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Proximate Composition, Functional and Qualitative Analyses of Sweet Detar (*Deterium Senegalense*)

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Abstract

Detarium microcarpum also known as sweet detar tree, is an underutilized tree legume that grows natively in the drier parts of West and Central Africa. Referred to as taura in Hausa language. Proximate composition, functional and qualitative phytochemical analysis was determined on the three parts of the sweet deter fruit (Bark, flesh and whole fruit). The result shows no significantly in the moisture content of the whole fruit (9.29%) and bark (9.30%) compared to the fruit pulp (8.95%). Ash contents should no significant difference between the pulp (1.87%) and the bark (1.92%). High protein content was observed in the fruit pulp (9.94%), while high fiber content was observed in the whole fruit. The fruit showed a significantly low fat content (2.49, 2.98 and 2.70%) respectively. Water absorption capacity shows a significantly different result with the highest in the pulp (8.90%) and the lowest in the bark (7.08%). The pH of both samples where acidic (5.5, 5.6 and 5.5), respectively. The fruit pulp gelatinized higher with about 70% compared to the other samples (bark and whole fruit). Flavonoids was found in abundance in the pulp, while moderate in the bark and the whole fruit. Alkaloids where mild in all the samples. Steroids where observed in abundance in all the samples, but no tannins where observed.

Key Words: *Deterium senegalense, sweet deter, phytochemical, extraction, Taura*

Introduction

In Nigeria, several wild fruits remain unknown or less exploited by the local population, despite their importance and their richness in health promoting compound (Sourou *et al*., 2020). Edible wild plants are incredibly nutrient-dense and can serve as a great source of additional vitamins and minerals (Duguma, 2020). They can also be used to augment dietary needs. Wild edible plants are utilized by various ethnic groups in Nigeria as supplemental, seasonal, or survival food sources; as such, they help to reduce food insecurity (Zahra'u *et al*., 2014). *Detarium senegalense* commonly known in English as sweet deter is a tree that is found in Africa (Olatunji et al., 2021). Sweet detar tree is common in tropical Africa, found near the coast and known for its round pods (Olatunji *et al*., 2021). It is a spherical drupe with a diameter of 3 to 8 cm, with a large stone in the center, surrounded by green, fibrous, acidic and sweet flesh pulp. The fruits are highly appreciated and widely used in the form of honey or fresh fruits (Ndiaye *et al*., 2016). The tree's leaves, seeds, and fruit pulps are all useful in various ways both as food and medicinal (Nwozo *et al*., 2018). Sweet deter fruit is well received in Nigeria and Senegal, mainly consumed as drinks, marmalades, as soup thickeners, sorbets or in its fresh form (Dossa *et al*., 2020). The pulp of the fruit is traditionally used against rheumatism, kidney disease, spinal tuberculosis, fever medication, eye ointment, enema, poison remedy, and skin disease treatment, making it a valuable resource in eastern Nigeria (Nwozo *et al*. 2016). Sweet detar, a wild fruit tree with numerous applications, is economically feasible in West Africa and has the potential to contribute significantly to food security. The fruits are widely utilized and sold for a variety of reasons (Neuenschwander *et al*., 2011). Oibiokpa *et al*., 2014 reported the nutritional composition of the fruit; moisture content of sweet deter as 11.06%, ash content 4.47%, crude fat 2.23%, crude fiber 12.19%, protein 4.68% and carbohydrate content of 65.38%. The mineral composition of the fruit was reported to be; calcium (70.97mg), iron (78.71mg), potassium (908.10mg) and magnesium (113.50mg). The fruit was reported to have a vitamin C content of 55.10mg/100g, vitamin B_2 (4.20mg/100g) and vitamin E (12.44mg/100g) (Adamu & Nzelibe., 2022). Sweet detar fruit was also reported to have high phenols, flavonoids and other antioxidants (Dossa *et al*., 2020). Despite its nutritional value, the fruit is not fully utilized. The fruit has always been used locally by children; they eat it as dessert/snack. It is underutilized and not fully known throughout the city or in the international world. The fruit production is close to zero. Screening and integrating the fruit into our food system will be a step forward to improve our diet status by increasing the nutritional level, given the composition of the foods that reach in functional characteristics and demonstrating the work of compounds contained in fruits. A thorough examination of the sweet deter fruit's nutritional value and antinutritional characteristics is necessary before incorporating it into culinary products and that leads of the objectives of this research.

Materials and Methods

Sample Collection

The sample of sweet detar was purchased from Wudil market, Kano State. The samples were transported under careful condition to the food processing laboratory of Food Science and Technology Department, Kano University of Science and Technology Wudil, for further assessment. All the chemicals used were of analytical grade and distilled water was used for all the cleaning and preparation of solution. Figure 1 shows a pictorial view of the sweet detar.

Fig. 1 Sweet Detar

Sample preparations

The sample preparation was carried out by separating the fruit pulp from the whole fruit, bark of the fruit was also collected and the whole fruit of the sweet detar was used as well. The fruit separation was done using sharp laboratory knife, which was then packaged and stored at room temperature prior to analysis.

