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# CARCASS CHARACTERISTICS AND INPUT USE EFFICIENCYOF WEST AFRICAN DWARF GOATS FED VARIED FUNGI TREATED CASSAVA ROOT SIEVATE BASED DIETS

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**Abstract**
The study aimed at determining the effect of *Pleurotus tuber-regium* treated cassava root sievate based diets on carcass characteristics and input use efficiency of West African dwarf (WAD) goats. Sixteen WAD bucks between six and eight months old were randomly divided into four groups of four goats each. The groups were randomly assigned to the four experimental diets ($T_1$, $T_2$, $T_3$, and $T_4$) for 90 days in a completely randomized design. Warm carcass weight, dressing percentage, loin and set weights were significantly ($p<0.05$) increased at $T_3$ and $T_4$. Total cost of feed was highest ($p<0.05$) in $T_4$ (₦2278.13) with the corresponding lowest value in $T_1$ (₦1763.70). Feed cost/weight gain was highest for $T_1$ (₦489.92) and lowest for $T_4$ (₦325.45).Cost-benefit ratio showed significant ($p<0.05$) differences with $T_4$ having the best value. Incorporation of PTRCRS in diets of WAD bucks generally enhanced dressing percentage and cost/benefit ratio. Diet $T_4$ promoted the best relative performance among the treatment diets and is therefore recommended for production of goat in South East Nigeria.
**Keywords**: Goats, Solid state fermentation, Cassava, Dressing percentage and economics of production

## INTRODUCTION

The West African dwarf (WAD) goat is the dominant breed of small ruminants found in West Africa where they are raised under smallholder management system. Chiejina and Behnke (2011) ranked WAD goat first with population of approximately eleven million in the humid zone of eastern Nigeria, and this population may be higher today. In general, WAD goat population is considered large in Nigeria, but still far below its demand. It is a trypano-tolerant breed reared extensively for meat and weigh between 20 and 30 kg at maturity. It is raised extensively by subsistent farmers mostly in the rainforest and derived savanna ecological zone of Nigeria with average stock number of 3 to 20 goats per household. They are multipurpose animal, contributing greatly to the nation's animal protein supply. However, the production of this goat has been hampered by poor quality diets, which arise from nutritional imbalance as a result of seasonal fluctuations in feed quality and quantity. The objective of this study was to evaluate the effects of varying levels of *Pleurotus tuber-regium* treated cassava root sievate on the carcass and input use efficiency of WAD goats.

## Materials and Methods

The experiment was carried out at the sheep and goat Unit, Federal College of Agriculture, Ishiagu, Ivo L.G.A., Ebonyi State. The cassava root sievate from TME419 was sourced from Akawa, Nneato, Umunneochi L. G. A. Abia State. The inoculation was conducted at the Tissue Culture Laboratory of National Root Crops Research Institute, Umudike, Abia State.The inoculation room was thoroughly swept, washed and disinfected using Izal in water at the rate of one litre Izal to four litres of water. The floor was mopped free of water and the doors, allowed to dry and locked up for two weeks to kill any surviving contaminant. Thereafter, the milled cassava root sievate were wetted with water at the rate of 1.0 kg sievate to 1.0 litre of water and thoroughly mixed to enable complete wetting of the cassava root sievate. The tubers of *Pleurotus tuber-regium*, were

weighed, washed, dissected to smaller bits and soaked in water for two hours after which they were removed and put in white transparent buckets and covered for three days to enable spore formation of the tubers. Spores of PTR were inoculated into a wetted CSR at the rate of 1.0 kg spores to 3.0 kg CRS. The ends of the poly-ethene sheets were brought together and sealed using masking tape to create an airtight environment. Water was poured on the room floor and some left in buckets after which doors of the inoculation room were closed. After 45 days, the mass of composted CRS now colonized by mycelium of the fungi showing whitish growths were taken out of the inoculation trays from the inoculation room and sun dried by spreading them thinly on a drying surface to terminate growth of the fungi and to dry the material. The materials were put in sacks and stored until required for use.

