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# PERFORMANCE AND NUTRIENTS DIGESTIBILITY OF PIGLETS FED DITARY DETOXIFIED *BALANITES AUGYPTIACA* FRIUTS

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**ABSTRACT**

A feeding trial was conducted to assess the effect of dietary detoxified Nigerian *Balanites aegyptiaca* fruits on performance and nutrients digestibility of weanling pigs. Twenty pigs weighing averagely 4.5 ± 0.85kg were used for the experiment which lasted for one month. The pigs were randomly allocated to the five dietary treatments in a completely randomized design. Five diets made of a corn-soy control diet and four others to which 20% of boiled, roasted, boiled and roasted, boiled and fermented respectively were used. Feed consumption and weight gain of pigs maintained on the Balanites based diets were comparable with the conventional diet ($p > 0.05$). However, efficiency of feed utilization on the Balanites containing diets was inferior to that on the control diet ($p < 0.05$). Nutrients digestibility measured by dry organic matter and crude fiber were not significantly influenced ($p > 0.05$) but protein and fat digestibility were significantly influenced by dietary Balanites ($p < 0.05$). Gross energy intake and daily retained energy were significant on Balanites containing diets ($p < 0.05$) relative to the reference diet while the metabolizable energy was not affected ( $p > 0.05$). Nitrogen consumption using indices of protein intake, fecal nitrogen output, daily retained nitrogen and nitrogen retention coefficient were not significantly different from values obtained on the control diet ($p > 0.05$). It was therefore concluded that *Balanites aegyptiaca* fruits, when detoxified by any of the traditional methods adopted, could be incorporated in diets for livestock even up to 70% inclusion level without deleterious effects on animal consuming the feed.

**KEY WORDS**: *Balanites aegyptiaca*, weanling pigs, performance, nutrients digestibility.

## INTRODUCTION

The 68g of animal protein per head per day for man recommended by FAO (1982) is a standard yet to be attained in many developing tropical countries of the world. Nigeria for instance, consumes only about 18.7g per head a day (Olayide et al., 1972) as against the minimum recommendation of 35g animal protein intake (FAO, 1986). On the global level, 40% of the world's population is malnourished especially in countries where people live mainly on cereals, grains and tubers that cannot supply some essential amino acids needed for growth and development. Animal proteins contain most of the nutrients: essential amino acids, minerals and vitamins which cannot be obtained from vegetables. This fact calls for an increase in production of animal product. Besides, the livestock industry in Nigeria represents a very important national resource since it contributes substantially to the national wealth and also supply the populace with the important animal protein required for healthy living (Kallah, 1992). However, for good management to give an appreciable result in terms of animal production and products especially meat, egg and milk, the role of feed and feeding must be given high consideration.

Two classes of animal which production can contribute rapidly to the available meat supplies on the short run are swine and poultry. Pig production is very important because most agro-based industries depend on its products of pork, leather, bacon and fat used in soap making industries. Also, when rapid increase in animal products supply over a short period of time is required, this class of animals is useful. Pigs are highly prolific, produce at a short generation interval, they mature early and are efficient converters of even poor quality feeds to meat for human consumption in addition to supplying energy and other uses. Regrettably, pigs, being monogastric animals, compete with man for conventional feedstuffs particularly maize, soybeans, sorghum, millet, groundnuts cake and so on. The competition for the available conventional feedstuffs between man and livestock in developing countries like Nigeria has been identified as the cause of high cost of feeding and consequent animal products (Adeloye and Adebiyi, 1990). The increased competition and scarcity of food have drawn the attention of animal nutritionists and scientists into research on the use of novel feedstuffs that are not staple food for humans to meet the nutritional requirement of farm animals. *Balanites aegyptiaca* fruits in question in this research work is one

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of such unconventional feedstuffs that is not staple food for human that may meet the nutritional requirement of animals. *Balanites aegyptiaca* belongs to the family Balanitaceae and is commonly known as desert dates, thorn tree, soapberry tree, Egyptian balsalm, Zachum oil tree, Teisset, Adoua (in Hausa) and Adowa (Yoruba). It is one of the most common but neglected wild plant species of tropical Africa and south Asia (Hall and Walker, 1991). The plants grow extensively even when neglected and it has been estimated that over 400,000 tons of Balanites fruits are produced in Sudan alone (Mohammed et al. 2006).

Virtually no work has been done on utilization of *Balanites aegyptiaca* fruits in nutrition of non-ruminant animals, hence this present work tends to investigate the nutritional potentials of Nigerian detoxified Balanites fruits on performance and nutrients digestibility of weanling pigs. *Balanites aegyptiaca* is known to contain saponins, tannins, nitrites/nitrates, coumarines and other alkaloids (Archibald, 1933; Kon and Weller, 1939; Hardman, 1969; Hardman and Sofowora, 1972; Clydesdale and Francis, 1985), hence must be detoxified before feeding to monogastric animals for improved performance.

