Original Article *Journal of Sustainability and Environmental Management (JOSEM), Vol. 1, No. 4 (2022), 398 – 402*
p-ISSN 2822-1729, e-ISSN 2822-1737 Available online at https://www.nepjol.info/index.php/josem

Nutritional and Antinutritional Analysis of Dawadawa Condiment in Aliero Local Government, Kebbi State, Nigeria

Ahmad, A[1*], Keta, J.N[1], Dharmendra Singh[1], Hassan, S.R[2], Ibrahim, M[3]

[1]Department of Plant Science and Biotechnology Kebbi State University of Science and Technology Aliero, Nigeria
[2]Department of Science Education, Biology Unit, Waziri Umaru Federal Polytechnic Birnin Kebbi, Nigeria
[3]Department of Animal and Environmental Biology Kebbi State University of Science and Technology Aliero, Nigeria

**Corresponding author: abdulrahmanahmad434@gmail.com*

Abstract: Dawadawa is among the most important soup ingredients in Aliero, Kebbi State, Nigeria. The locally produced condiment is being prepared and used to add flavor to soup for many decades without the scientific knowledge of its nutritional and anti-nutritional contents. This study aimed to analyze the proximate and antinutrional contents of Dawadawa in Aliero Local Government, Kebbi State, Nigeria. Five samples from each four collection areas were collected and transported to Botany Laboratory, Kebbi State University of Science and Technology Aliero for analysis. Analysis of the proximate and antinutrient parameters were carried out using the AOAC (Association of Official Analytical Chemists) recommended techniques. The result of the study revealed that the condiments had high moisture contents (33.34 + 2.09) followed by protein (29.37 + 1.31), fibre (13.07 + 0.54), carbohydrate (12.83 + 1.34), lipid (8.92 + 1.75) and ash (2.49 + 0.83). While the results antinutrional analysis revealed that that Cyanide has the highest composition (4.81 + 0.33) followed by Oxalate (4.07 + 0.50), Phytate (3.01 + 0.19) and Saponins (2.90 + 0.36). It was found that Dawadawa condiments have high nutritional contents with low level of antinutrients. In view of the high nutriental content and low antinutriental content, it is recommended that Dawadawa should be used as substitute to the monosodium glutamate-based seasoning salts.

Keywords: *Aliero, Condiment, Dawadawa, Kebbi, Monosodium*

Conflicts of interest: None
Supporting agencies: None

Received 24.09.2022; Revised 11.11.2022; Accepted 27.11.2022

Cite This Article: Ahmad, A., Keta, J.N., Singh, D., Hassan, S.R., & Ibrahim, M. (2022). Nutritional and Antinutritional Analysis of Dawadawa Condiment in Aliero Local Government, Kebbi State, Nigeria. *Journal of Sustainability and Environmental Management*, 1(4), 398-402.

1. Introduction

The economies of the environment determine the kind of food or food ingredients to be consumed. There are communities that are unable to afford seasonings, hence they have their own methods of producing a local condiment which serve as substitute for seasonings and these local condiments are product of legume seeds that are highly rich in protein. But due to poor method of processing and storage, these local condiments are expose to various microorganism capable of releasing toxins substance that when consume causes different type of diseases (Ahmad, Keta, & Singh, 2022).

Condiment is a local ingredient that is added to food in the form of powder or something alike to improve the flavor. Food seasonings made from fermented locust bean seeds, melon seeds, soybeans, cotton seeds, and pigeon peas were often utilized in developingcountries like Nigeria and throughout Africa. The majority of condiments are still made in traditional small-scale, family settings with a wide range of environmental factors (Odunfa 1981).

Dawadawa condiment is an important food additive associated with Hausa people of the Northern Nigeria, it is a product of fermentation of locust bean seeds (Dimejesi and Odibo, 2017). The conventional process for making dawadawa requires unrestrained solid substrate fermentation, which causes considerable hydrolysis of the protein and carbohydrate component (Achi, 2005). Due to a variety of environmental reasons, dawadawa condiment quality might vary unexpectedly (Ogueke et al., 2013).