The experimental diets designated as $T_1$, $T_2$, $T_3$, $T_4$ were formulated from non-biodegraded cassava root sievate, brewers dried grain, palm kernel meal, soyabean meal, bone meal, salt and premix) to contain 0, 20, 40 and 60% biodegraded cassava root sievate (Table 1).

**Table 1.** Gross composition of *Pleurotus Tuber-regium* degraded cassava root sievate based diets

| **Ingredients (%)** | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** |
|---|---|---|---|---|
| Non-Biodegraded cassava root sievate | 60.0 | 40.0 | 20.0 | 0.0 |
| Biodegraded cassava root sievate | 0.0 | 20.0 | 40.0 | 60.0 |
| Brewers dried grain | 15.0 | 15.0 | 15.0 | 15.0 |
| Palm kernel meal | 14.0 | 14.0 | 14.0 | 14.0 |
| Soya bean meal | 7.0 | 7.0 | 7.0 | 7.0 |
| Bone meal | 3.0 | 3.0 | 3.0 | 3.0 |
| Salt | 0.5 | 0.5 | 0.5 | 0.5 |
| Premix* | 0.5 | 0.5 | 0.5 | 0.5 |
| Total | 100 | 100 | 100 | 100 |

Vitamin and mineral premix contributed the following to each kilogram of diet: vitamin A 500 IU, vitamin D 1500 IU, vitamin E 3 IU, vitamin K 2 mg, riboflavin 3 mg, pantothenic acid 6 mg, niacin 15 mg, vitamin B12 0.8 mg, choline 3 mg, folic acid 4 mg, manganese 8 mg, zinc 0.5 g,
iodine 1.0 mg, Co 1.2 mg

The WAD bucks used for this experiment were between 6 to 8 months of age and were sourced from Nkwo Achara, Uturu, Isukwuato, L.G.A., Abia State. Prior to the trial, the animals were quarantined for 21 days, dewormed using Albendazole® and subsequently were given Ivermectin sub-cutaneously. The goats were vaccinated against Peste' Petit de' Ruminante' (PPR) using PPR vaccine at rate of 1 ml per 10 kg body weight of the animal. Each animal received 1 kg of chopped *Panicum maximum* and 3.5% of their body of the control diet (Table 1) for a preliminary period of 21 days. This was done to build up each animal's appetite for concentrate diet.

Sixteen WAD goats were randomly divided into four groups of four animals each. Four experimental diets $T_1$, $T_2$, $T_3$ and $T_4$, were formulated. The groups were randomly assigned the four experimental diets ($T_1$, $T_2$, $T_3$, and $T_4$) in a completely randomized design (CRD). The animals were housed individually in a well-ventilated cement floored pens equipped with feeders and drinkers. Each animal received a designated treatment diet in the morning (08:00 hr) for 90 days. Feed offered was based on 3.5% body weight per day in addition to 1 kg wilted chopped *Panicum maximum* which was fed at 16:00 hr. Regular access to fresh drinking water was ensured.

Three goats from each treatment were randomly selected and starved of feed for 24 hours prior to slaughter. Just before slaughter, each of the randomly selected animal was weighed to get the live weight at slaughter. Subsequent weights were taken after slaughter and after dressing. **Dressing percentages** were calculated as the weight of dressed warm carcass in relation to live weight before slaughter.

A dressed (**warm**) **carcass** is defined as the weight of the goat after removal of the head, skin, contents of thoracic and pelvic cavities (including the diaphragm and kidney) and the limb distals to the carpal and tarsal joints **Meat cuts** were expressed as percentages of the warm carcass.

The prevailing market prices of the feed ingredients at the time of the experiment were used to estimate the unit cost of the experimental diets. The variable costs of feeding the goats were considered the cost of feeds and all other costs (i.e., labour, capital investment and housing) were the same for all the treatments. The cost of sourcing, processing and inoculation of the biodegraded cassava root sievate was included as the feed cost. Feed cost (N) per kilogram, cost per kilogram of daily weight gain, and cost-benefit ratio were calculated accordingly. The cost-benefit ratio was determined by dividing cost/kg live weight with feed cost/weight gain.

