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Sensory Evaluation of Croaker Fish Exposed to Solar and Traditional Drying Methods

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Abstract

*The study aimed to compare the sensory properties of croaker fish (*Pseudotolithus typus*) dried using a traditional roadside dryer and a solar-powered dryer. A panel of ten experts, including laboratory technologists and fish processors, used a 9-point hedonic scale to evaluate the products for taste, texture, appearance, odor, and overall acceptability. The experiment was repeated five times for each property evaluated. Statistical Package for the Social Sciences (SPSS) software was used to determine the significance of the data between the samples from the two dryers at a 5 % probability level. The mean values from the five experimental trials were compared for the two drying methods. The results indicated significant differences in taste, texture, and overall acceptability between the two drying methods, with probability values less than 5 % ($p < 0.05$). However, there was no significant difference in odor between the samples dried using the different methods, with a probability value of 0.290. The panelists rated the products from the solar dryer as more appealing than those dried using the traditional roadside dryer.*

Keywords: Sensory properties, Croaker Fish, Solar Drying, Traditional Drying, Preservation

1.0 Introduction

The quality of dried food material is vital for prolonging its shelf life. The sensory properties of food are crucial in establishing a reliable dataset that can inform processors, vendors, and consumers about their preferences (Udoh *et al.*, 2022). Various authors have conducted research on the sensory properties of fish, providing valuable information that helps define the quality of dried fish products (Chibuezeh *et al.*, 2022; Banna *et al.*, 2022; Hoque *et al.*, 2022; Islam *et al.*, 2022; Rasul *et al.*, 2018; Umar *et al.*, 2018; Sogbesan and Paulina, 2017) Hoque *et al.* (2022) suggested that traditionally dried fish products are associated with several public health

concerns, which are significant as fish is a primary source of protein consumed by many in Southern Nigeria. Santiago *et al.* (2024) proposed that drying methods influence the physicochemical and nutritional properties of dried fish products. Croaker is commonly found in the riverine communities of Mkpát Enin and Eastern Obolo in Akwa Ibom State, South-South, Nigeria. Some studies have introduced innovative ways of drying and preserving fish to enhance marketability (Holzloehner *et al.*, 2024; Rasul *et al.*, 2022; Kim *et al.*, 2020; Onyeneke *et al.*, 2020; Anwan and Anetekhai, 2020; Ayeloja *et al.*, 2020).

In a study by Nooraida *et al.* (2020), it was found that there was no significant difference in the sensory attributes of tilapia fillets subjected to different processing treatments. Thirty panelists evaluated the products for characteristics such as color, texture, aroma, taste, and overall quality using a nine-point hedonic scale as part of a quantitative descriptive analysis method. In another study by Fakunmoju (2023), the effects of four different processing methods on the sensory properties of four species of fish (*clarias*, *gariepinus*, *chrysichthys*, *nigrodigitatus*, *tilapia*, *niloticus*, and *pseudotolithus typus*) were investigated using 24 samples. The samples were divided into three portions and evaluated using a 9-point hedonic scale. The study reported a significant difference between the samples analyzed. Additionally, Majumdar *et al.* (2023) studied the sensory, physicochemical, and microbiological properties of five sun-dried marine fish species. The study found that the sensory properties (color, odor, and texture) were superior in sun-dried samples compared to other drying methods. However, the sun-dried samples were not as firm as products from other drying methods that were evaluated. Opara (2022) developed a solar fish dryer using a concentrating collector. The study observed that enclosing the drying process limits the impact of contamination and enhances the quality of the final product.

There is mounting concern regarding the safety of fish processed by roadside vendors, as they often fail to adhere to proper hygiene and food safety practices. As a result, researchers are now exploring innovative approaches to develop drying systems that not only enhance the quality of the end product but also have a positive economic impact and promote environmental sustainability. Most studies on the sensory properties did not pay much attention to products from solar drying experiments. This study focused on evaluating the proximate properties of croaker fish subjected to a solar-powered dryer and a conventional dryer used by fish vendors to dry the product. The study provides relevant literature that could help address concerns about the questionable quality of dried fish products and provide a nexus for consumer preference.

2.0 Materials and Methods

A sensory evaluation was conducted to assess the quality of the dried Croaker products. The drying process involved a traditional roadside fish dryer and a solar fish dryer. The panel for the experiment comprised ten members, including four laboratory technologists and six fish processors. The panelists were between the ages of 25 and 40, and 60 % of them were women. The products were dried to a safe moisture level of 7.75 % before being allowed to cool and presented to the panelists for evaluation. The solar-powered dryer took on average 80 minutes to dry the products to a safe state, whereas the conventional roadside dryer, which served as the control experiment, required 135 minutes for a similar quantity. The samples were served individually to the panelists who were equidistant to each other in the venue used for the experiments. The panelists assessed the dried products based on taste, texture, appearance, odor,

and acceptability, using a 9-point hedonic scale. A similar method was utilized by Nooraida *et al.* (2020), as demonstrated in Table 2.1.

Table 2.1: Scaling for sensory evaluation using the 9-point hedonic scale

Extremely dislike	Very much dislike	Moderately dislike	Slightly dislike	Neither like nor dislike	Slightly like	Moderately like	Very much like	Extremely like
1	2	3	4	5	6	7	8	9

The panel was constituted in the Department of Agricultural Engineering, Akwa Ibom State University, Akwa Ibom State, Nigeria and comprised of academic and technical staff, who independently assessed the products from the solar dryer and the traditional fish dryer (control). The experiment was replicated five times for all the sensory properties tested. The data was subjected to Two-Sample T-Test using the SPSS software (version 27) to ascertain the level of significance of the data at 5 % probability. In each of the parameters considered, the mean values of the five trials were compared with values of different parameters for the samples from the two mediums.