The following steps are commonly included in the production of dawadawa condiments. (1) The seeds are dehulled; (2) They are washed; and (3) They are wrapped in plantain leaves and boiled for nine to eighteen hours. (4) cooling and fermenting the wrapped, boiled, dehulled seeds for three to four days at a constant temperature

(350C). After unwrapping, the product is ground into a paste with a mortar and pestle. It is then packaged on fresh, blanched leaves and aged in the sun for two to three days before consumption. Through fermentation, the anti-nutritional elements in locust bean seeds are diminished while flavor compounds, digestibility, and nutritional value are enhanced (Mensa et al., 1990; Achi, 2005).The genus Bacillus bacteria were in charge of causing the dawadawa condiment to ferment (Ojinnaka et al., 2013). In developing nations where the average protein intake is less than necessary, plant proteins have recently become increasingly important in the fight against food insecurity (Khalid et al., 2013). The constant hunt for novel legumes, such as locust bean seeds and oil seeds, as new protein sources for usage as both functional supplements due to insufficient supplies of dietary proteins (Onweluzo and Nwabugwu, 2009).

Modern researches have thus give more emphasison microbial analysis of these condiments and toxins produced by these microorganisms in order to know their safety for consumption. However, few researches were conducted in regards to the level of nutritional and antinutritional contents of these local condiments and most of the researches carried out were conducted in Southern and Eastern part of Nigeria. Therefore, this study was conducted to analyze the proximate and antinutritional analysis of dawadawa condiment in Aliero Local Government, Kebbi State, Nigeria.

2. Materials and methods

Survey was conducted to collect dawadawa samples in Aliero Local Government Area, Kebbi State, Nigeria. Five (5) samples in four (4) collection areas were collected, making a total of 20 samples and put in a sterilized polythene bag, then transported to Botany Laboratory, Kebbi State University of Science and Technology Aliero for analysis.

All the 20 samples were grounded to a fine powder using pestle and mortar to make a homogenized mixture, the homogenized mixture were then put in a clean labeled container pending analysis.

2.1. Nutritional analysis

Determination of moisture content

A crucible was carefully cleaned, dried in the oven for 30 minutes at 100°C, and then allowed to cool within a desiccator. It was weighed after cooling, and the result was noted as (W1). The sample was weighed after being poured into a crucible at a weight of one gram (1g) (W2). The sample and crucible were then baked for two hours at 100°C, allowed to cool in a desiccator, and weighed after 30 minutes. Up until a steady weight was attained, the procedure was repeated (W3). The obtained values were utilized to determine the moisture content percentage (James, 1995).

Determination of crude fiber

One gram (1g) of the sample was hydrolyzed with petroleum ether in a beaker before being refluxed for 30 minutes with 200ml of a solution containing 1.25% H2SO4 per 100ml of solution. Filter paper was used to filter the solution. After filtering, the sample was thoroughly rinsed in boiling water to remove any remaining acidity. After that, the residue was passed through a filter crucible and dried at 100°C for two hours. The weight after drying and the sample weight were used to compute the percentage of crude fiber (AOAC, 2002).

Determination of ash content

One gram (1g) of the sample was placed into a crucible that had already been lit and weighed. The crucible and its contents were burned for two hours at 650°C in a muffle furnace that had been warmed. The crucible was weighed after being allowed to cool in a desiccator to a consistent weight. The ash content percentage was then computed (AOAC, 2002).

Crude fat determination

The Soxhlet extraction method was used for this. Drying of a 250ml clean flask was done for about 30 minutes in an oven set at 105–110°C. The dried material was precisely weighed at one gram (1g) into a labeled thimble before being carefully weighed into a boiling flask with the corresponding label. Petroleum ether (boiling point 40–60°C) was added to the boiling flask to a volume of about 100 ml. While the soxhlet extractor equipment was put together and refluxed for about three hours, the extraction thimble was lightly plugged with cotton wool. The Thimble was carefully removed, and petroleum ether was gathered on the setup's top container and emptied into a flask for reuse. The flask was removed after being cleared of petroleum ether and dried at 105-110°C for an hour. The bottle was placed in a desiccator after being removed from the oven, allowed to cool, and then weighed. The proportion of fat was calculated using the weight obtained (AOAC, 2002).

Determination of protein

This was done by Kjeldah method which remains the most popular method of protein determination.

