

PAPER 157 – EFFECT OF ROASTING TIME ON THE PROXIMATE AND ANTI-NUTRITIONAL COMPOSITIONS OF DELONIX REGIA SEED FLOUR

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ABSTRACT

This study aimed at investigating the effects of roasting time on proximate and anti-nutritional compositions of *Delonix regia* seed flour. The seeds were divided into four samples (A-D) of 1kg each. Sample A served as the control (not roasted) while samples B, C and D were roasted for 30, 60 and 90 minutes respectively at a temperature of 150°C. All the samples were afterwards dehulled and milled into a coarse particle size of about 3mm. The proximate and anti-nutritional properties were determined using standard analytical procedures. The results showed that the moisture and ash contents were reduced to 5.90% and 6.26% respectively with an increase in roasting time. The protein content of the flour increased with roasting time with the highest value of 31.52% recorded at 60 minutes. The highest value (10.70%) of fat was observed at 30 minutes roasting time while for crude fibre and carbohydrate contents, roasting reduced their values when compared with the control sample. All anti-nutritional properties evaluated (tannin, phytate, saponin, cyanide and oxalate) reduced with an increase in roasting time. Roasting of *Delonix regia* seeds can therefore help to reduce the anti-nutritional factors while enhancing some proximate qualities of the flour which in turn, can be explored as a protein source for animals' feed.

KEYWORDS: *Delonix regia*, roasted seed flour, proximate composition, anti-nutritional composition

1. INTRODUCTION

Delonix regia, is a wild, deciduous and ornamental tree belonging to the legume family (*Fabaceae*). It is called different names in different parts of the world where it is being grown, for instance, it is usually referred to in English as flame of the forest, peacock flower, flamboyant or flame tree; as Krisnachura in Bangladesh, in Bengali as chura or Radha and in French, as poinciana. The Hindus referred to it as gul mohr, shima or sunkesula and mayirkonrai, panjadi in Tamil (Ebada et al., 2023; Mayuri et al., 2022). Though the *Delonix* tree has its origin in Madagascar, it is widely cultivated in many tropical and subtropical countries (Sharma & Arora, 2015; Tura et al., 2015). Under favourable conditions, *Delonix regia* grows to a height of more than 15 m and produces pods which are 5 cm broad and 30-60 cm long, containing several seeds during the fruiting season (Alagbe et al., 2020; Umanah et al., 2019).

In fact, as reported in the literature, all the parts of the *Delonix regia* tree possess beneficial effects. The leaves, bark, flowers, root, fruit and seed have been reported to have anti-inflammatory, anti-microbial, anti-ulcer, anti-diarrheal, hepatoprotective, anti-diabetic, gastroprotective and antioxidant properties (Adejumo et al., 2019; Alagbe et al., 2020; Oyedeji et al., 2017; Umanah & David, 2021; Wang et al., 2016). This is because the plant is rich in phytochemicals and bioactive compounds such as phenolic compounds, flavonoids, tannins, steroids and carotenoids (Alagbe et al., 2020; Shewale et al., 2012). A study carried out by Ebada et al. (2023) recommended the use of pigment extracted from the flower of *Delonix regia* as additives in food formulation as colourants and sweeteners. This plant, especially the seed oil also has potent insecticidal activity as reported by Tura et al., (2015).

Delonix regia seed is another useful part of the plant, though it is often underutilized. Certain studies have shown that the seeds contain up to 36% crude protein and 9.39% lipids (Bake et al., 2016; Umanah et al., 2019). This can be a very good boost in the diet of both animals and man alike if adequately explored. However, proper utilization could be limited due to the presence of antinutrients in the seed which interfere with the bioavailability of nutrients in the body and can pose serious physiological and pathological dangers (Umanah & David, 2021). These anti-nutrients such as oxalic acid, phytates, phytic acid, lectins, and saponin which are present in the seed can be eliminated or reduced drastically by appropriate processing methods like cooking, boiling, roasting or germination. This will enhance the potential of the seed as flour, meal and diet formulation for livestock and probably human beings. Therefore, this study was aimed at investigating the effects of roasting time on the proximate and anti-nutritional composition of *Delonix regia* seed flour with a view to enhance its utilization.

