

Effect of Low-Cost Supplemental Feeding Practices on Pre-Weaning Weight Gain of Goat Kids in Tafa LGA Nigeria

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An earlier study on feed resources utilization by agro-pastoralists in the study area revealed unexplored use of crop residues and by-products as feed resources for livestock consumption. Therefore this study was conducted using rural participatory approach in the study area to investigate goat production levels and influence of low cost post-partum supplemental feeding of goat dam on pre-weaning growth and weaning weight of goat kids. An assessment of goat production among agro-pastoralists in the area was conducted, followed by an experimental supplement feeding trial. In the trial, eighteen (18) goat dams and thirty six (36) goat kids were used. The first group (T1) was 6 twin kids from 6 goat dams on extensive grazing without supplemental feeds, the second group (T2) was 6 twin kids from 6 goat dams fed prepared supplement concentrate diets in addition to extensive grazing while the third group (T3) was 6 twin kids from 6 goat dams fed cowpea haulms and millet straw as basal diet and prepared supplement concentrate in addition to extensive grazing. Birth weights for T1, T2 and T3 were 2.05 kg, 1.85 kg and 2.10 kg respectively. Supplemental feeding with crop residue and by-products in the study area significant ($P < 0.05$) for weaning weight and daily weight gain of the goat kids. The weaning weights for T1, T2 and T3 were 5.05 kg, 7.16 kg and 7.38 kg respectively while average daily gain was 25.00 gday^{-1} , 44.25 gday^{-1} and 44.00 gday^{-1} for T1, T2 and T3 respectively. The study suggested that improved pre-weaning kid performance was achievable using supplement diets produced from locally available crop residue and by-products as diets for goat dam post-partum in the study area. The study also suggested that the use of supplemental diets was capable of producing goats with higher yearling weights and early attainment of reproductive weight hence it recommended full scale evaluation of yearling and reproductive performances of goat kids with superior performance at weaning in response to the supplemental nutrition for their dams.

Keywords: Effects, Crop residue, By-products, Goat Kids, Weaning.

INTRODUCTION

Goats as small ruminant animals stand important positions in production of food for human

consumption than monogastric animals because, besides the production of meat and milk for immediate consumption the poor feed resources and agro-industrial by-products are normally converted into high quality protein for human


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consumption (NBS, 2012). Unlike monogastric animals, they are not competitors for human food such as grains, the major food in under-developed and developing countries of the world. In rural Nigeria, small ruminant (goats and sheep) are life bank for women and young people who seldomly sell them when need arise to attend to other activities (Omoike, 2006; Aphunu et al, 2011; Nampanzira et al, 2015 and Abdullahi et al, 2015). Most goats are still under traditional production systems in Nigeria thereby causing under-production by small-scale farmers in rural areas, non-commercial goats farming and under-utilization of feed resources that may be explore as cheap sources of feeds for goats. Innovative practices necessary for improved goat performance capable of mitigating current challenges facing commercial goat farming such as poor productivity of rangeland, poor animal performance and products yield are highly required.

Pre-weaning performance of goat kids is of both biological and economic importance in goat production enterprise because survival and weight gain of goat kids from birth to weaning has impact on lifetime productivity of the goats and profitability of meat goat industry (Akpa et al, 2010 and Andries, 2013). Kids' performance is a factor very important in small holder stock management because they ensure abundance and increasing number of the animals producing foods for human consumption. Apart from bringing forth kids to increase animal population, efficient *post-partum* performance of goat dams also promote nourishment of younger animals for them to have capacity to produce right quantity and quality of foods when they grow up through the process of lactation – a unique characteristics feature of food producing mammals. Pre-weaning weight gain and weight at weaning are also of reproductive importance because a fast pre-weaning growing in goat has potential of goat attaining acceptable reproductive weight faster than poor growing goats (Snyman, 2017). It is also scientifically novel to investigate performance of both dam and kid in a goat enterprise because it is a neglected area of livestock production research studies not only in Nigeria but in some other places across the world (Shrestha and Fahmy, 2007). Supplemental diet feeding is capable of leading to high pre-weaning growth rate in goat kids because the goat kids will have access to sufficient quantity and quality of milk produced by the dams since there will be no competition between nutrients

requirements for survival and milk production in the dams. This study is a follow up to an assessment of feed resources utilization by agro pastoralists in the study area which earlier established crop residues and by-product use as unexplored. The aim of the study was to investigate influence of locally available crop residues and by product supplement feeding for lactating goats on pre-weaning growth performance of goat kids in the study area.

