



EFFECT OF PRE-PROCESSING OPERATIONS ON SENSORY PROPERTIES OF CONDIMENTS FROM *Prosopis Africana* SEED

*¹Chizaram Blessing Nweke and ²Michael O. Odo

¹Department of Human Nutrition and Dietetics, David Umahi Federal University of Health Sciences, Uburu, Ebonyi State, Nigeria.

²Department of Food Science and Technology, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria.

*Corresponding authors' email: nwekebc@dufuhs.edu.ng

ABSTRACT

The study is on the effect of pre-processing operations on sensory properties of soup made with condiments from *Prosopis africana* (African Mesquite) seed. Boiling, germination, soaking and roasting were the various pre-processing operations considered with boiling serving as control. *Okpehe* (African Mesquite condiments) prepared from the different processing methods was used to prepare bitter leaves (olugbu) soups; the prepared soups were coded and presented to semi-trained thirty-member panel of judges who are familiar with the consumption of the product. Each panellist was provided with enough privacy to avoid biased result. The samples were scored for appearance, mouth feel, taste, and general acceptability using a nine-point Hedonic scale, where 9 indicated liked extremely and 1 indicated disliked extremely. The data obtained were represented in charts. The roasted sample was most preferred in relation to aroma and taste with 33.3 % and 20.0 % liked extremely respectively. The boiled sample (control) was most preferred in relation to appearance and texture with a value of 10.0 % and 13.3% liked extremely respectively. In overall acceptability of the roasted sample was the most preferred with a score of 46.7 % liked extremely. The study had revealed that pre-processing operations had effect on the sensory properties of condiments from *Prosopis africana* seeds.

Keywords: Sensory, Condiment, Pre-processing, *Prosiopis africana*, boiling

INTRODUCTION

Condiments are ingredients that are typically added sparingly to improve the flavor of food, as well as food safety and storage quality. (Chen et al., 2023). Among the common constituents of several condiments are salt and sugar and they come in several forms: liquid, semisolid, and solid (Chen et al., 2023). Different groups enjoy and consume condiments with different sensory qualities. In Asian and American markets for instance, soy sauce and ketchup are the most popular condiments, respectively (Ghada, 2021). In many countries, condiments have become food vehicles for micronutrient fortification because they are not expensive, frequently consumed, and extensively utilized by individuals of all socioeconomic groups in predictable amounts (Garcia-Casal et al., 2016).

Among the common condiments are those traditionally or locally produced and those industrially produced. Regrettably, a lot of industrially produced condiments contain an appreciable amount of added sugar or sodium, which should be avoided to lower the elevated risk of non-communicable diseases (WHO, 2015). However, a fortified nutrient's consumption may be reduced as a result of such a restriction. These condiments' base ingredients of sugar and salt put people at risk for conditions including diabetes and high blood pressure. Thus, traditionally or locally produced condiments are used as a better alternative when properly prepared.

Traditional condiments are essential for foods in West Africa due to its nutritional and sensory characteristics (Akpiet et al., 2023). Among such common traditional condiments popularly consumed in South-East region of Nigeria is *okpeye* condiment. It is one of the fermented condiments that has strong aroma and enhances the flavor of soups. Food's organoleptic, nutritional, health-promoting, and preservation qualities have all been shown to be enhanced by fermentation (Oyewole and Isah, 2012). *Okpeye* is a famous fermented soup condiment made from the seeds of the *Prosopis africana* (African mesquite) tree. According to Oguntoyinbo et al.

(2007), *Prosopis africana* is a plant that grows throughout the African Savannah and Rainforest. In parts of South-East Nigeria and the middle belt, *okpeye* is mostly used as a seasoning. *Okpeye* is characterized with dark brown colour with pungent fragrance but rich in Vitamins, Protein, and Minerals and anti-oxidants. It enhances the nutritional content of traditional foods when used as a condiment; hence makes significant contribution to consumers' nutrient intake (Ugwuanyi, 2016; Nweke and Odo, 2025).