2. MATERIALS AND METHODS

2.1 Sample Preparation and Production of *Delonix regia* Seed Flour

Four (4) kg of *Delonix regia* seeds were obtained from the Federal University of Technology, Minna and conveyed to the laboratory for analysis; the seeds were collected manually, sorted and washed to remove contaminants. Other materials used include; a conical flask, Soxhlet apparatus, distil water, weighing balance, Kheldjal apparatus, measuring cylinder (200 ml), oven, air circulated oven, filter paper, volumetric flask (250 ml), heating mantle, burettes, milling machine. The seeds were divided into four samples A, B, C and D. Sample A was used as control (raw) and the initial moisture content was determined. Samples B, C and D were roasted in an oven at a temperature of 150°C for 30, 60 and 90 minutes, respectively, and then de-hulled and milled into a coarse particle size of about 3 mm and packaged for further analysis.

2.2 Proximate and Anti-nutrient Contents

Association of Analytical Chemists, AOAC (AOAC, 2005) standard procedures were used for the analysis of the proximate composition (moisture, fat, protein, ash, and crude fibre) and the antinutrients (tannin, phytate, saponin, cyanide and oxalate) of the seed flour samples and carbohydrate content was calculated by difference. All analyses were carried out in triplicate. The methods used were similar to the ones reported by Oyediji et al., (2017)

3. RESULTS AND DISCUSSION

3.1 Effect of Roasting Time on the Proximate Composition of *Delonix regia* Seed Flour

The effect of roasting time on the proximate composition of *Delonix regia* seed flour is presented in Table 1. The moisture contents of roasted *Delonix Regia* seed flour range from 8.10 % in sample B which was roasted for 30 minutes to 5.90% in sample D (roasted for 90 minutes). Both roasted samples and the control had moisture contents that are within the safe range (14% or less) for dried agro-products (Vera Zambrano et al., 2019). It was observed from the study that the higher the roasting time of the seeds, the lower the moisture content of flour obtained. These values were lower than those recorded for raw and cooked *Delonix regia* seed meal incorporated in fish feed (Umanah & David, 2021) and for *Delonix regia* seeds (Oyediji et al., 2017). However, almost the same range of values of moisture content obtained in this study were reported by Alagbe et al., (2020) for *Delonix regia* leaves and roots. The variations in the moisture content obtained may be due to the season of harvest, processing methods, varietal differences or temperature of processing. The ash content of roasted *Delonix regia* seed flour of samples B, C and D is 8.81%, 6.55% and 6.26% with a control (sample A) of 9.2% respectively. Sample D which was roasted for 90 minutes had the lowest ash content. The results of the ash content obtained were higher than the 4.14% (toasted sample at temperature between 60 and 80°C) and 6.35% (raw sample) reported by Bake et al., (2016) and 5.93% (raw sample) reported by Abulude & Adejayan, (2017). Similarly, the highest fat content obtained in this study (10.70% for sample B which was roasted for 30 minutes) was higher than the value obtained by Bake et al., (2016) for toasted *Delonix regia* seed. These varying values obtained for the roasted samples compared to that obtained by Bake et al., (2016) may probably be due to the difference in roasting temperature and time used for processing the *Delonix regia* seed flour.

A reduction in the crude fibre content of roasted *Delonix regia* seed flour was observed from 8.57% in the control sample to 7.92% in sample B (30 minutes roasting time) and then an increase from this value to 8.21% at 90 minutes roasting time. However, this value is lower than the one for the control sample; so, it can be concluded that roasting *Delonix regia* seed reduces the crude fibre content of the flour. Higher values of crude fibre were reported by Olufayo & Falola, (2018) for raw, soaked and roasted *Delonix regia* seed. Increasing the roasting time of *Delonix regia* seed flour resulted in a rise in protein content. At 60 minutes of roasting, the protein content increased from 21.01% in the control sample to 31.52%, but it later declined to 28.01% at 90 minutes of roasting. It can be deduced that an increase in the roasting time of *Delonix regia* seed above 60 minutes will negatively affect the protein content of the flour. The protein values obtained from this study are higher than those reported for soaked, cooked, parboiled and roasted *Delonix regia* seed (Lamidi & Evien, 2019); *Delonix regia* leaves and roots (Alagbe et al., 2020); raw and cooked *Delonix regia* seed used for fish meal (Umanah & David, 2021). The highest carbohydrate content (47.93 %) obtained from this experiment was observed in the control sample and reduced to 42.49% in sample D. However, these values are higher than the 30.10% obtained by Abulude & Adejayan, (2017) but lower than 48.34% reported by (Oyediji et al., 2017) for raw *Delonix regia* seed.

