, powdered fermented soybean and their composite (50:50 locust and soybean) condiments. Both the proximate composition and sensory assessment of the condiments were determined. The proximate attributes investigated include protein, carbohydrate, fibre, lipid, ash and moisture contents of the samples while the sensory evaluation parameters include condiments' aroma, appearance, colour, taste and texture as well as the overall acceptability. Results showed that powdered fermented soybean condiment has the highest protein (51.63%), lipid (35.40%) and ash (11.64%) contents. The composite also has higher protein (51.19%) than locust bean (47. 25%). On the other hand, powdered locust bean condiment has the highest carbohydrate (4.44%) contents while the composite condiment has the highest fibre content (10.27%). No significant difference was observed in the overall acceptability of the three samples implying that they are equally acceptable among the consumers. It can be concluded that the production process of powdered soybean and the composite condiment should be taught to women in rural areas to enhance protein intake among the low-income rural households who may not be able to afford other expensive sources of protein.

Key words: Condiment, acceptability, fermentation, powdered

Introduction

The term "condiment" is derived from Latin "condimentum" and "condire". While "condimentum" means "spice, seasoning, sauce", "condire" means "preserve, pickle, season" (Collins English Dictionary, 2012). They are aromatic substances in form of powdered or sauce that are added to foods in order to impart a specific flavour or to enhance the food flavour, or to complement the food, but which cannot stand alone as a dish (Myschoollibrary, 2023; Rajak, 2023). Due to its affordability, people of various socioeconomic classes consume condiments regularly and widely

use it in small quantities to improve food flavour during cooking (Visith and Juntima, 2018)). However, Umanga (2021) reported that some condiments contain a lot of sodium or extra sugar and therefore should be consumed in a limited quantity in order to minimise the risk of being affected by Non-Communicable Diseases.

Condiments are prepared either by traditional methods or by the use of modern technologies. Traditional condiments are plant products that are used for flavouring of food or adjuncts of food. They serve as good sources of plant proteins and vitamins, and are usually produced in small-scale by household-based industries (Uchenna *et al.*, 2020). The production process is mainly through fermentation. This is one of the age long techniques used for food processing (Akinyele and Oloruntoba, 2013). According to Omodara and Olowomofe (2015), fermentation improves the physical properties of food crops, reduces the toxic content, makes food more palatable, improves flavour, increases the content and availability of food nutrients and imparts certain microbial properties on food crops. Akinsola *et al*. (2017) also reiterated that fermentation process aims at achieving desirable qualities in the characteristics of food and food products through microbial activities and their enzymes. The proximate composition of condiments produced from locally available raw materials as reported by Okafor *et al*. (2015) shows they could enhance the daily intake of nutrients such as minerals, fat, and proteins among Nigerians when consumed generously, particularly, in households with poor resources, where costly animal products cannot be afforded.

Several condiments are made from fermented seeds in different places across the globe. For example, *Kinema* is *in* Nepal (Tamang, 2000); *Tooa-nao* in Thailand (Yokotsuka, 1991), and *Soumbala* in Burkina Faso (Ouoba *et al*., 2003) as cited by Murtala *et al*. (2016). In Nigeria, the common traditional fermented condiments widely used especially among the rural households are *daddawa* from locust bean (*Parkia biglobosa*) seed, *daddawa* from soybean (*Glycine max*) seeds, *ogiri* from melon (*Citrullus vulgaris*) seeds, *ugba*- a product of African oil bean (*Pentaclethra macrophylla)* seeds as well as *owoh* from cotton (*Gossypium hirsutum*) seeds.

According to Omafuvbe *et al.* (2000), apart from serving as condiments for enhancing organoleptic properties of foods, *daddawa* are rich in proteins and vitamins especially the soya bean-based one which contains high contents of protein. *Daddawa* are recommendable for people with protein energy malnutrition who lack access to protein-rich foods. Omafuvbe *et al*. (2000). Omafuvbe *et al*., (2007) states that both soya beans-based and locust beans condiments are similar organoleptically. However, it has been observed that soya bean *daddawa* deteriorate faster than the one from locust bean (Popoola *et al.*, 2007).

