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Effects of Processing Methods of *Leptadenia Hastata* on Growth Performance, Nutrient Digestibility and Carcass Characteristics of Weaner Rabbits

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Abstract: *An experiment was conducted to evaluate the effects of processing methods of Leptadenia hastata on growth performance, nutrient digestibility and carcass characteristics of weaner rabbits. Thirty weaner rabbits of mixed breeds and sexes aged 5-6weeks with an average weight of 650.20g were used for the study. Five diets were formulated with L. hastata that was either washed in water (FRH), hot water processed (HWP), shade dried (SHD), oven dried (OVD) or sun dried (SUD). The rabbits were randomly allotted to five dietary treatments and were replicated three times in a completely randomized design. Results showed that there were no significant (P>0.05) differences in all the parameters measured for growth performance. Nutrient digestibility was significantly (P<0.05) influenced by the treatments. DM digestibility was significantly higher (65.60%) in T1 (FRH) while the lowest value (62.21%) was observed in T5 (SUD). CP digestibility ranged from 34.37-53.04% while the EE was between 70.10-79.03%. The digestibility values for CF and NFE ranged from 40.31-66.15% and 84.00-87.67% respectively. The carcass evaluation revealed that pelt, carcass weight and dressing percentages were significantly (P<0.05) higher in T2 (HWP). The weight of liver, lungs and kidney were significantly (P<0.05) higher in T1 (FSH). The spleen, stomach, caecal weight, caecal length, large intestine weight and small intestine length were all similar across the treatments. It can therefore be concluded that all the processing methods except the FRH can be used to improve the nutritional profile of L. hastata for improved rabbit production.*

Key words: *Processing, Leptadenia hastata, performance, digestibility, carcass, rabbits*

I. Introduction

Animal protein malnutrition has been reported in many developing countries including Nigeria. Animal protein consumption by an average Nigerian is still quite low when compared to the recommended 34g per day by Food and Agriculture Organization (FAO, 2006). This acute shortage of animal protein in the diets of many Nigerians has necessitated the search for other animal protein sources to complement what is available. Rabbit has been looked upon as an alternative animal protein source that can bridge the gap in animal protein consumption due to its very low cost of production, higher feed conversion ratio, higher prolificacy and short generation intervals (Abdu et al., 2011). Rabbits been herbivores has the ability to degrade substantial amount of fibre (non-starch polysaccharides and lignin) the main constituents of commercial rabbit feed (Gidenne et al, 1998; Aduku and Olukosi, 1999).

The use of forages and other agricultural by-products such as Tridax precumbens (Taiwo et al., 2005) Moringa (*Moringa oleifera*) (Odeyinka et al., 2008) Acacia (*Acasia nilotica*) Abdu et al.(2011), composite cassava meal (Ukachukwu et al., 2011), *Commelina benghalensis*, *Leucerna leucocephala*, *Boerhavia diffusa*, Impomia triloba (Yakubu et al., 2012) have been reported.

Leptadenia hastata belongs to the family *Asclepiadaceae* is edible non-domesticated vegetable and it is collected in wild throughout Africa. *L. hastata* is a voluble herb with creeping latex stems, glabescent leaves, glomerulus and racemes flowers as well as follicle fruits. It is typically grown in tropical dry lands in sandy soil. Thomas (2012) reported that the vernacular names for *L. hastata* include: *hagalhadjar* (Arabic) in Chad, *yadiya* (Hausa) in Nigeria and Niger, *hayla* (Kusume) Ethiopia, *ekamongo* (Turkana) in Kenya, *lolongo* (Moore) in Burkina Faso, *tarhat* or *darhat* (Wolof), *busumba amata* (Jola) in Senegal, and *nzongnè* (Bambara) in Mali.

Fresh leaves of *L. hastata* contain 10.86% crude protein, 4.7% crude fibre, 8.18% ether extracts and energy value of 54Kcal/kg. It is also rich in calcium, phosphorus, and potassium. It has appreciable amount of ascorbic acid, and niacin (Hassan *et al*, 2007). The plant is commonly used in Hausa speaking communities of Nigeria as a spice and a sauce (Ibrahim et al., 2012). The local healers also use the plant for hypertension, catarrh and diabetes (Danbata, 2011).