(a) Protein digestion: Into a Kjeldah flask, one gram (1g) of the sample was weighed, five (5g) of anhydrous sodium sulphate was added. After that, 1g of copper sulfate and 1 tablet of Kjeldah catalyst were added. Five glass beads and 25ml of strong sulfuric acid were added to the mixture. Heating was done gradually in the fume cupboard while shaking occasionally until the solution took on a green hue. The flask's black particle that was visible at the neck and tip was allowed to cool before being cleaned with distilled water. First, the mixture was gently heated until the green color vanished, and then it was allowed to cool. The digest was transferred with repeated washings into a 250ml container following cooling, distilled water was added to the specified level in a volumetric flask. Distillation was done using distillation apparatus (AOAC, 2002).

(b) Protein distillation: Before use, the distillation equipment was heated for roughly 15 minutes. The condenser tip was positioned below the liquid in a 100ml conical flask containing 5ml of boric acid indicator. A tiny

funnel aperture was used to pipette 5ml of the digest into the apparatus body. The digest was then followed by 5ml of a 60% NaOH solution. To gather adequate ammonium sulphate, the mixture was fully heated for a period of 5-7 minutes. The condensed water was then taken from the receiving flask. The solution was titrated in the receiving flask with (0.1m) sulphuric acid, and the nitrogen content was calculated (AOAC, 2002).

Determination of carbohydrate

The formula: percentage carbohydrate = 100% - (moisture + ash + fat + crude fiber + protein) % yielded the sample's total carbohydrate content (AOAC, 2002).

2.2. Anti-nutritional analysis

Determination of Phytate content

A standard iron (II) chloride solution was titrated with 25ml of the filtrate using 0.3% ammonium thiocyanate as an indicator until a brownish yellow color developed and remained for 5 minutes. Four grams (4.0g) of each sample were soaked in 100ml of 2% HCl for three hours (Debela, 2002).

Determination of Oxalate content

One gram (1g) of the ground material was added to 75ml of 3.0M H2SO4, stirred, and then filtered. A 0.05M KMnO4 solution was titrated hot (80–90oC) against 25ml of the filtrates (extract) until a light pink color developed and remained for at least 30 seconds (Debela, 2002).

Determination of Cyanide content

To release all bound hydrocyanic acid, four grams (4g) of each sample were immersed in a solution comprising two milliliters (2ml) of orthophosphoric acid and forty milliliters (40ml) of distilled water. The samples were then kept at room temperature overnight. In order to distill the mixture, 5ml was added to 40ml of distilled water that also contained 0.1g of NaOH pellets. The distillate was prepared to a volume of 50ml using distilled water, and 20ml of this volume was used to titrate against a solution of 0.01M silver nitrate using 1.0ml of a solution of 5% potassium iodide, with the end point being marked by a weak but persistent turbidity (AOAC, 2002).

Determination of Saponin content

Each sample was diluted in 100ml of 20% ethanol with a weight of 5g. The residue was again extracted with another 100ml of 20% ethanol after the suspension had been heated, filtered, and extracted. Over a water bath heated to roughly 90°C, the mixed extracts were reduced to 40ml. Diethyl ether (20ml) was used to extract the concentration, and the ethereal layer was then discarded. The aqueous layer was twice cleaned with 10ml of 5% aqueous sodium chloride and twice extracted with n-butanol. The solution was then dried to a consistent weight and evaporated over a water bath (Debela, 2002).

3. Results and discussion

The results of nutritional composition of Dawadawa sample is presented in Table 1. From the results, it can be seen that Moisture has the highest composition (33.34 + 2.09) followed by Protein (29.37 + 1.31), Fibre (13.07 + 0.54), Carbohydrate (12.83 + 1.34), Lipid (8.92 + 1.75) and Ash (2.49 + 0.83).

The results of anti-nutritional composition of Dawadawa sample is presented in Table 2. From the results, it can be seen that Cyanide has the highest composition (4.81 + 0.33) followed by Oxalate (4.07 + 0.50), Phytate (3.01 + 0.19) and Saponins (2.90 + 0.36).