In West Africa, locust bean *iru* or *daddawa* is one of the condiments that are very important and from natural origin (Daramola, 2015). More than being an ordinary culinary condiment, it also has a lot of health-related benefits, valuable dietary properties and several usages (Nwokolo, 2023). Nutritionally, locust bean contains high food nutrients such as protein, carbohydrate, lipid and essential minerals like

calcium, potassium and phosphorus. Its health benefits include its capability of reducing the risk of diabetes, regulating cholesterol levels and providing an excellent source of vitamin A. It also helps in prevention and treatment of hypertension, provides remedy for diarrhoea, healing of mouth ulcers and relieving receding gums (Nwokolo, 2023).

Soybean *is* another legume seed like African locust bean. It is used to produce various food products which include soybean oil, milk and cheese; baby formula, confectionaries, condiments and bakery products (Iwe, 2003). It has been reported that soybean-based condiment may serve as an appropriate substitute to that of locust bean especially with the continuous reduction in the available locust bean trees due to deforestation activities which is gradually causing inadequate availability of locust bean seeds for the production of the condiments (Tersoo-Abiem *et al*., 2021). While the demand for locust beans condiment is increasing, its production is still at the small-scale level. Okafor *et al*. (2015) recommended that other legumes especially soybean can be processed into condiments for ready availability of necessary nutrients (such as protein and mineral) required by the body at low cost. Moreso, it has been observed that more households in Nigeria now prefer using condiments made from legumes as seasonings due to the various controversies on the usage of monosodium seasonings (Achi, 2013; Walker and Lupien, 2000).

It has been observed that in the study area, the wet form of locust bean condiment characterised with offensive odour and poor shelf life is that commonly available with only few processors producing the dried form while it is very rare to come across the powdered form of the traditional condiments. In addition, the use of soybean-based condiment is not familiar to most of the households living in the area of study. These observations necessitated the need to evaluate the proximate compositions and consumer acceptability of the powdered condiments made from fermented soybean and locust seeds.

Materials and Methods

The locust bean and the soybean seeds used for the study were obtained from open market in Ile-Ife, located in Ife Central Local Government Area, Osun State, Nigeria, on the geographical coordinates of 7° 28' 0" North, 4° 34' 0" East. Powdered condiment was produced from both locust and soybean seeds as illustrated in figures 1 and 2 while a blend powdered condiment was obtained from the mixture of 50% locust bean and 50% soybean powdered condiments. One table spoonful of each of the powdered condiments (100% locust bean, 100% soybean and composite 50:50 locust: soyabean blend) was used as seasonings to prepare melon soup. The soup was served with *eba* (a swallow Nigerian food from cassava) to the panel of judges who were familiar with the traditional condiments. Two replicates were carried out and 10 members familiar with traditional locust bean condiment participated in each

replicate. For each replicate, sensory characteristics of the condiments such as appearance, taste, texture, colour, smell and overall acceptability were evaluated on 9 points hedonic scale where 9 represents Extremely Like, 8 is Like very much, 7 is Moderately Like, 6 is Slightly Like, 5 is Neither like nor dislike, 4 is Slightly Dislike, 3 is Moderately Dislike, 2 is Dislike very much while 1 stands for Extremely Dislike as used by Olawuyi and Oyetola (2020), in measuring the sensory characteristics of the cookies they produced from the mix of trifoliate yam flour-soybean. The difference was determined using Analysis of Variance (ANOVA) and where significant difference was found, Duncan multiple range test was used to separate the means (Alabi, 2016). The proximate analyses of all the powdered condiment were done using the Analysis of Association of Analytical Chemist's (AOAC) method (AOAC, 2005) as employed by Ezekiel *et al*. (2022).