Indigenous knowledge, custom, and personal experiences serve as the foundation for the processing methods used to make *okpeye* and other condiments. Despite slight changes brought forth by location, regional customs, and individual preferences, the main or principal phases are identical.

The commonest method to prepare *okpeye* is to boil *Prosopis africana* seeds between 2-6 hours, or until they are tender and the cotyledon is enlarged (Ugwuanyi, 2016). The cotyledons are extracted by squeezing the seeds between the thumb and finger. In a pot lined with *Alchonea cordifolia* leaves, the recovered cotyledons are thoroughly cleaned, drained, and allowed to dry. After inserting the cotyledons into the basket to a depth of 1 or 2 cm, more leaves are added, backwards facing, and the basket is weighted with pebbles. Four days pass during the fermentation process. The seeds undergo fermentation, which turns them into a tasty, high-protein component for soups and other recipes. The process concludes with the cotyledons, which have turned dark brown and smell strongly of ammonia, being ground into a fine paste on a stone or mortar and then formed into different sizes and forms. The balls are usually and ideally dried in the sun for several days, depending on how strong the sun is, until they solidify and turn black; then, the condiment is prepared for use.

However, it is on note that pre-processing operations like germination, soaking and roasting could affect nutritional properties of legumes (Nweke and Odo, 2025). Nevertheless, there has not been vast documentation on how these various

pre-processing operations affect the sensory properties of okpeye. This study tends to fill this gap.

MATERIALS AND METHODS

Procurement of Sample

The *Prosopis Africana* seed were purchased from Okwo Main Market Ngbo in Ohaukwu Local Government Area of Ebonyi State, Nigeria. Extraneous and foreign matters such as insect infected seed, sand and chaff were removed manually from the sample.

Sample Preparation

The condiment (*Okpeye*) was processed using the following methods.

Boiling

This was carried out according to the traditional way of processing *Okpeye* (condiment). The *Prosopis africana* seeds were boiled for 3 hours and was allowed to cool and then dehulled manually. The dehulled seeds were wrapped in treated plantain leaf and kept at room temperature for four days for fermentation to occur. The fermented condiment were sun-dried, stored in zip locked polyethylene bags until it was used to prepare soup.

Germination

Germination was done using the method described by Uleh and Fagbemi (2017). The *Prosopis africana* seeds were soaked in hot water of 100°C at a ratio of 1:3 w/v for 72 hours with change of the hot water every 8 hours. The sample was kept in a lagged box to maintain a temperature of approximately 80-90 °C, after the 72 hours, the water was drained, and the seeds germinated for 14 days at room temperature. During germination, the seeds were sprinkled with cold water every twelve (12) hours. Seeds with sprout lengths of 1 mm or more were considered germinated. The germinated seeds were wrapped in treated plantain leaf and kept at room temperature for four (4) days for fermentation to occur. The fermented condiment were then sun-dried, stored in zip locked polyethylene bags until it was used to prepare soup.

Roasting

The *Prosopis africana* seeds were put in a frying pan and roasted for about 30 minutes when the hull was seen being separated from the cotyledon. Complete dehulling was manually carried out and the roasted seeds were soaked in water for 2 hours, and then wrapped in treated plantain leaf and kept at room temperature for four days to ferment. The

fermented seeds were sun-dried, stored in zip locked polyethylene bags until it was used to prepare soup.

Soaking

Soaking was done using the method described by Uleh and Fagbemi(2017). The *Prosopis africana* seeds were soaked in a hot water (about 100 °C) at a ratio of 1:3 w/v for 24 hours with the change of boiled water six (6) hourly. At the end of the 24 hours, the soaked seeds were de-hulled, then wrapped in treated plantain leaf and kept at room temperature for four days to ferment. The fermented condiments were sun-dried, stored in zip locked polyethylene bags until it was used to prepare soup.