Table 1: The effect of roasting time on the proximate composition of *Delonix regia* seed flour.

Roasting Temperature	150°C			
Sample Label	A	B	C	D
Roasting Time	Control	30min	60min	90min
Moisture Content (%)	8.50	8.10	6.15	5.90
Ash (%)	9.20	8.81	6.55	6.26
Fat (%)	4.79	10.70	8.70	9.13
Crude Fibre (%)	8.57	7.92	7.99	8.21
Protein (%)	21.01	24.51	31.52	28.01
Carbohydrate (%)	47.93	39.96	39.09	42.49

3.2 Effect of Roasting Time on the Anti-Nutritional Composition of *Delonix regia* Seed Flour

Anti-nutrients, just like the name implies, hinder or go against the actions of nutrients in the body of both humans and animals. They are chemical substances found in plants that have the capability of affecting the availability of nutrients by interfering with metabolic processes (Okezie et al., 2017). The effect of roasting time on some anti-nutritional composition of *Delonix regia* seed flour is presented in Table 2.

Table 2: The effect of roasting time on some anti-nutritional composition of *Delonix regia* seed flour.

Roasting Temperature	150°C			
Sample Label	A	B	C	D
Roasting Time	Control	30 min	60 min	90 min
Phytate (mg/100g)	634.90	410.86	402.39	392.43
Tannin (mg/100g)	1224.20	561.21	560.90	550.68
Cyanide (mg/100g)	551.28	228.21	213.33	203.46
Saponin (mg/100g)	746.92	560.40	521.60	490.74
Oxalate (mg/100g)	550.29	222.21	210.08	201.78

The phytate content of roasted *Delonix regia* seed flour reduces from 634.90 mg/100g in the unroasted sample to 392.43mg/100g after roasting the seeds for 90 minutes. The values were higher than those reported for selected green vegetables in Afaha Eket, Akwa-Ibom State, Nigeria (Okezie et al., 2017) and for *Delonix regia* seeds incubated in vitro with *Pennisetum purpureum* (Olufayo & Falola, 2018). The obtained tannin contents of roasted *Delonix regia* seed flour are 1224.20 mg/100g, 561.21 mg/100g, 560.90 mg/100g and 550.68 mg/100g for samples A, B, C and D respectively. It was observed that the tannin in the seed flour of *Delonix regia* reduced

as the roasting time increased. Sample D which was roasted for 90 minutes has the lowest tannin content. The results of the tannin content obtained were lower than the 882 mg/100g (roasted) and 2274 mg/100g (raw) reported by Bake et al., (2016). This may probably be due to the difference in roasting temperature and time used for processing the *Delonix regia* seed. There was a reduction in the cyanide content of roasted *Delonix regia* seed flour from 551.28 mg/100g in sample A to 203.46 mg/100g in sample D. The results of the cyanide content obtained were higher than the 7.15 mg/100g and 19.45 mg/100g reported for toasted and raw *Delonix regia* seed meal in the diet of *Clarias gariepinus* fingerlings (Bake et al., 2016). The saponin contents of roasted *Delonix Regia* seed flour obtained in this study are 746.92 mg/100g, 560.40 mg/100g, 521.60 mg/100g and 490.74 mg/100g for samples A, B, C and D respectively. The lowest saponin content was observed in sample D which was roasted for 90 minutes. The results of the saponin content obtained were higher than those reported for raw *Delonix Regia* seed (Oyededeji et al., 2017) and *Delonix regia* seeds which were roasted, soaked, parboiled and cooked (Lamidi & Evien, 2019). The oxalate content of roasted *Delonix regia* seed flour varied between 550.29 mg/100 in the control sample and 201.78 mg/100g in sample D which was roasted for 90 minutes. The results of the oxalate content obtained were higher than the 10.15 mg/100g (roasted) and 45.46 mg/100g (raw) reported by Bake et al., (2016) and 2.57 mg/g (raw sample) reported by Oyededeji et al., (2017).

4. CONCLUSION

The effects of roasting time on proximate and anti- nutritional compositions of *Delonix regia* seed flour were studied. It can be concluded from the study that roasting time has varying effects on the proximate composition of *Delonix regia* seed flour while decreasing the anti-nutritional factors present in the *Delonix regia* seed flour. It was also observed that the protein content increased with an increase in roasting time. *Delonix regia* seed flour can therefore be incorporated into certain animal feed to boost the protein content.

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