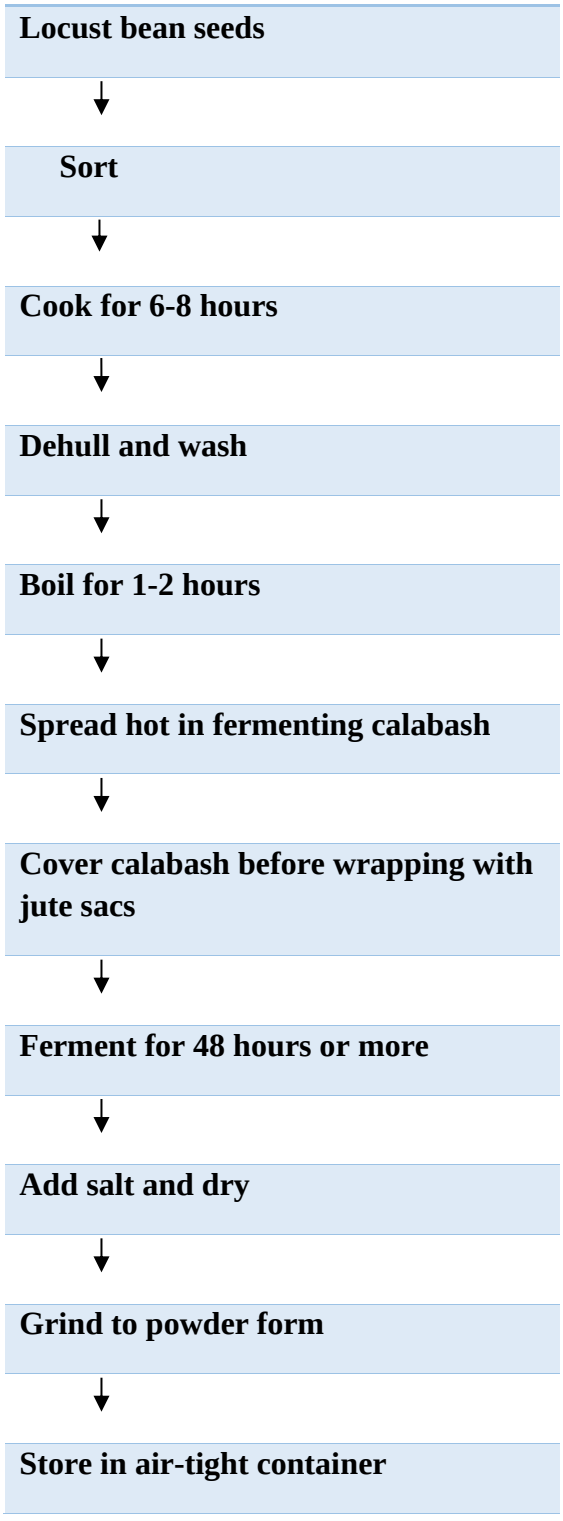
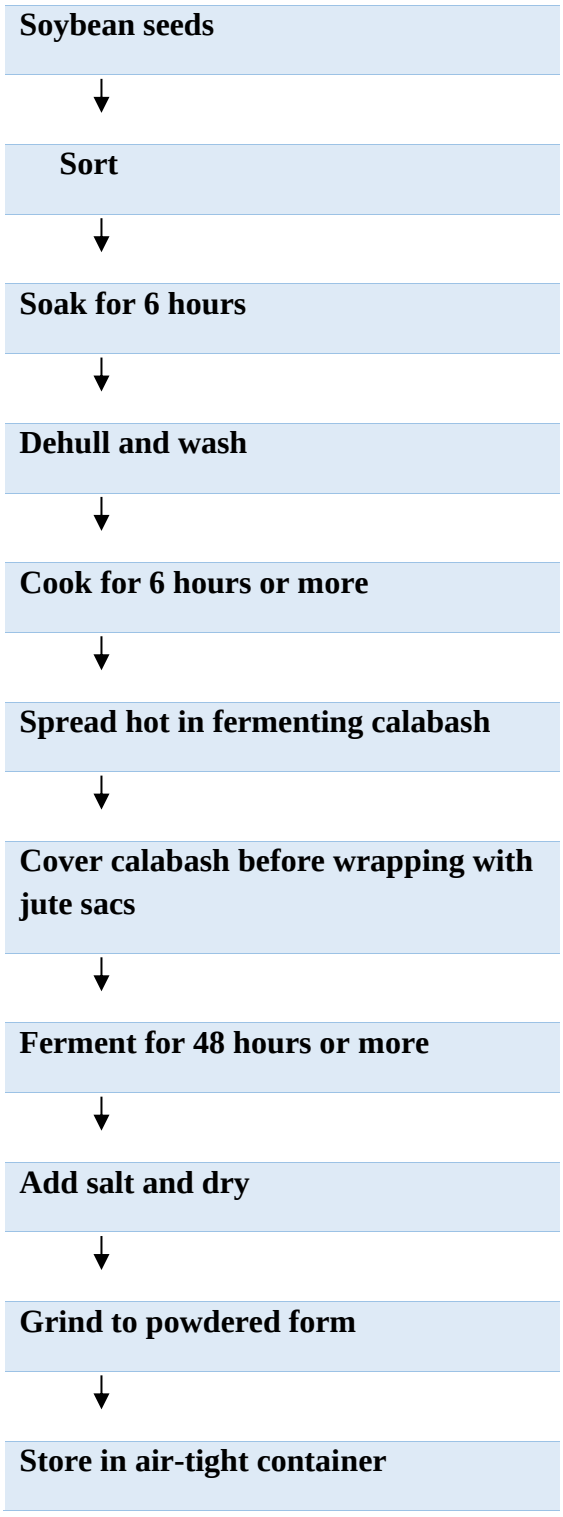