Like any other forage in the tropics, *Leptadenia hastata* contain some anti-nutritive factors (ANFs) including tannin, saponin, glucosides, alkaloids which may interfere with the utilization of the forage (Hassan *et*

al., 2007; Inuwa, 2012). Several studies have been reported on the deleterious effects of ANFs on nutrient digestibility and growth performance of animals (Makkar, 1993, Van soest, 2004. The objective of the study therefore was to evaluate the influence of processing methods of *L. hastata* on growth performance, nutrient digestibility and carcass characteristic of weaner rabbits,

II. Materials and methods

Experimental site

The experiment was conducted at the Rabbitary Teaching and Research Farm of the Federal University of Technology, Yola. Yola lies between latitude 7^o and 11^o N and longitude 11^o and 14^oE. Temperature in this climatic region is high in February, March and April because of high radiation, which is evenly distributed throughout the year. Maximum temperature in the state can reach up to 40^oc particularly in April, while minimum temperature can be as low as 18^oc between December and January. Mean monthly temperature range from 26.7^oc in the South to 27.8^oc in the North Eastern part of the state (Adebayo, 1999).

Collection and processing of L. histata

The leaves were collected around Federal University of Technology, Yola. The leaves were processed using five different processing methods: sun drying SUD), oven drying (OVD), drying under shade,(SHD), washing in water (FRH) and washing in hot water (HWP). Sun drying (SUD) was achieved by spraying the leaves on a concrete floor from 10.00am-5.00pm until they are dried. In oven drying (OVD) the leaves were placed in an oven at 60oC for 24 hours to obtain a completely dried sample. Drying under shade (SHD) involved keeping the leaves under the shade from 10.00am-5.00pm until the leaves were completely dried while in hot water (HWP) processing method, fresh leaves were submerged in hot water at 100^0C for ten minutes, drained and allowed to get dried under room temperature (27^0C) while washing in water (FRH) was achieved by washing the fresh leaves in large quantity of water to remove dust and other contaminants.

Experimental diets

Five diets were formulated with the differently processed *L. histata* leaves. Local and available feed ingredients that included maize, groundnut cake, maize offal, fish meal, salt, bone meal and premix were included in all the dietary treatments to carter for vitamins and micro-minerals. The treatments were designated T1 (FRH) containing fresh leaves that has been washed in water, T2 (HWP) consists of leaves that were washed in hot water, T3 sun dried leaves (SUD), T4 leaves dried under shade (SHD), and T5 oven dried leaves (OVD). The ingredient composition of the experimental diets is shown in Table 1.

Table 1. Ingredients and composition of experimental diets.

	Processing methods				
Ingredients	T1(FRH)	T2(.HWP)	T3(.SHD)	T4(.OVD)	T5(SUD)
Maize	38.00	38.00	38.00	38.00	38.00
L.hastata	10.00	10.00	10.00	10.00	10.00
Groundnut cake	20.00	20.00	20.00	20.00	20.00
Maize offal	27.00	27.00	27.00	27.00	27.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Calculated analysis					
Crude protein	18.15	18.07	17.97	17.66	18.11
Crude fibre	5.22	6.24	6.37	5.97	6.07
Ether extracts	4.41	4.25	4.21	4.51	4.19
NFE	72.22	71.44	71.45	71.85	71.63
*ME kcal/kg	3557.07	3548.96	3542.37	3569.76	3552.32
Calcium	1.48	1.58	1.76	1.71	1.68
Phosphorus	0.61	0.68	0.67	0.66	0.66

*Metabolizable energy = ME (kcal/kg) = 37 x % CP + 81 x % EE + 35.5 x % NFE (Pauzenga, 1985). FRH= Fresh, OVD = Oven dried, SUD = Sun dried, SHD shade dried, HWP = hot water processing, NFE = Nitrogen free extract,

Experimental animals and management

Thirty (30) weaner rabbits of mixed breeds and sexes were purchased from the National Veterinary Research Institute (N.V.R.I) Vom, Plateau state, Nigeria. The rabbits were between 5-6 weeks of age with an average weight of 650g. Each rabbit was housed in an individual cage. Before the commencement of the experiment, the cages were thoroughly disinfected with Diazintol® and were allowed to dry. Each cage was provided with feed and water containers. Prior to the experiment, each animal was dewormed using Piperazine®. Antibiotics and coccidiostats were also administered against bacterial infection and coccidial

infections. The rabbits were fed twice daily in the morning between 7.00am-8.00am and evening between 3.00pm-4.00pm. Feed offered daily and the left over were weighed to determine the feed intake. Water was offered *ad libitum.*

Experimental design

Thirty rabbits were randomly assigned to the five dietary treatments consisting of 6 rabbits per treatment (2 per replicate) in a completely randomized design.