MATERIALS AND METHODS

The Study Area

The study was carried out at agro pastoral communities located around Kuruduma layout of Sabon Wuse in Tafa Local Government Area of Niger state of Nigeria. Tafa Local Government is one of the 774 local government areas in Nigeria headquartered in Sabon-Wuse. The local government is a place where Niger state is sharing boundaries with Abuja and Kaduna state. Sabon-Wuse the headquarter of Tafa Local Government area is approximately 84km from Minna, the capital of Niger state and approximately 25km from the Federal Capital Territory of Nigeria (Abuja). Geographically, Tafa Local Government is located on latitude 9.33° north and longitude 7.26° east. Rural communities involved in this study include *Dadin-Kowa*, *Kawudna*, *Rugan-Wakili* and *Chawa* all of which are located in Kuruduma layout of Sabon-Wuse in Tafa Local Government area. In addition to the agro-pastoralists, the area also have many small-medium scale commercial farms located within the area (Sikiru, 2016).

Experimental design

The experiment follows a rural participatory approach whereby the rural dwellers were invited to a meeting to discuss the research and the potential benefits they will derive from the study. Questionnaire for individual agro-pastoralists and focus groups in the Feed Assessment Tools (FEAST) developed by International Livestock Research Institute (ILRI) was modified for collection of data related to goat production and management. After the consultation meeting and interviews, three groups of goat owners were engaged for establishment of experimental field of animals for

Table 1. Proximate composition and cost of the supplemental diet

Ingredients	Quantity (%)	Cost (Naira/100 kg ^{**})
Maize bran	49.00	1225
Rice bran	49.00	980
Groundnut cake	1.50	150
Vitamin premix*	0.50	375
Analysis		
Crude Protein (%)	11.94	
Total Digestible Nutrients (TDN) in (%)	63.96	
Cost per Kg (in Naira)	27.30	

* Commercial vitamin premix supplied the following vitamins and trace elements per kg diet: Vit A 6250IU; Vit D3 1250IU; Vit E 14.38mg; Vit K3 1.25mg; Vit B 1.88mg; Niacin 31.25mg; Calcium pantothenate 6.25mg; Vit B12 0.02mg; Choline Chloride 250mg; Folic acid 0.63mg; Biotin 0.03mg; Mn 75mg; Fe 62.5mg; Zn 50mg; Cu 5.31mg; I 0.94mg; Co 0.19mg; Se 0.08mg and Antioxidant 75mg. ** Cost of the crop residues and agro industrial by products as sourced locally within the villages in the study area for the purpose of this research.

Treatments 1, 2 and 3. Goat owners released gravid goats does for the study using physical observations of the goats' nearness to kidding as criterion for selection and acceptance as experimental animal since there is no records of mating dates. One hundred and fifty (150) gravid goats were initially volunteered for the study and the goats were then distributed into Treatment groups as they kidded. Within 48 hours of goats volunteering, 18 goats with twin births were selected to form the Treatment groups until the 3 Treatment groups were established. All other goats were then released to their owners after formation of the treatment groups and the selected goats were randomly allocated into treatment groups as follows:

Treatment 1 - 6 goat dams with 6 twin kids and not fed any supplemental diet in addition to extensive grazing.

Treatment 2 - 6 goat dams with 6 twin kids fed prepared supplement diet in addition to extensive grazing.

Treatment 3 - 6 goat dams with 6 twin kids fed cowpea haulms and millet straw as basal diets and prepared supplement diet in addition to extensive grazing.

Supplemental diets and animal management

Supplemental concentrate diet was produced using predominant crop residues and by-products in the study area as presented in Table 1 above. All

animals in the experiment were provided with housing similar to what their owner do provide for them (*i.e.* housed in the night and during hot day) and provided with *ad-libitum* access to minerals and vitamins supplemented water all day at shades within their grazing area while the concentrate diet as presented in Table 1 above was fed at 500 g per day to each of the lactating goat dams in T2 and T3. Feeding of the concentrate diet to the goat dams was carried out 08:00 hours in the morning while the goats are still in their individual pens before released for grazing and by 17:00 hours when they returned back to their pens. All the goat kids were housed with their respective dams during the night and they are always moving about with their dams during the day. Health management practices including treatment against *Clostridia* infection, *anemia*, and minerals/vitamins deficiencies were carried out on the goat kids. The goat kids were weighed individually weekly throughout the experimental period and the weight were recorded in Microsoft excel worksheet which were then analyzed using SAS[®] version 19.0. Analysis of variance was carried out and Duncan multiple range test was use for means separation of significant means.