Fig. 1: Production chart for powdered locust bean condiment

Source: Adapted from Odunfa (1988)



Source: Adapted from Odunfa (1988)

Fig. 2: Flow chart for processing soybean powdered condiment

Results and Discussion

Proximate Composition of the Condiments

Figure 3 shows the proximate composition of the powdered condiments produced. Powdered condiment from soybean has the highest moisture content (10.78%) followed by that of locust beans (8.90%) while the composite powder has the least (4.51%). The finding agrees with Murtala *et al*. (2016) who reported that soyabean *daddawa* contained more moisture than locust bean *daddawa* while it disagrees with Tersoo-Abiem *et al*. (2021) who reported indicating higher moisture content in locust bean *daddawa* than that of soybean. However, all the powdered condiments had low moisture contents which make them better than the wet form in terms of the product shelf life. The high moisture content in the wet *daddawa* could encourage rapid deterioration and spoilage of the product by bacteria and fungi. All the powdered condiments produced contain high ash contents ranging from soybean (11.64%), composite (10.00%) and locust bean (8.51%) which is an indication of the presence of high mineral contents in all the samples. However, soya beans powdered condiment has the highest ash content in line with Tersoo-Abiem *et al*. (2021), implying that it is the most loaded with minerals and more nutritionally advantageous to use. Arise *et al.* (2019) and Okpo *et al*., (2022) posited that the high ash content in products denotes rich mineral contents. The crude fibre content in the composite powdered condiment is the highest (10.27%) followed by locust bean (10.09%) and soybean (8.43%). This is contrary to the findings of Murtala *et al.* (2016) who claimed that soybean *daddawa* contained higher crude fibre than locust bean *daddawa* while Tersoo-Abiem *et al*. (2021) claimed that locust bean *daddawa* contained higher percentage. The finding shows that the combination of both locust and soybean *daddawa* will give the best result in terms of crude fibre content. The importance of dietary fibre has been documented in literature to include digestion regulation, absorption of nutrients in the intestines and indirect prevention of obesity (Farrell *et al*., 1978; Van Italie, 1978). Arise *et al.* (2019) cited Dhillon *et al.* (2016), associated increase in fibre content to the increase in the digestibility of the product of their study.

The results further revealed that soybean powdered condiment has the highest lipid content (35.40%) followed by that of composite (31.96%) while locust bean has the least (27.60%). This is in agreement with the previous findings that soybean *daddawa* has more fat content. Lipid as an important source of energy is necessary in human diet. All the produced powdered condiments contain high crude protein. Soybean with 51.63% had the highest, closely followed by the composite condiment (51.19%). Locust bean powdered condiment had the lowest (47.25%). This indicates that in poor rural households' diets, these condiments could serve as good protein sources (Diawara, 2000). In line with the findings of Murtala *et al.* (2016), locust bean powdered condiment contains the highest carbohydrate content (4.44%). Next to it is soybean (2.73%), followed by the composite (2.34%).