3.0 Results and Discussion

3.1 Sensory Evaluation of the Dried Product

The samples dried using both dryers exhibited near similar features when their sensory properties were examined. Figure 3.1 depicts the product after undergoing a drying experiment in the conventional roadside fish dryer. The products dried in the traditional roadside dryer appeared burnt. This was attributed to the direct contact with the fuel source and the uncontrolled nature of the smoke that hovered the product's surface. The products from the conventional dryer had a salty taste, hardened texture, and burnt appearance, whereas the products from the solar dryer had a palatable taste. The solar-dried products were softer, firmer, more appealing, and possessed a favorable texture.



Figure 3.1: Product from the traditional road side dryer

The samples dried in the solar dryer looked cleaner than the samples in the conventional drier, as depicted in Figure 3.2. This distinction can be attributed to the solar dryer's ability to prevent direct contact between the product and the fuel source (hot charcoal), unlike the conventional roadside dryer.



Figure 3.2: Product from the solar dryer

The panel members conducted individual evaluation of the samples for taste, odor, texture, general appearance, and overall acceptability. The mean values and standard deviation for the sensory properties from the five experiments are provided in Table 3.1. It was observed that all sensory properties (taste, texture, odor, appearance, and overall acceptability) were numerically higher in the solar-dried samples compared to those dried in the traditional dryer.

Table 3.1: Mean and standard deviation of sensory properties from the two drying mediums

Sensory Property	Taste	Odor	Texture	Appearance	Overall Acceptability
Traditional Dryer (Control)	5.80±0.20	5.80±0.20	5.80±0.58	6.20±0.20	6.20±0.37
Solar Powered Dryer	7.80±0.49	7.00±0.32	7.60±0.24	8.00±0.32	6.80±0.37

The confidence interval, *t-values* and *p-values*, for the sensory properties analyzed are presented in Table 3.2. Based on the results, there were significant differences in taste, texture, appearance, and overall acceptability, with probability values less than 5 % ($p < 0.05$). However, there was no significant difference in the odor of samples between the two drying mediums, as the probability value was more than 5 % ($p = 0.290$). This finding is consistent with a similar observation made by Sulieman and Mustafa (2012) in their evaluation of dried fish samples.

Additionally, the resemblance in some sensory properties evaluated aligns with the study conducted by Akinneye *et al.* (2010) when assessing the quality of fish species obtained from different drying methods. The values obtained for taste (7.80 ± 0.49 %), odour (7.00 ± 0.32 %), texture (7.60 ± 0.24 %) for the solar dried samples were very close to 7.14 ± 0.90 %, 8.00 ± 0.81 and 7.49 ± 1.13 % respectively obtained for the same properties by Hosseini-Shekarabi *et al.* (2014) in their study of the sensory properties of minced fish and surimi from black mouth croaker (*Amblyeleotris nibe*).

Table 3.2: Statistical analysis of experimental data from the two drying mediums

Proximate Property	Difference of Dryer	No. of Trials	Degree of Freedom	Simultaneous 95% CI	T-Value	P-Value
Taste	Solar-Traditional	5	8	(-3.220, -0.780)	-3.78	0.005*
Odor	Solar-Traditional	5	8	(-1.820, 0.620)	-1.13	0.290
Texture	Solar-Traditional	5	8	(-2.063, -0.337)	-3.21	0.012*
Appearance	Solar-Traditional	5	8	(-3.258, -0.342)	-2.85	0.022*
Overall Acceptability	Solar-Traditional	5	8	(-2.663, -0.937)	-4.81	0.001*

* Significant difference between products from the two mediums

The *p-values* obtained from the statistical analysis, agree with the finding of Fakunmoju (2023), who noted significant difference for sensory properties of fried, smoked and cooked *Pseudodolithus typus*. Ayeloja *et al.* (2020) highlighted similar trend in their study. The panelist preferred the product from the solar dryer based on the respective sensory properties tested (taste, odor, texture, appearance, and overall acceptability). This observation is similar to the findings of Rasul *et al.* (2018) and Nazra and Devadasan (2023). They agreed that fish products subjected to solar drying were more appealing than those from the traditional drying medium. Islam *et al.* (2022) also shared a similar view. The use of a solar dryer significantly improved the appearance and flavor of the product, making it more appealing to consumers and enhancing its marketability. The properties of the dried products were influenced by the drying method, with the enclosed environment of the solar dryer preventing exposure to impurities and contaminants, unlike the traditional dryer. This difference in drying environment contributed to the distinct properties of the solar-dried product, while products exposed to contaminants could potentially pose health risks to consumers.

4.0 Conclusion

The products from the solar dryer were more appealing than those from the traditional drying system. The panelists recommended the use of solar dryers to dry the products in order to enhance the quality and shelf life of the final product as well as optimize marketability. This approach will help address consumer concerns about the safety of products processed by roadside vendors, who often neglect established protocols for consumer protection. In addition to safeguarding the products from contamination, which is achieved through the use of solar dryers, a comprehensive study of the proximate and mineral composition of products from both drying medium is suggested. This study will provide insights into the effects of exposing these products to different drying mediums on their physical and chemical properties.

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