Data collection

Growth performance

The growth performance determined were feed intake, weight gain and FCR was calculated as ratio of total feed intake to total weight gain. Feed intake was calculated as the difference between feed offered and left over after a period of 24hours

Digestibility study

At the 8^{th} week of the experiment, a rabbit from each replicate were randomly selected and placed in metabolic cages. The rabbits were acclimatized for 2 days prior to sample collection. Total sample collection lasted for 5 days. Samples from each replicate were bulked and dried in an oven until constant weight was obtained. The dried samples were milled in a hammer mill before chemical analysis was conducted. The proximate composition of the experimental diets and the faecal samples were analyzed as described (AOAC, 1990)

Carcass characteristics and internal organs measurements

Three rabbits from each treatment were randomly selected at the 8^{th} week to determine the influence of the treatments on carcass and internal organs weight. The rabbits were slaughtered, skinned and eviscerated to obtain the carcass weight and pelt. All the internal organs were separated and weighed.

Statistical analysis

Data obtained were subjected to one way analysis of variance (Steel and Torrie, 1980) and differences were separated using Duncan Multiple Range Test (Duncan, 1955)

III. Results

Proximate composition and some anti-nutritive factors of processed L. histata leaf

The result of proximate composition of processed *L. histata* is shown in Table 2. Crude protein (CP) content varied from 10.40 in T4 to 15.30 in T1 while ether extract (EE) was highest in T4 (9.50) and lowest value was observed in T3 (6.50) and T4 (6.50). The crude fibre (CF) content in T3 (13.50) was higher than the rest of the treatments and the lowest was recorded in T4 (9.86). Ash content ranged between 12.77 in T1 to 13.50 in T2. The value for nitrogen free extract (NFE) was highest in T4 (56.60) and lowest in T1 (51.51). All the values for ANFs determined which included alkaloid, saponin and tannin were higher in T1 than the other treatments.

Table 2: Proximate composition and some anti-nutritive factors of processed *L. hastata* leaf

	Processing methods				
Parameter	**T1(FRH)**	**T2(HWP)**	**T3(SHD)**	**T4(OVD)**	**T5(SUD)**
Dry matter	91.10	94.50	93.00	94.00	94.50
Crude Protein	15.30	14.50	13.50	10.40	14.90
Ether Extracts	8.50	6.95	6.50	9.50	6.70
Crude fibre	11.99	12.20	13.50	9.86	10.50
Ash	12.77	13.50	14.50	14.00	12.50
NFE	51.51	52.85	52.30	56.60	55.40
Anti-nutritive factors					
Alkaloid	2.00	0.85	1.10	0.95	1.07
Tannin	3.00	1.00	1.22	1.07	1.15
Saponin	2.75	1.02	1.13	1.09	1.11

FSH= Fresh, OVD = Oven dried, SUD = Sun dried, SHD shade dried, HWP = hot water processing, NFE = Nitrogen free extract,

Growth performance

The result of the growth performance of rabbits fed processed *L. histata* leaf meal is presented in Table 3 and it showed no significant differences (P>0.05) between the treatments. Average daily feed intake (ADFI) ranged from 45.88g in T1 to 51.65g in T2 while average daily weight gain (ADWG) was between 9.39g in T4 and T5 to 10.29g in T2. Feed conversion ratio was superior in T1 (4.87) and inferior in T5 (5.44).

Table 3: Effects of processing methods of *L. hastata* on growth performance of weaner rabbits.

	Processing methods					
Parameters	T1(FRH)	T2(HWP)	T3(SHD)	T4(OVD)	T5(SUD)	SEM
Initial weight (g)	614.00	657.80	671.90	625.00	654.17	18.84^{ns}
Final weight (g)	1154.00	1240.00	1232.90	1199.47	1185.63	42.44^{ns}
ADFI (g)	45.88	51.65	50.35	50.35	50.72	1.97^{ns}
ADWG (g)	9.53	10.29	9.95	9.39	9.39	0.76^{ns}
FCR	4.87	5.08	5.07	5.30	5.44	0.45^{ns}

Ns= not significant (P>0.05), SEM = Standard error of mean, ADFI = Average daily feed intake, ADGW = Average daily weight gain, FCR = feed conversion ratio, FRH, Fresh, OVD = oven dried, SUD = Sun dried, SHD shade dried, HWP = hot water processing, NFE = Nitrogen free extract,

Nutrient digestibility

The result of nutrient digestibility of rabbits fed processed *L.histata* leaf meal is shown in Table 4. The dry matter and nutrient digestibility were significantly (P<0.05) different between the treatments. The DM digestibility ranged from 62.21-65.60% while CP and CF ranged from 34.37-45.27% and 40.31-66.15% respectively. EE digestibility was significantly (P<0.05) higher in T3 (79.03%) and T4 (79.03%). Digestibility of NFE ranged from 84.00% in T1 to 87.67% in T2.