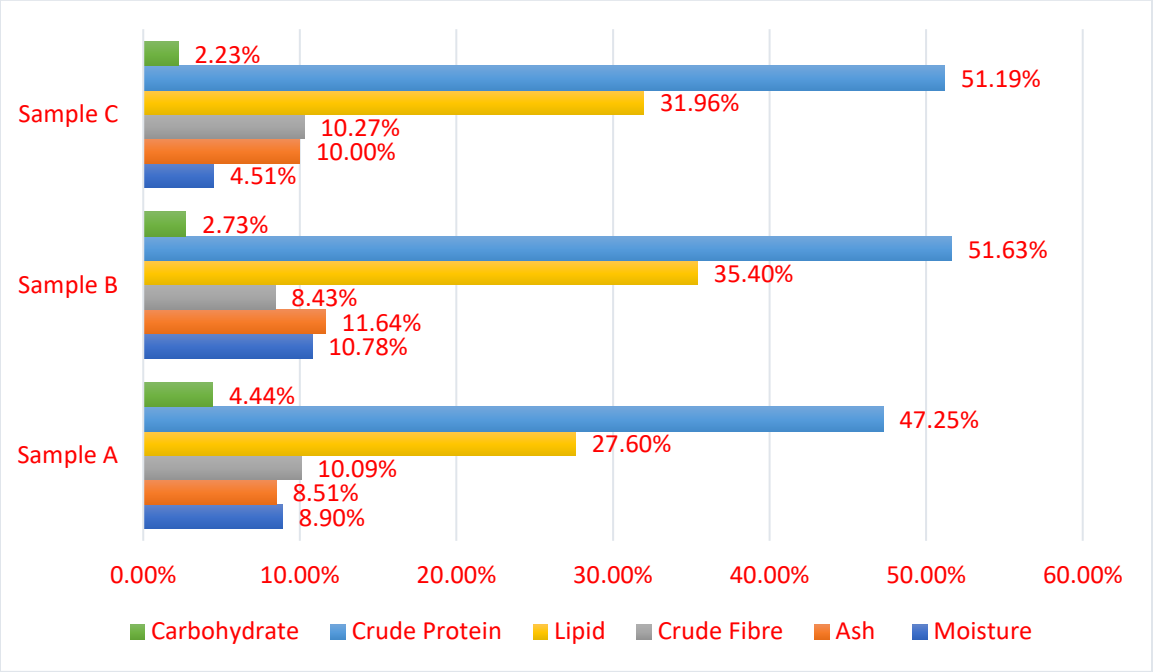


Fig. 3. Proximate composition of the fermented soybean and locust bean condiments

Key: Sample A = Fermented locust bean powdered condiment
Sample B = Fermented soybean powdered condiment
Sample C = Composite fermented locust and soybean powdered condiment

Sensory Evaluation of the Condiments

Table 1 shows the result of the sensory evaluation carried out on the three condiments. The parameters evaluated were appearance, taste, texture, colour, aroma and overall acceptability. The results showed that there is no significant difference in all the evaluated parameters for soybean and locust bean powdered condiments, except in their textures. Also, there is no major difference in all the evaluated parameters for the composite and soybean powdered condiments, except in their tastes and colour. However, there is a significant difference between locust bean powdered condiment and the composite condiment in all the evaluated parameters, except in the overall acceptability and aroma. All the powdered condiments are equally acceptable among consumers, implying that soybean powdered condiment and the composite powdered can adequately replace locust bean where there is scarcity of locust bean due to its seasonal availability and

deforestation activities that threaten its existence. The study agrees with Awofadeju *et al.* (2021) which reported no major difference in the overall acceptability of the soy and locust bean powdered condiments they produced.

Table 1: Sensory Evaluation of the Condiments

Parameter	Sample A	Sample B	Sample C	LSD
Appearance	7.4^{a}	7.1^{ab}	6.8^{b}	0.42
Taste	7.3^{a}	7.1^{a}	6.7^{b}	0.39
Texture	7.2^{a}	7.0^{b}	6.4^{b}	0.54
Colour	7.3^{a}	7.1^{a}	6.4^{b}	0.62
Aroma	6.7^{a}	6.8^{a}	6.7^{a}	0.54
Overall acceptability	6.6^{a}	6.8^{a}	6.6^{a}	0.51

a, b: Means along the same row with the same superscript are not different significantly from each other at $p \leq 0.05$
LSD = Least Significant Difference

Conclusions and Recommendations

The study revealed that all the powdered condiments are acceptable to the consumer which is an indication that they can serve as good replacement for the wet locust bean condiment which is susceptible to rapid deterioration and development of foul odours due to its high moisture content. It shows further that both the soybean and the composite condiments can serve as better alternatives to locust bean condiment due to their higher nutrient contents and the ready availability of soybean since locust bean is usually scarce and expensive during its off seasons, more so, that deforestation activities are currently threatening its availability. It is therefore recommended that the production process of powdered soybean and the composite condiment should be taught especially to women in rural households in order to enhance nutrient intake especially protein among the low-income rural dwellers who may not be able to afford other expensive sources of protein. This may also reduce the consumption of the controversial monosodium-based condiments among rural households.