Sensory Evaluation

Okpeye prepared from the different processing methods was used to prepare bitter leaves (olugbu) soups; the prepared soups were coded and presented to semi-trained thirty-member panel of judges who are familiar with the consumption of the product. The following codes were adopted: Boiled-Fermented-BF, Germinated Fermented-GF, Soaked-Fermented-SF and Roasted Fermented-RF. The samples were scored for appearance, mouth feel, taste, and general acceptability using a nine-point Hedonic scale, where 9 indicated liked extremely and 1 indicated disliked extremely. Each panellist was provided with enough privacy to avoid biased result. They were served with cracker biscuit and water to thoroughly rinse their mouth after each sample was eaten (Okaka, 2010).

RESULTS AND DISCUSSION

Sensory Evaluation of Soup made of Condiments from Processed *Prosopis Africana* Seed

The result of the analysis of the sensory evaluation of the soup made using processed *Prosopis africana* seed as a condiment are depicted using visual display. The evaluation is on the: aroma, text, appearance and texture.

Figure 1 represents the percentage distribution of the respondents' likeness on the aroma of the soup made of the condiment from processed *Prosopis africana* seed. None of the evaluators scored the soups between "dislike extremely" to "Neither like or Dislike". The result further revealed that at least 57% of the respondent "like slightly" the soup made of the condiments from *Prosopis africana* seed for Control, soaked, germinated samples. Roasted sample only had 40% and 33.3% "like very much" and "like extremely" respectively on the aroma. This suggests that the most preferred "like extremely" processing method in terms of aroma is the roasted sample. Ranking them in ascending order: Roasting → Germination → Control → soaking

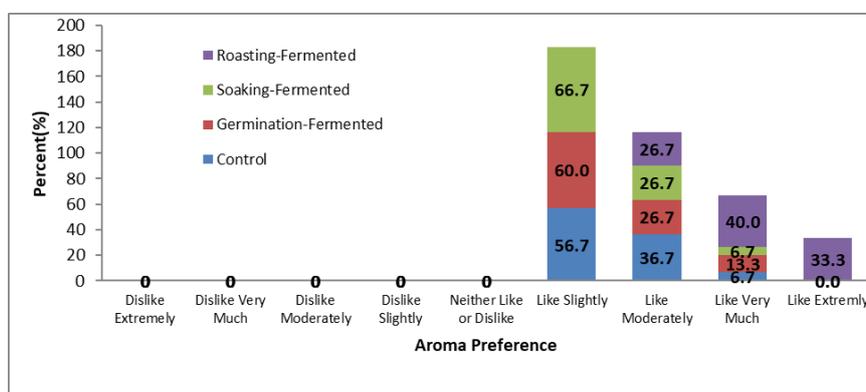


Figure 1: Percentage Distribution of Sensory Evaluation (Aroma) Score on the Soup made using Processed *Prosopis africana* Seed as Condiment

In figure 2, which is on Taste evaluation, only Roasted had 20% of the respondents with rank score of “like extremely”. Also, roasted had no “like slightly” ranking. Other processing methods compete favourably in terms of taste with Control

leading slightly above other processing methods. Soaked and germinated had 60 % each of the respondents with rank score of “like slightly”. The analysis in taste ranking suggests that roasted was the most preferred in terms of taste.

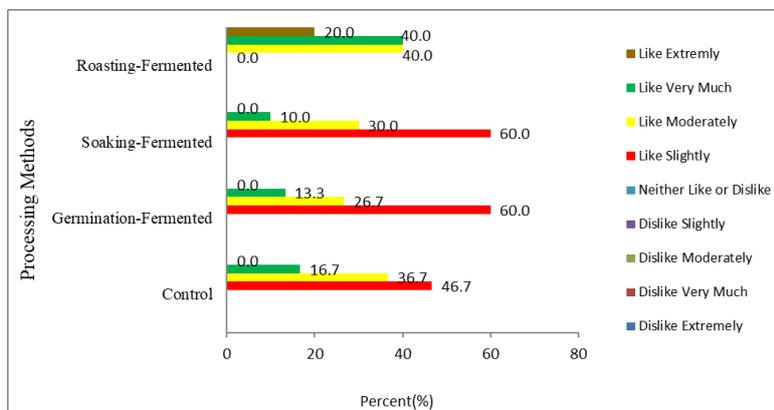


Figure 2: Percentage Distribution of Sensory Evaluation (Taste) Score on the Soup made from Processed *Prosopis africana* Seed as Condiment