RESULTS AND DISCUSSION

Goat production is a viable economic enterprise in the study area and predominantly owned by women

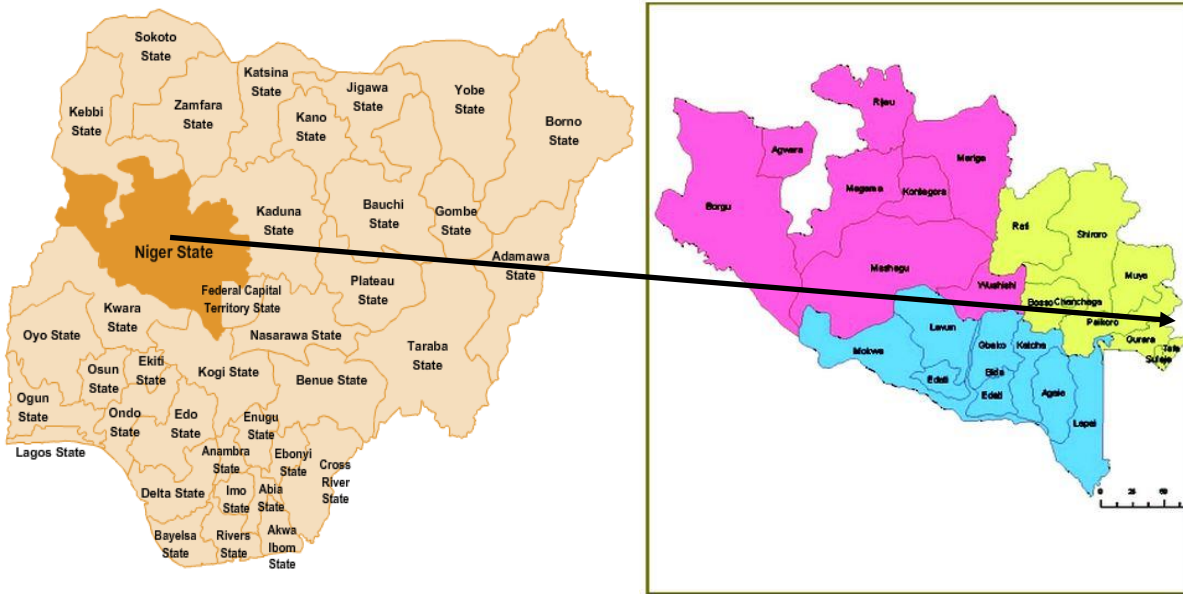


Figure 1. Map of Nigeria showing the study area.

and few men who practice extensive goat rearing. In recent time commercial farms in the area now engage in goat production as alternative to cattle fattening that was a common ruminant animal production in the area which is currently being limited by activities of cattle rustlers. The practice of goat rearing in the area can be described as subsidiary farm enterprise contributing to stability of farming households who use cash generation from sales of live animals to support their families. Three levels of importance of goat rearing were identified in this study, the purpose was to know how goat rearing is contributing to income generation of the agro-pastoralists based on their primary purpose of goat production. For the rural dwellers, 58% of the agro-pastoralists agreed that goat production is very important part of their agricultural activities for revenue generations. 29% agreed that goat is important part of their agricultural activities for revenue generations while 13% of the agro-pastoralists agreed that goat is not important part of their agricultural operations. This outcome is as presented in Figure 1 above.