References

Achi, O. K. (2013). The potential for upgrading traditional fermented foods through biotechnology. *African Journal of Biotechnology*, 4(5): 375-380.

Akinsola, A. O., Onabanjo, O. O., Idowu, M. A.& Ade- Omowaye, B. I. O. (2017). Traditional Complementary Foods: A Critical Review. *Greener Journal of Agricultural Sciences,* 7(8): 226-242.

Akinyele, B. J. & Oloruntoba, O. S. (2013). Comparative Studies on *Citrullus vulgaris, Citrullus colocynthis* and *Cucumeropsis mannii* for Ogiri Production. *British Microbiology Research Journal*, (3): 1-18.

Alabi, D. L. (2016). Evaluating the Acceptability of Maize Pap and Solid Gel Produced from Fermented Flour of Quality Protein Maize. *Academic Journal of Nutrition* 5 (2): 18-21.

Arise, A. K., Opaleke, D. O., Salami, K. O., Awolola, G. V., & Akinboro, D. F. (2019). Physico-Chemical and Sensory Properties of A Cheese-Like Product from The Blend of Soymilk and Almond Milk. *Agrosearch,* 19(2): 54-63 https://dx.doi.org/10.4314/agrosh.v19i2.

Association of Official Analytical Chemists (AOAC) (2005). Official Methods of Analysis, Gathersburg, MD U.S.A.

Awofadeju, O. F. J., 1., Ademola, I. T., Alagbe, O. A., Oyediran, R. I. & E. A. Adekunle (2021).Studies of Harnessing Quality Attributes of Condiment Powder (Iru) Processed from Soy (*Glycine max*) And African Locust Bean (*Parkia biglobosa*) Seeds *Journal of Research in Forestry, Wildlife & Environment* Vol. 13(1):85-94, *ISBN: 2141 – 1778*

Collins English Dictionary (2012). Complete & Unabridged 2012 Digital Edition William Collins Sons & Co. Ltd. Harpercollins Publishers https://www.dictionary.com/browse/condiment

Daramola, B. (2015). Preliminary Studies on Antioxidative Potentials of Extracts of Defatted Locust Bean Condiment. *Journal of Food Biosciences and Technology*, 5(1):23-30.

Dhillon, J., Tan, S.-Y. & Mattes, R. D. (2016). Almond consumption during energy restriction lowers truncal fat and blood pressure in compliant overweight or obese adults. *The Journal of Nutrition,* 146(12): 2513-2519.

Diawara, B. H. (2000). System for traditional fermented food (Soumbala) capacity building for research and quality assurance and food fermentation technology for African fermented foods. *WAITRO J, (*26):11-662

Ezekiel, O. O., Adedeji, O. E. & Umuokeke, N. (2022). Chemical Composition,Physicochemical, and Sensory Properties of Fermented Maize and Defatted Baobab Seed Flour Blends. *Agrosearch,* 21(1&2): 89-101 https://dx.doi.org/10.4314/agrosh.v21i1-2.8Farrell, D. J., Girle, L. & Arthur, J. (1978). Effects of dietary fibre on the apparent digestibility of major food components and on blood lipids in men. *Aust J Exp Biol Med Sci.* (56):469-79.

Iwe, M. O. (2003). The Science and Technology of Soybean. Rojoint Communication Services Ltd Enugu. pp 1-45

Murtala, Y., Babandi, A., Mashi, J. A., Ubayi, H. M., Ibrahim, S., Ibrahim, A., Shehu, D. & Alhassan, A. J. (2016). Proximate, Vitamins and Mineral Compositions of Locust

and Soya Beans-Based *Daddawa* sold in Kano Metropolis, Kano, Nigeria. *Bayero J Biomed Sci, 1(1): 1-7*

Myschoollibrary (2022). Condiments And Seasoning (Food Study): Description, Classification, Examples, Uses. Food And Nutrition Lesson Note. Retrieved from https://itsmyschoollibrary.com/2022/04/11/condiments-and-seasoning-food-study description-classification-examples-uses-food-and-nutrition-lesson-note/

Nwokolo, C. (2023). In Health Guide Nigeria Magazine. 7 Major Health Benefits of Locust Beans (Iru). https://healthguide.ng/health-benefits-of-locust-bean-iru/