Figure 3 depicts the respondents ranking on preference of the appearance of the soup made of condiment from *Prosopis africana* seed. Control had the highest “Like moderately” and “Like Very much” ranking: 60.0% and 33.3% respectively,

while roasted had the lowest “Like Very Much” (10%). Germinated had the most “like slightly” (60%). In a nutshell, the findings show that Control was most preferred in terms of appearance while germination was least ranked.

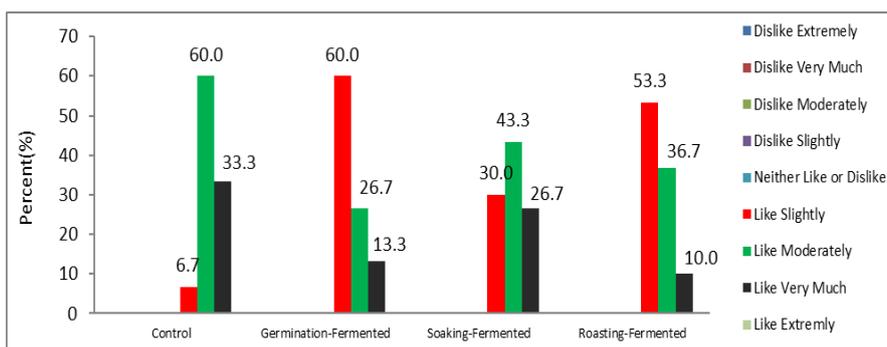


Figure 3: Percentage Distribution of Sensory Evaluation (Appearance) Score on the Soup made using Processed *Prosopis africana* Seed as Condiment

The result represented in Figure 4 above shows the texture (mouth feel) preference of the respondents of the soup made with condiments from processed *Prosopis africana* seed. The result shows clearly that soup with Roasted condiment had the highest rank of “Like Very Much” (36.7 %) while that of

Soaked had the least of “Like Very Much” (6.7 %) on its texture (mouth feel). Also, Soaked, Germinated and Control had at least 60 % of “Like slightly” score. This suggests that the aforementioned three methods had the similar pattern of texture preference but differs from that of Roasted.



Figure 4: Percentage Distribution of Sensory Evaluation (Texture) Score on the Soup made using Processed *Prosopis africana* Seed as Condiment

The overall preference of soup made of condiments from processed *Prosopis Africana* is as displayed in Figure 5. The overall reflect the overall ranking from Aroma, Taste, Appearance and Texture. The result revealed that Roasted was the most preferred among other processing methods with 46.7% of the respondents on the ranking it “Like Very Much”

scale, while the remaining 53.3% on the “Like moderately” scale. It had none on “Like slightly” scale. This is followed by Control which had only 13.3% on “Like slightly” scale but 80.0% on the “Like moderately” scale. Thus, the various methods could be ranked on the overall preference: Roasting → Control → Germination → Soaking.

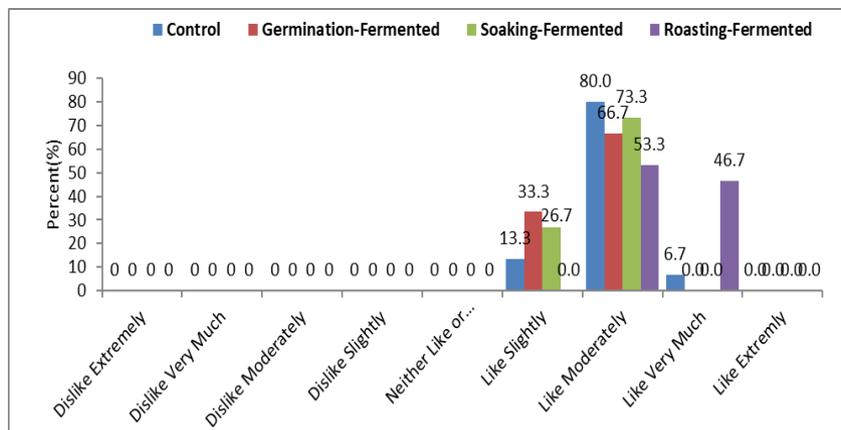


Figure 5: Percentage Distribution of Overall Acceptability of Soup made of Condiment from *Prosopis Africana* Seed