Findings of the proximate analysis revealed that the moisture contents was high, this may be due to the hydrolytic activity of the fermentation of the cotyledons (Adegunwa et al., 2012). After moisture, protein was found to be in large amount and are within the same range as that produced from other condiments such as Ogiri and Iru (Omafuvbe et al., 2004). However, the values were generally higher than that of other commonly consumed plant foods in Nigeria such as cassava products (Oboh et al. 2002; Oboh and Akindahunsi 2003), yam tubers (Akindahunsi and Oboh 1998) and leafy vegetables (Oboh and Akindahunsi 2003). Given that animal proteins are now quite expensive for a large portion of the population, the high protein concentration in these condiments may be a good and economical source of dietary protein. The lower amount of fiber, carbohydrates, and lipids in the condiments may have been caused by fermenting organisms that consumed some of the sugars for growth and metabolism. The reduced amounts of ash content observed in dawadawa may be due to the loss of minerals during the fermentation process that arise from the stimulating effects of boiling and leaching (Anigo et al., 2015).

Table 2 displays the amount of anti-nutrients present in the dawadawa that was produced in Aliero Local Government. The saponin, phytate, oxalate and cyanide contents is seen to reduce with fermentation and further reduction is expected with cooking and oxalate reduces calcium availability both in man and in non ruminants at higher dose. The saponinis a natural antibiotics, aiding the body's defenses against microbial invasions and illnesses, and this is in line with the research conducted by Okwu, (2004); Okwu and Emenike, (2006).

Antinutrients are chemical molecules that are present in fruits, vegetables, and meals, particularly in the seeds of legumes. They hinder the body's ability to absorb nutrients in many different ways and are harmful to both humans and animals (Umar et al., 2013). Depending on the type of food, how it is propagated, the chemicals used to cultivate the crop, as well as the chemicals used to store and preserve food substances, these compounds are found in various food substances in diverse amounts (Umaru et al., 2007).

Table 1: Nutritional composition of Dawadawa sample

Parameter	Composition
Moisture	33.34 $\pm$ 2.09
Ash	2.49 $\pm$ 0.83
Lipid	8.92 $\pm$ 1.75
Fibre	13.07 $\pm$ 0.54
Protein	29.37 $\pm$ 1.31
Carbohydrate	12.83 $\pm$ 1.34

Table 2: Anti-nutritional composition of Dawadawa sample

Parameter	Composition
Phytate	3.01 ± 0.19
Oxylate	4.07 ± 0.50
Cyanide	4.81 ± 0.33
Saponins	2.90 ± 0.36

4. Conclusion

It shows that Dawadawa condiments locally produced in Aliero Local Government Kebbi State, Nigeria have high nutritional contents. However, the level of anti-nutrients in Dawadawa condiments was low from the findings. In view of the high nutrients content and low antinutrients content of Dawadawa, it is recommended that Dawadawa should be used as substitute to the monosodium glutamate-based seasoning salts currently in use.

Acknowledgements

We acknowledge Malam Musa Isah Gumi, Salis Abubakar Nanoh, Iliya Ibrahim, Mal. Bashar Haruna Gulumbe, Mal. Abdulrahman Sani Aliero for their contribution towards the success of this paper.

References

Achi, O.K. (2005). Traditional fermented protein condiments in Nigeria: Review. *African Journal of Biotechnology, 4(*13), 1612-1621.

Ahmad, A., Keta, J.N. & Singh, D. (2022). Determination of Aflatoxin levels and prevalence of fungal flora of Cwande condiments sold in Zuru Local Government area, Kebbi State, Nigeria. *Journal of Sustainability and Environmental Management, 1(*4), 371-375.

Adegunwa, M.O., Adebowale, A.A. and Solano, E.O. (2012). Effect of thermal processing on the biochemical composition, anti-nutritional factors and functional properties of beniseed (Sesamumindicum) flour. *American Journal of Biochemistry and Molecular Biology, 2(*3), 175–182.

Aliero, Z.S., Singh, D., & Keta, J.N. (2022). Typha angustifolia L. Grass Hindering against Agricultural Productivity in Aliero River, Kebbi State, Nigeria. *Journal of Sustainability and Environmental Management, 1(*3), 339–343. https://doi.org/10.3126/josem.v1i3.48000

Akindahunsi, A.A. and OBOH, G. (1998).Chemical studies on two tropical wild yams Dioscoreabulbifera and Dioscoreamanganotiana. *Sostanze Grasse*, 75, 511–514.

Anigo, M.K., Abdullahi, S.A., Olagunju, S. and Michael, A. (2015). Effect of open and controlled fermentation on proximate and antinutrient compositions of Glycine max (Soya bean). *Advances in Research, 3(*1), 1-6.