Odunfa, S. A. (1988). Review: African fermented foods. From art to science *World Journal of Microbiology and Biotechnology* 4(3):259-273 DOI: 10.1007/BF01096132

Okafor, G. I & Omah, E.C. (2015). Selected Functional Properties, Proximate Composition and Sensory Characteristics *Pakistan Journal of Nutrition, 14: 581-585.*

Olawuyi, Y. O. & Oyetola, F. (2020). Flour Functionality, Chemical and Sensory Properties of Cookies from Trifoliate Yam Flour-Soybean Blends. *Agrosearch,* 20(1): 106-117 https://doi.org/10.4314/agrosh.v20i1.10S

Omafuvbe, B.O., Shonukan, O. O. & Abiose, S. H. (2000). Microbiological and biochemical changes in the traditional fermentation of soybean for 'soy-daddawa'—Nigerian food condiment. *Food Microbiol*; 17(5):469-74.

Omafuvbe, B. O., Esosuakpo, E. O, Oladejo, T. S. & Toye, A. A. (2007). Effect of soaking and roasting dehulling methods of soybean on Bacillus fermentation of soy-daddawa. *Am J Food Technol*; 2(4):257-64

Omodara, T. R. & Olowomofe, T. O. (2015). Effects of Fermentation on the Nutritional Quality of African Locust Bean and Soybean. *International Journal of Science and Research*, 4(1):1069-1071

Okpo, N. O., Alalade, O. M., Dawi, A.W. & Tahir, Z. H. (2022). Quality Attributes of Condiments Made from Some Locally Underutilized Seeds. *Dutse Journal of Pure and Applied Sciences (DUJOPAS)*, 8 (2a): 235-244. https://dx.doi.org/10.4314/dujopas.v8i2a.23

Ouoba, L. I., Rechinger, K. B., Barkholt, V., Diawara, B., Traore, A.S. & Jakobsen, M. (2003). Degradation of proteins during the fermentation of African locust bean (Parkia biglobosa) by strains of Bacillus subtilis and Bacillus pumilus for production of Soumbala. *J Appl Microbiol* 94(3):396-402.

Popoola, T. O., Kolapo, A. L &Afolabi, O. R. (2007). Biochemical deterioration of soybean daddawa-A condiment. *J Food Agric Environ* 5(1):67.

Rajak, H. (2023). Classification of food flavours and uses. https://hmhub.in/classification-food-flavours-uses/

Tamang, J. P. (2000). Microbial Diversity Associated with Natural Fermentation of *Kinema*. Proceedings of the 3rd International Soyabean Processing and Utilisation Conference, October 15-20, 2000, Tsukubo, Japan. 2000: pp 713-717.

Tersoo-Abiem, E. M., Sule, S., Iwuamadi, I., & Awulu, E. O. (2021). Quality Evaluation of Dried Fermented Locust Bean and Soybean Condiments. *European Journal of Agriculture and Food Sciences*, *3*(2), 63-67. https://doi.org/10.24018/ejfood.2021.3.2.261

Uchenna K. A., Chukwudi I. N. & J. O. Ugwuanyi (2020): Review on Development of Starter Culture for the Production of African Condiments and Seasoning Agents. *Advances in Microbiology*, 2020, 10, 599-622 https://www.scirp.org/journal/aim

Umanga, Y. (2021). Condiments in Food Industry. https://www.linkedin.com/pulse/condiments-food-industry-umanga-yasas

Van Italie, T. B. (1978). Dietary fiber and obesity. *Am J Clin Nutr*; 31:S43-S522

Visith, C. & Juntima, P. (2018). Chapter 15 - Condiments and Sauces, in Editor(s): M.G. Venkatesh Mannar, Richard F. Hurrell, Food Fortification in a Globalized World, Academic Press, 2018, Pages 153-158, ISBN 9780128028612, https://doi.org/10.1016/B978-0-12-802861-2.00015-8. (https://www.sciencedirect.com/science/article/pii/B9780128028612000158)

Walker, R. & Lupien, J. R. (2000). The safety evaluation of monosodium glutamate. J. Nutr. (130): 1049S–1052S.

Yokotsuka, T. P. (1991). Fermented Foods and Condiments Prepared with Koji Moulds. In: *Handbook of Applied Mycology, Food and Feeds*, Arora DK, Mukerji KG, Marth EH (Eds.). Vol. 3. Marcel Dekker, New York.: pp. 329-373.