Dataobtainedwere analyzed using analysis of variance (ANOVA) as described by SAS (2008). Significant means were separated using the Duncan multiple new range test (Duncan, 1955) at $p<0.05$.

**Results and Discussion**

The carcass characteristics of West African dwarf goats fed graded levels of *Pleurotus tuber regium* degraded cassava root sievate are presented in Table 2. Diets had significant ($p<0.05$) influence on live weight at slaughter, warm carcass weight, dressing percentage, loin and set weights while empty weight, shoulder, leg, end and shank weights were not influenced ($p>0.05$) across the treatment groups. The animals on $T_1$ had the lowest ($p<0.05$) live weight slaughter in comparison with the treatment groups. This may be attributed to lower final weight of animals in $T_1$ relative to other treatments. The warm carcass weight of 3.64 – 6.75 kg obtained in this study compared with 4.43 - 7.17kg reported by Jiwuba *et al.* (2018a), 2.9-9.81kg by Marichal *et al.* (2003) and 3.40-4.65kg reported by Odoemelam *et al.* (2014). The warm carcass weights are however in agreement with the findings of Odoemelam *et al.* (2014) and Jiwuba *et al.* (2018a) who reported significant effects on warm carcass weights in WAD goat. Devendera and Burns (1983) earlier noted that dressing percentage is affected mainly by plane of nutrition and other factors. The differences observed in this present study may be due the plane of nutrition and live weight at slaughter. Goats on the treatment groups have better dressing percentage, which may be attributed to better nutrient balance, intake and utilization by the animals. Jiwuba and Ogbuewu (2019) attributed increased dressing percentage to nutrient balance and increase in feed intake. Noteworthy, the dressing percentage recorded in this study fell within 38 and 56% baseline reported by Anjaneyulu and Joshi (1995) for goats. This further explained that the PTR-CRS diets were nourishing and supported the deposition of lean meat. Jiwuba *et al.* (2018a) identified meat cuts as important factor in evaluation of meat yield in goats. $T_2$, $T_3$ and $T_4$ produced higher ($P<0.05$) loin and set weights than the control group. This may indicate that these treatments (PTR-CRS containing diets) had a positive influence on the development of these cut parts better than the control group.

**Table 2:** Carcass characteristics of West African Dwarf goats fed graded levels of *Pleurotus tuber regium* degraded cassava root sievate in their diets

| **Parameters (%)** | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | **SEM** |
|---|---|---|---|---|---|
| Live weight at slaughter | $8.50^{c}$ | $10.00^{b}$ | $10.92^{b}$ | $12.13^{a}$ | 2.42 |
| Empty weight | 5.18 | 7.07 | 8.68 | 9.57 | 1.53 |
| Warm Carcass Weight | $3.64^{b}$ | $4.70^{b}$ | $5.79^{a}$ | $6.75^{a}$ | 1.18 |
| Dressing Percentage | $42.82^{c}$ | $47.00^{b}$ | $53.02^{a}$ | $55.65^{a}$ | 5.23 |
| Meat cuts expressed as percentage (%) of warm carcass weight | | | | | |
| Loin | $17.83^{c}$ | $21.82^{b}$ | $23.32^{a}$ | $23.94^{a}$ | 3.44 |
| Set | $18.15^{c}$ | $22.55^{b}$ | $24.16^{a}$ | $25.61^{a}$ | 4.01 |
| Shoulder | 9.18 | 8.69 | 10.29 | 9.21 | 2.29 |
| Leg | 20.92 | 22.55 | 21.63 | 23.54 | 4.21 |
| End | 4.46 | 5.36 | 5.39 | 6.58 | 1.48 |
| Shank | 9.50 | 9.15 | 9.78 | 9.91 | 1.92 |

