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Nutrient digestibility of Broiler fed roasted pride of Barbados (*Caesalpinia pulcherrima*) seed meal

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ABSTRACT
An eight weeks (56 days) experiment was conducted using seventy two broilers to investigate the effect of roasted pride of Barbados seed meal on the performance and nutrient digestibility of finisher broilers. The finisher broilers were allocated to four dietary treatments. The treatments were replicated thrice at six broilers per replicate. The dietary treatments were formulated with 0, 5, 10 and 15% inclusion level of roasted pride of Barbados seed meal. The experimental layout and the data were arranged in a completely randomized designed. Inclusion of roasted pride of Barbados seed meal resulted in a fluctuation in the final live weight of broilers fed experimental diets. The highest (P<0.05) final weight (2390 g) and highest weight gain (2340 g) was obtained in 10% inclusion level of roasted pride of Barbados seed meal while the lowest (P<0.05) find weight (2000 g) and lowest weight gain (1950 g) was obtained in 15% inclusion level of roasted pride of Barbados seed meal. The highest crude protein (62.98%) digestibility was recorded in diet containing 0% inclusion level of roasted pride of Barbados seed meal, while the lowest crude protein (60.16%) digestibility was obtained in diet containing 15% inclusion level of roasted pride of Barbados seed meal. The results suggest that 10% inclusion level of roasted pride of Barbados seed meal could be effectively used for good performance and nutrient digestibility.

Keywords: Performance, nutrient digestibility, roasted pride of Barbados, finisher broilers.

1. Introduction
Poultry production accounts for the major parts of all meat produced in many developing countries, being an integral component of nearly all rural, peri-urban and urban households. Poultry are of considerable significance to rural as well as national economics [1]. The major locally available plant protein sources commonly found used in poultry feed production are soya bean meal and groundnut cake has been reported to be scarce and expensive. The use of pride of Barbados seed meal in poultry nutrition has been established and success was recorded particularly in broiler chicken. Legumes are very important sources of protein, lipids and other nutrient like minerals and vitamins for proper growth. However, the quality of leguminous plants is influence by the anti-nutritional factors present in them which make them unsuitable for consumption in their natural form [2]. It is known however that processing techniques like fermentation, roasting, germination and autoclaving can improve nutritional quality and bioavailability of nutrients present in legumes. The objective of this study was to ascertain the performance and nutrient digestibility of broiler fed roasted pride of Barbados seed meal.

2. Materials and Methods
2.1 Experimental location
The experiment was carried out at the poultry farm of Birganj, Nepal. The average minimum temperature was about 27.5 °C and maximum average temperature of about 35.5 °C during the experiment. The average humidity in the study area was 58.0%. The experiment was carried out during June to September.

2.2 Preparation and processing of Test Ingredient
Ripened pod of pride of Barbados seed were collected from local garden between the months of February and March, 2013. The mature pods were processed to remove the seeds in lateral arrangements.

Over 5 kg seeds were collected and roasted at 100-110 °C using open flame for up to 17 minutes in an open pan. During roasting about 1.5-2.0 kg of the seeds were added intermittently into the pan set over the burning firewood. A small quantity of sand was added and the content stirred repeatedly to prevent charring. The seeds were considered roasted when about 75-80% of the seeds cracked. The seeds were then spread out to cool after which they were milled into roasted pride of Barbados seed meal using a hammer mill with a sieve size of 3 mm. The meal produced was used to formulate four isocaloric and isonitrogenous experimental diets.

2.3 Experimental Animals and their Management
A total of seventy two day old Broiler chicks were used in the farm house. Prior to start the experiment, the brooding pen had been previously washed and cleaned thoroughly with disinfectant. The birds were divided into four brooding unit each brooding unit has three replicates in a completely randomized design. The birds were weighed and their average weights per unit were determined. The birds were maintained with a twenty-four hours constant light schedule during brooding. Feed and water were supplied *ad libitum* throughout the experiment.

2.4 Experimental Diet
Four experimental diets were formulated for the starter (0-4 weeks) and finisher (5-8 weeks) phase. Four inclusion levels of experimental ingredient were added at 0%, 5%, 10%, and 15% respectively.

2.5 Digestibility Trial
Digestibility trial was conducted at the 7th week of the finisher phase to determine the apparent nutrient digestibility. Two birds were selected from two of the replicates in each treatment and place in metabolic cage, known weight of feed which matched their daily feed intake was fed to the birds for seven days. The birds were first acclimatized to the metabolic cage for the first two days. On the third day, the birds were starved for twenty-four hours daily excreta voided per bird for the remaining four days were collected and dried to a constant weight at 70 ^{0}C. Dried excreta sample were used to determine their respective proximate composition [3].

2.6 Quantification of Toxins in RPBSM
The roasted pride of Barbados seed meal were determined for tannin using modified vanillin assay, Oxalate by a procedure [4], Phytate method [5] and Saponin by Hudson and El-Difrawi method [15].

2.7 Determination of Proximate Analysis
Samples of pride of Barbados seed, experimental diet and faecal droppings were analyzed on dry matter basis for proximate composition [3].

2.8 Experimental Design
The experimental design used was completely randomized design (CRD)

2.9 Statistical Analysis
Data obtained in the study were subjected to analysis of variance (ANOVA) using Statistical Package System Software (1999) and where differences exist between means Duncan's Multiple Range Test was used to separate the means at 5% probability level [6].