## MATERIALS AND METHODS

*Balanites aegyptiaca* fruits used for this experiment were obtained from Kebbi state in northern Nigeria. The fruits were sun-dried prior to grinding. Milled fruits were further dried to prevent the growth of moulds. The meal was divided into four parts of 30kg each. The four parts were subjected to different traditional detoxification methods namely boiling, roasting, boiling and roasting, boiling followed by fermentation. 30kg Balanites meal was boiled in a pot maintained at about 100$^{o}$C for 1hr after which excess water was strained and the meal sun-dried to constant weight. 30kg Balanites meal was roasted by placing the meal in a hot frying pan heated between 75-89oC and continuous stirring for 15-20 minutes after which the roasted meal was spread to air-dry. Boiling and roasting are combination of the two heat treatment methods described above, while boiling and fermentation were conducted by boiling for an hour, allowing to cool and after the drainage of excess water, the dough was fermented in a carbon-dioxide environment as described by Annongu et al. (1996).

### Diets formulation, experimental animal models and feeding trial

Five iso-nitrogenous and iso-caloric diets were formulated comprising a maize-soybeans based control diet and four other test diets to which 20% boiled, roasted, boiled & roasted and boiled and fermented Balanites test feedstuff was included as shown in table 1.

**Table 1**: Composition of the experimental diets on as fed basis

| Diets | *MSCD | BBD | RBD | BRBD | BFBD |
|---|---|---|---|---|---|
| **Ingredients** | | | | | |
| Maize | 59.93 | 46.93 | 47.93 | 45.93 | 46.93 |
| Soybean meal | 37.00 | 30.00 | 29.00 | 31.00 | 30.00 |
| Balanites meal | 0.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| Lysine | 1.01 | 1.01 | 1.01 | 1.01 | 1.01 |
| Dical.phosphate | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 |
| Limestone | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Vitamin premix | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Anti-microbial premix | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |

*__MSCD__, maize-soybeans control diet; **BBD**, Boiled-Balanites based diet; **RBD**, Roasted-Balanites diet; **BRBD**, Boiled-roasted-Balanites diet; **BFBD**, Boiled-fermented-Balanites diet.

A total of 20 males-weanling pigs weighing an average of 4.45 ± 0.085kg were used for the experiment because considering digestibility trial, males animals are preferred for ease of separate urine and fecal collections. They were randomly assigned to the five dietary treatments. The experimental design was completely randomized. The piglets were first fed a commercial feed for seven days to acclimatize them to the experimental conditions before assigning them to individual pens to be given the test diets. All the management practices were observed in the course of the experimental period which lasted five weeks. While the experiment lasted, data was collected on feed intake, weight gain, efficiency of feed utilization, protein efficiency ratio. Two weeks into the experiment, a nutrient digestibility trial was carried out to determine nutrients digestibility, including energy and protein intake. A pig (male) from each of the five dietary treatment was selected and placed individually in a metabolism cage designed for fecal and urine collection. Fecal and urine collections for determination of digestibility including the calculated feed supplied for the three days of the determination of digestibility were recorded.

### Chemical and statistical analyses

The proximate composition of the Nigerian raw Balanites, the various detoxified Balanites samples, boiled, roasted, boiled & roasted, boiled & fermented, as well as the fecal samples were determined according to the methods of A.O.A.C. (1980).

All data were analyzed according to the analysis of variance using the model for a completely randomized design. Significant differences between treatment

means were further determined using the Duncan multiple range test (Steel and Torrie, 1980).

## RESULTS AND DISCUSSION

**Table 2**: Proximate composition of the Nigerian *Balanites aegyptiaca* fruits

| Nutrients | Concentration (%) |
|---|---|
| Dry matter | 93.00 ± 0.47 |
| Crude protein | 18.00 ± 0.39 |
| Ether extract | 11.02 ± 0.24 |
| Crude fiber | 5.95 ± 1.71 |
| Total ash | 9.10 ± 0.76 |
| Soluble carbohydrate | 49.71 ± 0.01 |
| *Gross energy cal/g | 4.31 ± 0.00 |

*Gross energy value of Balanites fruits was determined using the formula:
CP x 5.8/100 + EE x 9.3/100 + CF x 4.2/100 + NFE x 4.2/100 (Carpenter and Clegg, 1956). Where CP, crude protein; EE, ether extract; CF, crude fiber; NFE, nitrogen free extract

Table 2 presents the proximate analysis of the Nigerian raw Balanites fruits. *Balanites aegyptiaca* is shown to contain dry organic matter, crude protein, crude fat, crude fiber, total ash or mineral matter, soluble carbohydrates, gross energy. The presence of the anti-nutritional factors in Balanites however, may prevent its dietary utilization and availability (Apata and Ologhobo, 1986). The performance of weanling pigs fed diets containing detoxified *Balanites aegyptiaca* is shown in Table 3.