Commercial farms operating in the study area also practice goat production but not as an important part of their business and revenue generations because only 10% of the farms visited found goat keeping to be very important. 15% of the farms agreed that goat production is important to their business while

75% of the farms categorized goat keeping as not important business enterprise. The result of the finding as presented in Figure 2. This showed that for all the respondents (both rural dwellers and commercial farms), cash generation from sales of live goats top the main reason of keeping goats. They rear goats to market sizes and take them to markets for sales or invite goat merchants to their houses or farms for purchase or in some cases goat merchants are invited to buy goats while on trade trip to the villages looking for where they can get goat for purchase. Figure 3 showed the purpose of producing goats by the agro-pastoralists and few commercial farms in the study area. Predominant breeds of goat commonly produce and kept by the agro-pastoralists and commercial farms in the study area is West African Dwarf with 65%, follow by Kano Brown 15% while Maradi goats and Borno white are 10% each in the study area. The distribution of goat breeds under production in the study area is as presented in the Figure 4. The study also showed that free range grazing on extensive rangeland remains the major source of feeds for the goats kept by both the agro-pastoralists and the commercial farms. An evaluation of the agro-pastoralists willingness to accept improved nutritional management practices of supplementation with crop residues such as corn bran, groundnut haulms and cowpea haulms from households' cultivation is

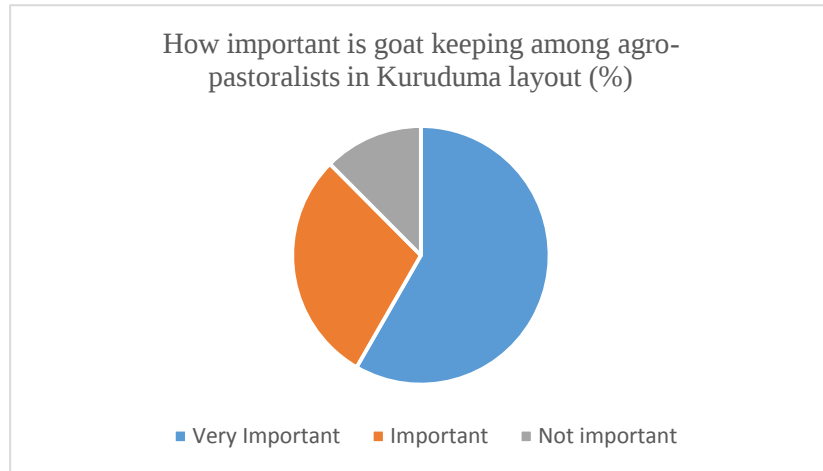


Figure 2. How important is goat keeping among agro-pastoralists in Kuruduma layout.
(Source: Field survey, 2016).

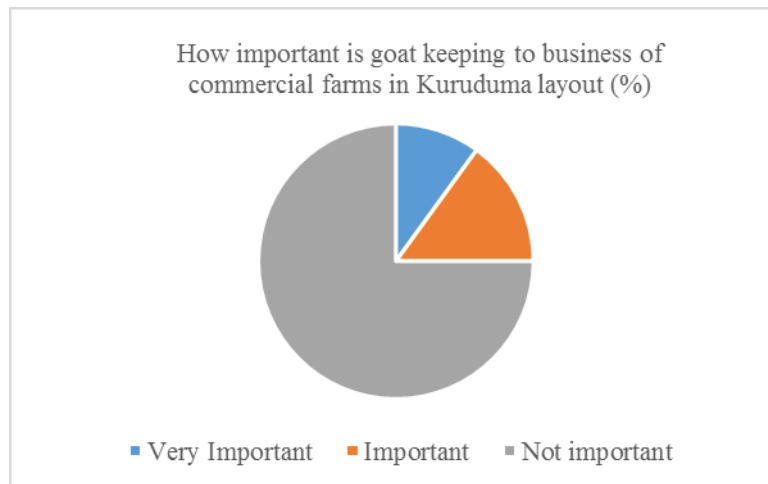


Figure 3. How important is goat keeping to business of commercial farms in Kuruduma layout.
(Source: Field survey, 2016).

highly promising. Even the commercial farms hardly practice any innovative nutritional management although they implement minerals and vitamins supplementation unlike the rural agro-pastoralists who leave their goats to extensive grazing alone. Nutritional management practices are presented in Figure 5 and 6. In the study area, just like in many other parts of Nigeria; goat production is not commercial, it is relatively confined to rural areas and production systems still remain traditionally

local. Most rural dwellers producing goats keep few bands just to serve purpose of immediate cash in case of natural disasters or crop failures. No facilities and structure to support commercial large scale production. This study therefore find out that there is need and potential for commercial goat production because several reports and positions agreed that increasing income, increasing population and increasing demand for food are imperative features of some countries in sub-Sahara