Figure 6 shows clear differences in consumer overall acceptability among the condiment from the various pre-processing operations under study. Condiments from roasted received higher overall ratings, forming larger and more outward radar profiles, while others showed lower acceptability with smaller shapes. The chart highlights that

overall preference depends on a combination of sensory factors (aroma, taste, appearance and texture), and the variations suggest that formulation differences significantly influenced consumer perception. This concurs with the result in figure 5 which was based on percentage distribution.

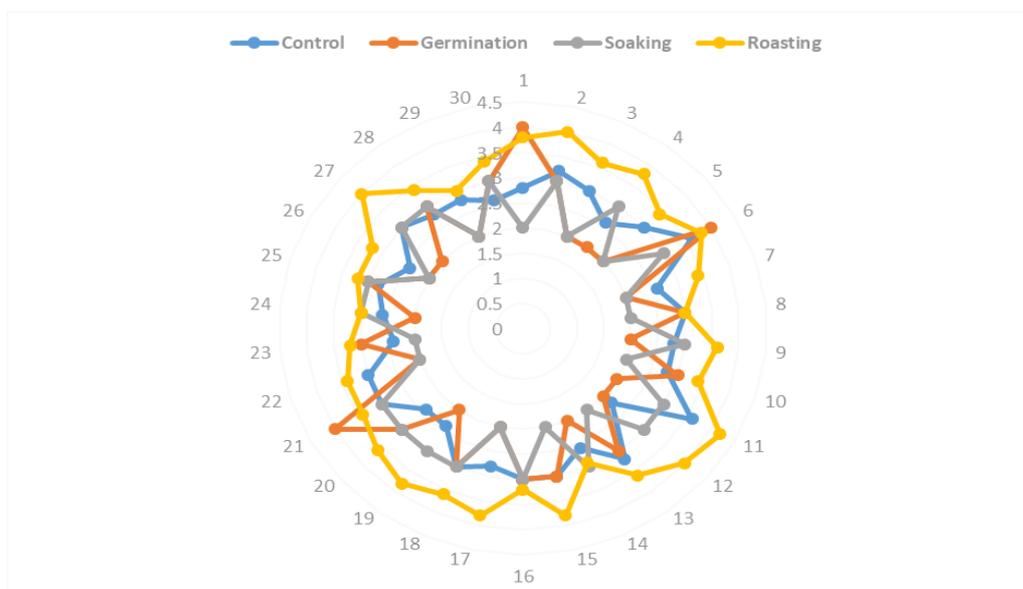


Figure 6: Rader Chart of the Overall Acceptability of the Condiments

Discussion

The preference of roasted sample in relation to aroma and taste maybe as a result of the roasting processing imparting desirable flavour to the condiment. This agrees with the findings by Nalan *et al.* (2022) which assert that roasting improves taste and aroma in food samples like legumes. Numerous chemical processes (polymerization, decarboxylation, oxidation, reduction, and hydrolysis) and complicated reaction (Caramelization, Strecker degradation, the Maillard reaction, and lipid thermal deterioration) occur during roasting and result in unique volatile taste

compositions (Sruthiet *al.*, 2019). The aforementioned processes during Roasting enhances N-heterocyclic chemicals like pyrazines and pyrroles and O-heterocyclic compounds like furans and pyranone(Sruthiet *al.*, 2019). Texture is considered by the way the food feels in the mouth of the judges (Garba *et al.*, 2025).On texture, the finding indicates that the boiled (control) had a notable impact on the texture characteristics of the *okpeye*. Afinding on investigation of texture for different processed cowpea by Affrifahet *al.* (2022), showsthat the heat from boiling breaks down the proteins and starches in legume seeds, softening

them. The seed's cellular structure is disrupted as a result of this breakdown of complicated chemicals, giving it a softer texture. Additionally, the heat encourages the starches to gelatinize, which softens the seeds (Burak *et al.*, 2023).