Association of Official Analytical Chemists (2002). *Official Methods of Analysis*. The Association of Official Analytical Chemists International Arlington, VA.

Debela, A. (2002). *Manual for Phytochemical screening of medicinal plants.* Ethiopian health and nutrition research institute, Addis Ababa, Ethiopia 35-47.

Dimejesi, S.A. and Odibo, F.J.C. (2017). *Determination of heavy metals, Aflatoxin and Amino Acid Profile of fermented seeds of Telfairiaoccidentalis.* Proceedings of the 41st Nigeria Insitute of Food Science and Technology (NIFST) Conference and Annual Genral Meeting at Abuja, 251-252.

James, C.S. (1995). *Analytical Chemistry of Foods*. Chapman and Helf, New York.

Khalid, E.K., Babiker, E.E. and El-Tinay, A.H. (2003). Solubility and functional properties of fermented sesame seed protein as influenced by pH and salt concentrate. *Food chemistry, 82(*3), 361-366.

Mensah, P.P.A., Tomkins, A.M., Draser, B.S. and Harrison, T.J. (1990). Fermentation of cereals for reduction of bacterial contamination of weaning foods in Ghana. *The Lancet*, 336, 140-143.

Oboh, G., Akindahunsi, A.A. and Oshodi, A.A. (2002). Nutrient and anti-nutrient content of Aspergillusniger fermented cassava products (flour and gari). *Journalof Food Compost*, 15(5), 617–622.

Oboh, G., Akindahunsi, A.A. and Oshodi, A.A. (2003). Dynamics of phytate-Zn balance of fungi fermented cassava products (flour &gari). *Plant Food Human Nutrition*, 58, 1–7.

Odunfa, S.A. (1981). Microbiology and amino acid composition of Ogiri, a food condiment from fermented melon seeds. *Nahrung* 25, 810–816.

Ogueke, C.C., Okoli, A.I., Owuamanam, C.I. and Nwosu, J.N. (2013). Fermentation of melon seeds for "Ogirieguși" as affected by fermentation variables using Bacillus subtilis. *Malaysian Journal of Microbiology, 9(*4), 79 – 288.

Ojinnaka, M.C., Ojimelukwe, P.C. and Ezeama, C.F. (2013). Microbial and enzymatic changes associated with the production of ogiri from castor oil bean using Bacillus subtilis as starter culture. *Sky Journal of Food Science, 2(*2), 10-18.

Okwu, D.E. and Emenike, I.N. (2006). Evaluation of the phytonutrients and vitamin contents of Citrus fruits. *International Journal of Advance Science*, 2, (1), 1-6.

Okwu, D.E. and Emenike, I.N. (2006). Evaluation of the phytonutrients and vitamin contents of Citrus fruits. *International Journal of Advance Science, 2*, (1), 1-6.

Okwu, D.E. (2004). Phytochemicals and vitamin content of indigenous spices of South Eastern Nigeria. *Journal of sustainable Agriculture Environment*, 6, (1), 30-37.

Okwu, D.E. (2004). Phytochemicals and vitamin content of indigenous spices of South Eastern Nigeria. *Journal of sustainable Agriculture Environment, 6*, (1), 30-37.

Omafuvbe, B.O., Falade, O.S., Osuntogun, B.A. and Adewusi, S.R.A. (2004). Chemical and biochemical changes in African locust bean (Parkiabiglobosa) and melon (Citrullus vulgaris) seeds during fermentation to condiments. *Pakistan Journal of Nutrition*, 3, 140–145.

Onweluzo, J.C. and Nwabugwu, C.C. (2009). Fermentation of Millet (Pennisetumamericanum) and Pigeon Pea (Cajanuscajan) Seeds for Flour Production: Effects on Composition and Selected Functional Properties. *Pakistan Journal of Nutrition*, 8, 737-744.

Umar, K.J., Hassan, L.G., Usman, H. and Wasagu, R.S.U. (2013). Nutritional composition of the seeds of wild Melon (Citrullusecirrhosus). *Parkistan Journal of Biological Sciences*, 16, 536-540.

Umaru, H.A., Adamu, R., Dahiru, D. and Nadro, M.S. (2007). Level of Agricultural Factors in some wild edible fruits of Northern Nigeria. *African Journal of Biotechnology*, *6(*6), 1935-1938.