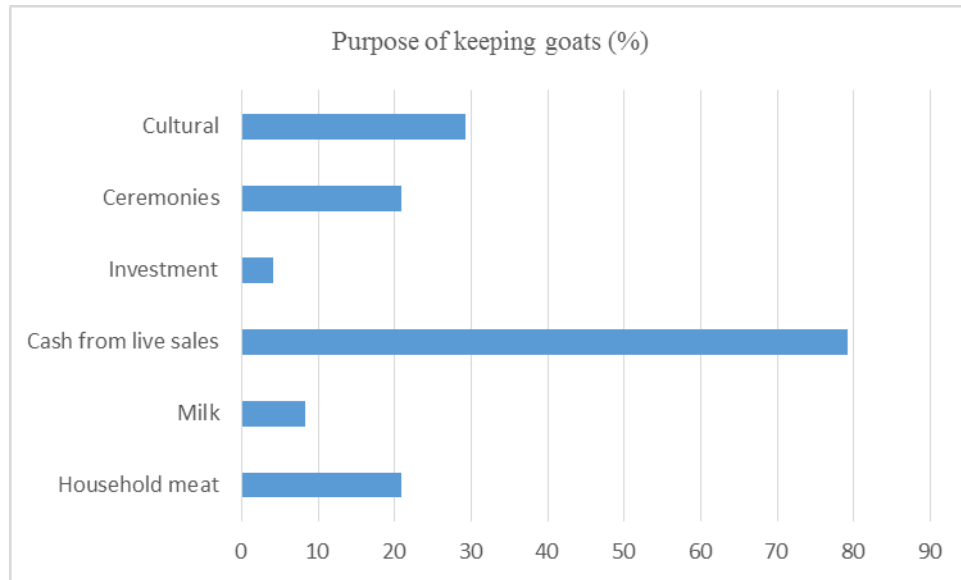


Figure 4. Purpose of keeping goats among rural dwellers and commercial farms in Kuruduma layout.
(Source: Field survey, 2016)

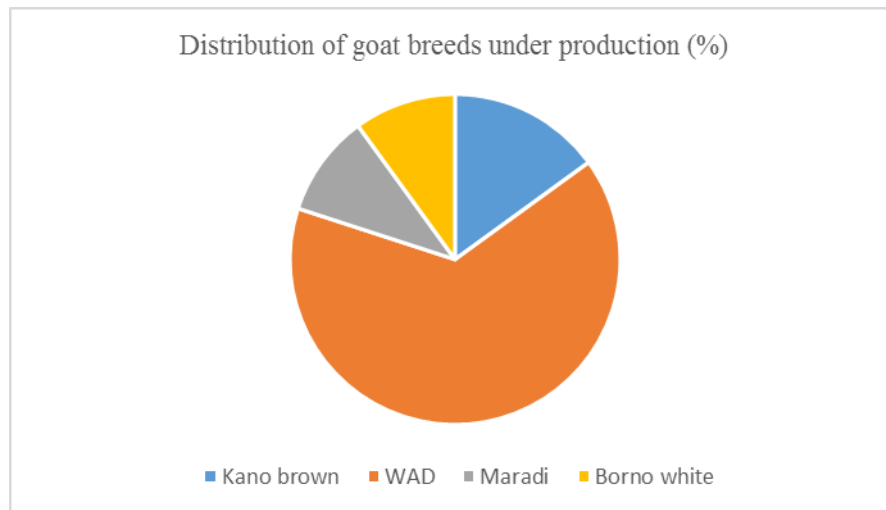


Figure 5. Distribution of goat breeds under production in Kuruduma layout.
(Source: Field survey, 2016).

Africa (Obi, 2003; Heinke, 2015). Nigeria is one of the countries in the region with highest potentials for these predictions. Nigeria population has been ever increasing, growth in gross domestic products although ironically with stiff competition between number of mid-income earners and the poor; hence scenario for increased demand for meat in place like

Abuja which is the major city nearest to the study area is naturally not contestable. Demand for goat meat is not seasonal or festive-led in Abuja; what drive demand for goat meat include consumption in local restaurants, local kitchens (popularly known as *Mama-Put*) where many people living in the city patronize to take breakfast and lunch and goat