Roasting was most preferred in this study. According to a study by Sruthi *et al.* (2021), roasting is known to produce a crunchy texture due to structural and chemical changes that occur during the process, such as lowering moisture content and altering lipids, which results in the formation of a crispier and more delicate structure with less hardness.

In appearance the roasted sample was the least preferred and this is consistent with the study carried out on sesame seed by Berk *et al.* (2019) indicating that roasting of the seed led to a progressive decrease value which is evident by the appearance of dark color.

CONCLUSION

This study had examined the effect of pre-processing operations on the sensory properties of okpeye. The various pre-processing operations considered include: boiling, germination, soaking and roasting while each undergo fermentation after pre-processing. The finding revealed that roasting had the highest overall acceptability.

REFERENCES

Affrifah, N. S., Phillips, R. D., & Saalia, F. K. (2022). Cowpeas: Nutritional profile, processing methods and products – A review. *Legume Science*, 4(3), e131.

Chen, Y., Liu, Y., & Feng, X. (2023). Food perception: Taste, smell and flavour. *Foods*, 12(19), 3628. <https://doi.org/10.3390/foods12193628>

Garba, M. P., Okere S., & Gyebi, G. (2025). Nutrient and antinutrient profiles of three micronutrient-rich powders from Local vegetables and beef liver: formulation, composition and sensory Acceptability. *FUDMA Journal of Sciences*, 9(12), 29 – 35

Garcia-Casal, M. N., Peña-Rosas, J. P., & Gomez-Malave, H. (2016). Sauces, spices, and condiments: Definitions, potential benefits, consumption patterns, and global markets. *Annals of the New York Academy of Sciences*. <https://doi.org/10.1111/nyas.13045>

Ghada, S. R. A. S. (2021). What to know about food flavor? A review. *Jordan Journal of Agricultural Sciences*, 18(1). <https://doi.org/10.35516/jjas.v18i1.100>

Nalan, Y. (2022). Sensory analysis of microwave-roasted fenugreek and coffee blend. *Legume Science*, 5(3). <https://doi.org/10.1002/leg3.166>

Oguntoyinbo, F. A., Sanni, A. I., Franz, C. M., & Holzapfel, W. H. (2007). In vitro fermentation studies for selection and evaluation of *Bacillus* strains as starter cultures for the production of Okpehe, a traditional African fermented condiment. *International Journal of Food Microbiology*, 113, 208–218. <https://doi.org/10.1016/j.ijfoodmicro.2006.07.006>

Oyewole, O. A., & Isah, P. (2012). Locally fermented foods in Nigeria and their significance to national economy: A review. *Journal of Recent Advances in Agriculture*, 1, 92–102.

Sruthi, N. U., Premjit, Y., Pandiselvam, R., Kothakota, A., & Ramesh, S. V. (2021). An overview of conventional and emerging techniques of roasting: Effect on food bioactive signatures. *Food Chemistry*, 348, 129088. <https://doi.org/10.1016/j.foodchem.2021.129088>

Ugwuanyi, J. O. (2016). *Microbial technology and food security: Microorganisms put safe food on our tables* (106th Inaugural Lecture). University of Nigeria, Nsukka.

Uleh, M., & Fagbemi, T. (2017). Progeny trial of *Prosopis africana* in Benue State, Nigeria. *Journal of Research in Forestry, Wildlife and Environment*, 9(1), 61–66.

World Health Organization. (2015). *Healthy diet* (Fact sheet No. 394). http://www.who.int/nutrition/publications/nutrientrequirements/healthy_diet_factsheet394.pdf

Wikipedia. (2016). Condiment. <https://en.wikipedia.org/wiki/Condiment>