Table 4. Nutrient digestibility of rabbits fed processed *L. hastata* leaf meal.

	Processing methods					
Parameters	T1(FRH)	T2(HWP)	T3(SHD)	T4(OVD)	T5(SUD)	SEM
Dry matter	65.60^{a}	64.29^{b}	64.00^{b}	63.40^{c}	62.21^{d}	0.14*
Crude Protein	34.37^{d}	53.04^{a}	39.48^{c}	45.27^{b}	45.02^{b}	0.75*
Ether Extracts	70.54^{c}	70.10^{c}	79.03^{a}	79.03^{a}	73.62^{b}	0.17*
Crude fibre	40.31^{e}	41.66^{d}	47.00^{c}	53.84^{b}	66.15^{a}	0.17*
NFE	$84.00b^{b}$	87.67^{a}	86.60^{a}	87.00^{a}	86.71^{a}	0.26*

a, b, c, d, e = Means in the same row bearing different superscripts differ significantly (P<0.05) ns = not significantly different (P>0.05) FRH= Fresh, OVD = Oven dried, SUD = Sun dried, SHD shade dried, HWP = hot water processing, NFE = Nitrogen free extract,

Carcass characteristics and internal organs weights

The results of carcass characteristics and internal organs weights are shown in Table 5. Carcass and pelt weight were significantly (P<0.05) higher in T2 with values of 592.27g and 90.30g respectively while all the other treatments for both parameters were similar across the treatments. Dressing percent (DP %) was significant higher in T2 (47.91%) than all the other treatments. The length of the small intestine and weight of large intestine were not affected by the processing methods but the weight of small intestine and length of large intestine were significantly (P<0.05) influenced by the processing methods of *L. histata* leaf meal. Caecal lengths and weights were similar across all the processing treatments. A significant (P<0.05) difference was observed in the weights of the liver. Rabbits in T1 (24.00g) had significantly higher weight of the liver than those on the other treatments. Variations in the weights of lungs and kidney were also observed between the treatments. Results of the heart, spleen and stomach did not show any differences between the treatments.

Table 5: Effects of processing methods of *L. hastata* leaf meal on carcass yield and internal organs of weaner rabbits.

	Processing methods					
Parameters	**T1(FRH)**	**T2(HWP)**	**T3(SHD)**	**T4(OVD)**	**T5(SUD)**	**SEM**
Live weight (g)	1154.00	1240.00	1232.90	1157.73	1185.63	42.44^{ns}
Pelt (g)	79.00^{b}	90.30^{a}	84.43^{b}	81.40^{b}	80.70^{b}	1.62*
Carcass weight (g)	479.00^{b}	592.27^{a}	484.43^{b}	479.96^{b}	480.10^{b}	2.00*
Dressing (%)	41.61^{b}	47.91^{a}	39.31^{b}	41.52^{b}	40.82^{b}	1.66*
Small intestine (cm)	219.33	212.00	216.67	210.33	210.00	16.96^{ns}
Small intestine (g)	8.67^{a}	6.63^{b}	7.30^{ab}	9.20^{a}	8.03^{a}	0.55*
Large intestine (cm)	104.67^{a}	96.70^{ab}	89.87^{ab}	76.87^{b}	87.77^{ab}	6.12*
Large intestine (g)	13.46	12.20	12.08	12.43	14.10	0.97^{ns}
Caecal length (cm)	41.00	43.67	38.33	37.00	42.00	2.95^{ns}