Extraction for Phytochemicals

Ten (10 grams) of sample was added into a conical flask containing 100 ml of solvent (ethanol) (at room temperature) and then plugged with cotton wool. The mixture was kept at room temperature for 48 hours. After which, the mixture was filtered using filter paper which yielded crude extract (Rodríguez-Miranda *et al*., 2012)

Methodology

The moisture content, ash content, fiber, crude fat, and crude protein was analyzed using association of analytical chemists (AOAC) official method (2005) and carbohydrates by difference. Bulk density and pH. Was determined using the method described by Wan *et al*. (2014). Gelatinization of the fruit samples were determined according to the method described by O'Kane *et al*. 2005, while, solubility and water Absorption capacity was determined according to the method described by Rodriguez-Ambriz *et al*. (2005). Qualitative phytochemicals analysis of the sweet deter fruit was carried out on the samples using the standard method to identify phytochemicals constituents according to the methods described by Vertuani *et al.*, 2002. Triplicate sample was used to obtain measurement values which was reported as mean ± standard deviation. One-way ANOVA was used to teste the statistical significance ($P<0.05$) using Turkey test. Minitab statistical software was used for the statistical analyses.

Results and Discussion

From the result obtained in table 1.0 below, the moisture content of the pulp (8.95%) has a lower mean compared to other samples. The whole fruit (9.29%) and the peel (9.30%) show no significant different at $p>0.05$. The ash content shows no significant different at $p>0.05$ in the pulp which has a value of 1.87% and 1.92% for the whole fruit, while the peel differs with a mean value of 1.59%. The fiber content ranges from 4.87%, 6.95% and 8.47% for the pulp, whole fruit and the peel respectively. This shows that there is significant different between the three samples at $p<0.05$. Protein ranges from 9.42% for the pulp, 9.94% for the whole fruit and 8.82% for the peel which statistically shows significant different for the three samples at $p<0.05$. The calculated carbohydrate ranges from 72.40%, 68.90% and 69.12% for the pulp, whole fruit and the peel respectively. The result showed that the peel and the whole fruit are not significantly different at $p>0.05$ compared to the pulp which has a mean value of 72.40%. The result of the moisture, fat and carbohydrate content of the sweet deter was in line with that reported by oibiokpa *et al*., 2014, while the ash, fiber and protein content were lower than that obtained in this research.

The difference in the proximate composition may be due to the climate condition or species of the samples. The samples of oibiokpa et al., 2014 were obtained from Niger state, while the one used in this studies from Kano state. Table 1.2 present the functional properties result. As seen in the table, water absorption is higher in the bark (8.90%), followed by the whole fruit (8.80%) and lowest in the fruit pulp (7.00%), there is no significant difference at P≤0.05 between the whole fruit and the peel. The pH was found to be 5.5 for the pulp, 5.6 for the whole fruit and 5.5 for the fruit peel. There was no difference in the pH of all sweet detar samples. The gelatinization properties were determined and the temperature was recorded as the gelatinization temperature. The gelling temperature was found to be 70 °C for the pulp and the peel compared to the whole fruit which has a mean value of 60 °C. Table 1.3 shows the phytochemical analysis results for the bark, pulp section, and whole fruit of the sweet detar fruit. The phytochemical examination of the fresh sample found that flavonoids are highly available and abundant in the pulp and whole fruit, but moderately available in the peel. Phytochemicals are compounds produced by plants through primary or secondary metabolism. They often have biological functions in plants and play a role in plant growth or resistance to diseases, competitors and predators (El-beltegiet *et al*., 2018). Steroids where found in abundant in both the pulp entire fruit and the peel fruit. Studies have shown that steroids have anti-hyperglycemic properties as well as treatment of tumors and inflamed or ulcerated tissues. Tannins are absent in the peel, pulp, and whole fruit, although alkaloids are moderate in all three sample.

Table 1. Proximate Composition (%) of the Different Parts of Sweet detar

Parameters (%)						
Sample code	**Moisture**	**Ash**	**Fiber**	**Fat**	**Protein**	**Carbohydrate**
Pulp	8.95±0.01[a]	1.87±0.02[a]	4.87±0.04[a]	2.49±0.11[a]	9.94±0.14[c]	72.40±0.32[b]
Peel	9.30±0.21[b]	1.92±0.04[a]	6.95±0.07[b]	2.98±0.03[c]	9.42±0.04[b]	68.90±0.29[a]

Conclusion

The qualitative results obtained shows that the sweet deter fruit extracts (pulp, peel and whole fruit) contain a good quantity of antioxidants. This may help as anti-inflammatory effects and protect cells from oxidative damage that can cause disease such as heart disease, diabetes, cancer and cognitive impairment. Flavonoids have been reported to be potent free radical scavengers with potent anticancer properties that prevent oxidative cellular damage and prevent all stages of carcinogenesis, while alkaloids are reported to have important pharmacological properties for bacteria and bactericidal bacteria. In contrast, sweet detar fruit samples can be very useful and a valuable raw material resource in Nigeria. With the increase in food security and the current economic situation of the country, utilizing the available local raw materials will be a step forward and an economic boost to the country

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