3. Results
3.1 Performance
There was significant difference in all the parameters measured across the dietary treatment, the highest final weight (2390 g) and weight gain (2340 g) were obtained in diet 3 (10% inclusion level of pride of Barbados seed meal) while the lowest value (2000 g) and (1950 g) for final weight gain respectively were recorded in diet 4 (15% inclusion level of roasted pride of Barbados seed meal). The highest feed intake (4970 g) was obtained in diet four while the lowest feed intake (4700 g) was recorded in diet 1 (0% inclusion level of roasted pride of barbados seed meal). The best feed conversion ratio (2.09) was recorded in diet 1 while the lowest feed conversion ratio was recorded in diet 4. The percentage mortality fluctuates across the dietary treatment.

3.2 Nutrient Digestibility of broiler fed experimental Diet
There was significant difference (P<0.05) in all the parameters measured for nutrient digestibility of broiler fed experimental diets. The highest dry matter digestibility (97.68) was recorded in diet 2 (5% inclusion level of roasted pride of Barbados seed meal). The highest crude protein (62.98) digestibility was recorded in diet 1 while the lowest crude protein (60.18) digestibility was recorded in diet 4. The highest ether extract (47.63) was recorded in diet 2 (5% inclusion level of roasted pride of Barbados seed meal) while the lowest (45.92) was recorded in diet 3 (10% inclusion of roasted pride of barbados seed meal).

4. Discussion
There were significant (P<0.05) difference in average weight gain, average feed intake, feed conversion ratio and mortality percentage across the dietary treatment. The final weight and average weight gain of the birds fluctuate across the dietary treatment. This result negates the findings [7] who reported a decrease in final body weight gain across the dietary treatment. The best feed conversion ratio (2.09) was recorded in diet 1 (0% inclusion level of roasted pride of Barbados seed meal). This result is in agreement with [7] who reported the best feed conversion ratio in diet 1 (2.5% inclusion level of toasted *Daniella oliveri* seed meal). The highest mortality percentage (41.79) was recorded in diet 3 (10% inclusion level of roasted pride of Barbados seed meal) while the lowest mortality percentage (34.82) was recorded in diet 4 (15% inclusion level of roasted pride of barbados seed meal). This result is in agreement with the findings [7] who reported the highest percentage level in broilers fed 6.67% inclusion of toasted *Daniella oliveri* seed meal.

The highest dry matter digestibility was in diet 2 (5% inclusion level of roasted pride of barbados seed meal) while the lowest was in diet 1. This result negates the findings [7] reported the highest dry matter digestibility in diet 1. The highest crude protein, crude fibre and ash digestibility was recorded in diet 1 and this supports the findings of [7] who reported the highest crude protein, crude fibre and ash digestibility of broiler fed roasted *Daniella oliveri* seed meal.

The nutritional importance of a given feed depends on the nutrient and anti-nutritional constituents [8]. The values of phytate contents determined (0.06%) were lower than 234.00±3.60 mg/100 as reported for raw lima beans and lima beans boiled for 160 minutes respectively. The level of oxalate recorded was below the values reported for *Manihot esculenta*. Phytate, polyphenol oxalate affect bioavailability of composite nutrients. They complex with bivalent ions like Ca, Mg, Fe and Zn making them unavailable especially in monogastric animals [9]. Roasting reduced the tannin content to 0.02% this is in agreement with who reported [10] that about 30-40% of polyphenols can be removed from *Phaseolus vulgaris* by cooking and discarding the cooking water solution and since most tannins are located in the testa, its physical removal reduced tannin content. It shows that roasting led to a decrease in the level of saponin, phytate, tannin and oxalate. It therefore exerts positive effects as anti-nutritional factors are known to affect poultry birds negatively.

The results of proximate analysis of roasted pride of barbados seed shows that roasted pride of barbados seed meal has higher dry matter content than that of the raw pride of barbados seed meal and this shows that most of the moisture content of the roasted pride of barbados seed meal had been removed during roasting process [11]. The crude protein content of the roasted pride of barbados seed meal (21.93%) was lower than that of raw pride of barbados seed meal (23.96%), this might be as a result of the processing method employed to detoxify the anti-nutritional factors. The reduction in crude protein content of the roasted pride of barbados seed meal is in agreement with earlier reports on jack bean [12] and could possibly be due to damage on the nitrogenous compounds during roasting and also as a result of differences in geographical location. The crude fibre contents of roasted pride of barbados seed meal (5.86%) was lower than that of raw pride of barbados seed meal (6.81) this reduction in crude fibre contents of roasted pride of barbados seed meal could be attributed to the removal of the seeds hull during roasting [13]. The ash contents of roasted pride of barbados seed meal was lower (4.41%) than that of raw pride of barbados seed meal (4.64%), thus indicating that the roasted pride of barbados seed meal contained reasonable amount of potash which implies that these seeds are good source of minerals. The ether extract of the roasted pride of barbados seed meal were lower than that of raw pride of barbados seed meal (3.96%) and also lower than the 22.8-23.5% reported for soybean [14]. These results confirmed the findings of Ega [15] that whole seeds of legumes are richer than detoxified seeds in lipid contents and this indicates that roasted pride of barbados seed meal as a low fat feedstuff is good for lean broiler production. The ether extract content in detoxified pride of barbados seed meal was significantly reduced as a result of the effect of roasting and possibly due to burning off of lipid related compound [12].

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