Caecal weight (g)	2.03	2.43	2.47	2.67	2.50	0.14^{ns}
Liver (g)	24.00^{a}	14.97^{b}	19.13^{ab}	18.70^{ab}	14.97^{b}	2.28*
Heart (g)	4.03	3.77	4.88	3.70	3.98	0.51^{ns}
Lungs (g)	4.77^{a}	3.58^{b}	4.50^{ab}	3.70^{ab}	4.23^{ab}	1.03*
Kidney (g)	6.37^{a}	4.63^{b}	4.60^{b}	4.47^{b}	5.67^{ab}	1.63*
Spleen (g)	0.70	0.40	0.30	0.30	1.03	0.50^{ns}
Stomach (g)	4.43	3.43	4.16	3.73	3.40	1.10^{ns}

a, b = Means in the same row bearing different superscripts differ significantly (P<0.05) ns = not significantly different (P>0.05) FRH= fresh, OVD = Oven dried, SUD = Sun dried,
HWP = hot water processing, HWP = hot water processing, NFE = Nitrogen free extract

IV. Discussion

There appears to be a variation in the nutrient composition of *L. histata* leaf obtained in this study when compared with the findings of other workers. CP range of 10.40-15.30% obtained in this study was higher than the range of 8.16-11.59% reported by Hassan et al. (2007) and Inuwa, (2012). The values for EE however, were lower than the values reported by Hassan et al. (2007). Several workers have attributed such variations in nutrient composition of forages to the age of harvesting the forage, climatic conditions, edaphic factors as well as methods of processing and laboratory analysis (Ojeola et al., 2005; Taiwo et al., 2005).

L. histata like most tropical forages have one form of ANF or another which is capable of precipitating deleterious effects in animals. A phytochemical screening conducted by Bello et al. (2011) on *L. hastate* leaves indicate the presence of phenolic glycosides, tannins, flavonoids,

proanthocyanidins, alkaloids and saponins. Several methods such as soaking in water, boiling and cooking (Makkar, 1993) and addition of polyethylene glycol and poly vinyl pyrolidone (Butter and Ellies, 2001) have been adopted to reduce the effects of ANFs in feedstuffs for animals and it resulted in improved growth performance. The values obtained in this study showed that fresh *L. hiatata* leaf contained the highest amount of all the ANFs determined. This observation is consistent with findings of Price, (1992) and Makkar (1993) who observed that fresh forages contain more ANFs than those subjected to processing.

The growth performance indices of the rabbits which include average daily feed intake (ADFI), average daily weight gain (ADWG), feed conversion ratio (FCR) and final weight were not significantly (P>0.05) influenced by the processing methods of *L. histata.* The ADFI value range of 45.83-51.63g obtained in this study however was lower than the values of 56.19 -66.28g reported by Agunbiade *et al.* (2003). However, the values agreed with those reported by Ikurior and Akem (1998) and Fasanya and Ijaiya (2002). Similarly, the values for final weight gain were also in agreement with those reported by Jokthan *et al* (2003) and Adejumo, (2003).

Though there were significant differences (P<0.05) in nutrient digestibility across the treatments for all the nutrients evaluated, it did not follow a particular pattern. Significantly (P<0.05) higher digestibility rate for DM was observed in T2 while T3 had the highest CP digestibility. The values for DM, CP, EE and CF obtained in this study were however lower than the values reported by Amaefule et al., (2011). This could possibly be due to differences in the type and nutrient composition of the forages. Iyegbe-Erakpotobor et al. (2005) reported that the ability of rabbits to digest feeds depends on the nutrient composition of the diet.

The carcass yield showed a significant (P<0.05) difference in the dressing percentage. Rabbits on T2 produced the highest dressing percentage. It is possible therefore that hot water processing is an effect method of reducing the ANFs in *L. hastate* leaf. The dressing percentage range of 39.31-47.91% reported in this study was lower than the range of 55.30±0.72-67.45±0.43% reported by Idowu et al, (2006).

The significantly (P<0.05) higher weights of liver and kidney observed in T1 was expected because the treatment contained the highest amount of all the ANFs analyzed. Bone (1979) reported that, if a feed contain toxic element, abnormalities in weights of liver and kidney would be observed. The abnormalities will arise because of increased metabolic rate of the organs in an attempt to reduce the toxic elements or to convert the anti nutritional agents to non-toxic metabolites. The values obtained for relative weight of the heart were similar to the range of 3.90-4.15g reported by Ozung *et al*, (2011).

V. Conclusion

It could be concluded from the results obtained in this study that rabbit's can be fed with processed *Leptadenia hastata* leaves using all the processing methods except washing in water (FSH) without adverse effects on growth performance, carcass and internal organs characteristics of weaner rabbits.

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