$^{a-c}$ means within the same row with different superscripts are significantly different ($P<0.05$)

The input use efficiency of West African dwarf goats fed *Pleurotus tuber regium* degraded cassava root sievate in their diets are presented in Table 3. All the parameters differed ($p<0.05$) significantly across the treatment groups. As the level of inclusion of PTR-CRS in the diets increased from 0% ($T_1$) to 60% ($T_4$), the feed 100kg of feed and cost/kilogram for each treatment group increased. Total (N2278.13) and daily (N25.31) feed cost was highest in $T_4$ in comparison to the other treatments. This result perhaps is in does not agreement with earlier reports by Jiwuba *et al*. (2018a) who reported a reduced feed cost when cassava root sievate-cassava leaf meal -based diets were fed to WAD goats. The increase in feed cost in this study may be attributed to the additional cost in procuring the *Pleurotus tuber regium* and other materials for the biodegradation. The values for feed cost per body weight gain were lowest for the goats fed $T_4$ diet (N325.45); however, this unit cost differed ($p < 0.05$) significantly from the values recorded on goats fed other diets. Cost-benefit ratio showed significant ($p < 0.05$) differences with WAD goats on diet $T_4$ having the best value. This result was in agreement with the results of earlier studies by Jiwuba *et al*. (2018b) for WAD goats fed yellow root cassava peel - centrosema leaf meal based diets. The result demonstrated the qualitative benefits and financial returns of using PTR-CRS diets, with $T_1$ having the highest ratio and $T_4$ the lowest value. This entails an expected benefit of N1 for every N1.90 in cost for $T_4$ diet. This finding is in accord with the results of Jiwuba *et al*. (2016) who reported that inclusion of *Moringa oleifera* leaf meal in the diets of WAD goats produced the best cost/benefit ratio.

**3:** Input use efficiency of West African dwarf goats fed *Pleurotus tuber regium* degraded cassava root sievate in their diets

| Parameters (%) | $T_1$ | $T_2$ | $T_3$ | $T_4$ | SEM |
|---|---|---|---|---|---|
| Cost of 100kg of feed (₦) | $4473.63^{b}$ | $4671.08^{ab}$ | $4792.62^{a}$ | $4873.77^{a}$ | 16.34 |
| Cost/kg of feed (₦) | $44.73^{b}$ | $46.71^{ab}$ | $47.92^{a}$ | $48.73^{a}$ | 4.3 |
| Total feed consumed (kg) | $39.43^{b}$ | $41.73^{b}$ | $44.53^{a}$ | $46.75^{a}$ | 6.4 |
| Total cost of feed (₦) | $1763.70^{c}$ | $1949.21^{bc}$ | $2132.44^{b}$ | $2278.13^{a}$ | 7.34 |
| Daily feed cost (₦) | $19.60^{b}$ | $21.66^{b}$ | $23.69^{a}$ | $25.31^{a}$ | 3.5 |
| Body weight gain (kg) | $3.60^{c}$ | $5.11^{bc}$ | $5.71^{ab}$ | $7.00^{a}$ | 0.41 |
| Feed cost/weight gain (₦) | $489.92^{a}$ | $381.45^{b}$ | $373.46^{b}$ | $325.45^{c}$ | 6.11 |
| Cost/kg live weight (₦) | 1200 | 1200 | 1200 | 1200 | - |
| Cost benefit ratio | $1:2.45^{c}$ | $1:3.15^{b}$ | $1:3.21^{b}$ | $1:3.69^{a}$ | 1.22 |

$^{a-c}$means within the same row with different superscripts are significantly different ($P<0.05$)

**Conclusion and Recommendation**

Live weight at slaughter, dressing percentage, loin and set weights were significantly improved in the treatment groups, while $T_3$ and $T_4$ produced highest warm carcass weights. Cost of 100 kg of feed and cost/kg of feed were significantly reduced in $T_1$. Total feed costwas higher in $T_4$. The treatment groups showed the best feed cost/weight gain, benefit per BW gain and cost: benefit.

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