**Table 3**: Performance characteristics of pigs maintained on Balanites based diets

| Diets | MSCD | BBD | RBD | BRBD | BFBD |
|---|---|---|---|---|---|
| **Parameters** | | | | | |
| Mean daily feed intake (g/p/d) | 543 | 540 | 534 | 531 | 538 NS |
| Mean daily weight gain (g/p/d) | 335 | 275 | 255 | 250 | 270 NS |
| Feed conversion ratio (F/G) | 1.62[a] | 1.99[b] | 2.14[b] | 2.1[b] | 2.01[b] * |
| Mortality rate | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*Significant difference ($p < 0.05$)
NS, no significant difference ($p > 0.05$)
a-b, treatment means in the same row not sharing common letters differed significantly ($p < 0.05$).

There were no significant differences in feed consumption, daily body weight gain ($p > 0.05$). Efficiency of food utilization on the control diet was however, superior to that on the test feedstuff in diets ($p < 0.05$). There was no mortality records during the experimental trial. The absence of significant differences in most of the performance parameters of the experimental animal models suggests that the treatment methods used reduced or eliminated the chemical anti-nutrients in the treated Balanites in diets since feeding the fruits raw usually elicits poor performance or negative results.

**Table 4**: Influence of dietary detoxified Balanites on nutrient digestibility in pigs

| Diets | MSCD | BBD | RBD | BRBD | BFBD |
|---|---|---|---|---|---|
| **Indices** | | | | | |
| Dry matter intake (g/p/d) | 506 | 446 | 497 | 442 | 427 NS |
| % DM digestibility | 80.10 | 71.02 | 77.20 | 65.20 | 63.31 NS |
| Protein digestibility (%) | 74.14 | 66.57 | 74.84 | 59.13 | 64.21 * |
| % fat digestibility | 67.18 | 69.64 | 75.79 | 37.19 | 67.85 * |
| Fiber digestibility (%) | 60.11 | 53.78 | 63.79 | 46.58 | 46.93 NS |

Table 4 shows the influence of dietary detoxified Balanites on nutrients digestibility in pigs. No significant difference was observed on dry matter intake, dry matter digestibility and percent fiber digestibility ($p > 0.05$). There were significant differences in digestibility of protein and fat ($p < 0.05$). The significant differences in protein and ether extract digestibility may serve to explain that even though there was some improvement in digestibility of protein and fat of Balanites based diets, the improvement in digestibility on these diets could not equal that on the reference diet.

**Table 5**: Effects of dietary detoxified *Balanites aegyptiaca* on energy utilization in swine

| Diets | MSCD | BBD | RBD | BRBD | BFBD |
|---|---|---|---|---|---|
| **Parameters** | | | | | |
| Gross energy intake (Kcal/kg) | 2.34 | 2.10 | 2.40 | 2.08 | 2.01 * |
| Daily absorbed energy (Kcal/kg DM) | 387 | 296 | 382 | 253 | 238 * |
| *Metabolizable energy (%) | 75.63 | 62.86 | 75.85 | 60.82 | 57.33 NS |

*M. E., was determined using the formula: 53 + 38 (%CP) + 2.2 (%EE) + 1.1 (%NFE) + 0.22(%CF), (Carpenter and Clegg, 1956).

Energy utilization as influenced by dietary detoxified *Balanites aegyptiaca* is presented in Table 5. There was significant difference in gross energy intake and daily absorbed energy ($p < 0.05$), however, no statistical significant difference was recorded on the metabolizable energy ($p > 0.05$), indicating that the reference diet and the Balanites based test diets were comparable in metabolism.

**Table 6:** Nitrogen consumption of pigs as influenced by dietary detoxified Balanites

| Diets | MSCD | BBD | RBD | BRBD | BFBD |
|---|---|---|---|---|---|
| **Indices** | | | | | |
| Nitrogen intake (g/p/d) | 115.00 | 96.50 | 113.00 | 93.00 | 117.00 NS |
| Fecal nitrogen output (g/p/d) | 29.00 | 32.00 | 28.00 | 38.00 | 42.00 NS |
| Daily digested/retained nitrogen (g/p/d) | 86.00 | 65.00 | 85.00 | 56.00 | 75.00 NS |
| Nitrogen digestion/retention coefficient (NRC) | 0.75 | 0.68 | 0.75 | 0.59 | 0.64 NS |

Protein or nitrogen consumption as influenced by dietary detoxified Nigerian Balanites is given in Table 6. No significant differences were recorded on daily nitrogen intake, fecal nitrogen output, daily nitrogen retained or nitrogen retention coefficient ($p > 0.05$). The non-significant difference observed on the nitrogen utilization indices might indicate that the traditional treatment methods adopted, boiling, roasting, boiling and roasting, boiling and fermentation eliminated the toxic anti-nutritional factors that usually prevent the availability and utilization of the nutrients in *Balanites aegyptiaca.*

Based on the findings enumerated, it could be concluded that when Balanites fruits or its other by-products are processed by any of the traditional methods adopted, the inclusion level could be as high as 20% as used in this study or more, without adverse effects on the fed animals.

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