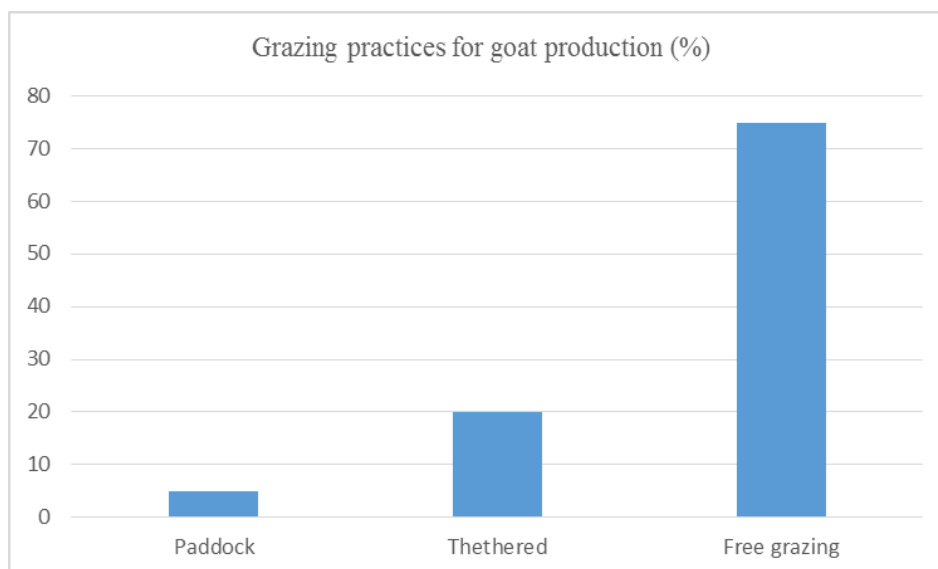


Figure 6. Grazing practices for goat production in Kuruduma layout.
(Source: Field survey, 2016)

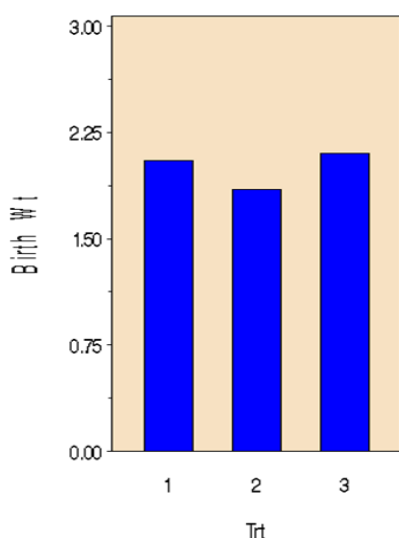
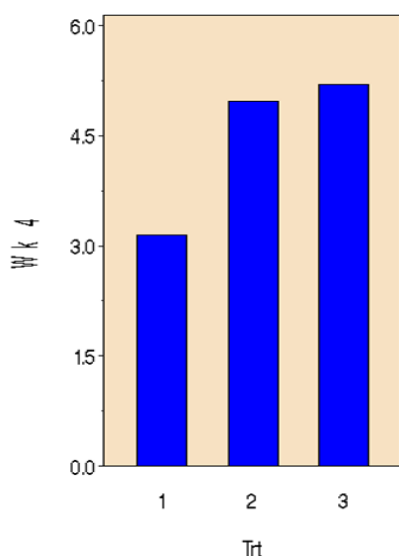
meat are being consumed. This is different from conditions obtainable in other places where demand for goat meat is seasonal and festive-led. So, because there are no commercial goat production units in the study area, livestock merchants see this as a business opportunity from other parts of the country that bring goats for sale in Abuja. Therefore, consumers end up paying more than 70% addition to the price they are supposed to pay for goat meat. This outcome agreed with the position of (Endeshaw, 2007; Zewdie and Welday, 2015) which stated that in Ethiopia buyers pay an additional cost to final sales prices of goat due to stock movement. In the study area, common food crops under cultivation by agro-pastoralists are maize, millet, cowpea, soybean, yam, rice and watermelon. During harvesting and processing of these crops they generate a lot of crop residues such as corn bran, rice bran, rice straw, millet straw, corn stover, cowpea haulms, and bean pods. Some of these residues are directly generated on the farms while crop by-products are generated at local agro-processing plants within the rural communities. Crop residues produced on the farms are mostly left for consumption of cattle under production of the Fulani agro-pastoralists while few indigenous *Gbagyi* people who engage in cattle fattening do pack some of the residue home for their cattle consumption. Crop residue including millet, maize and sorghum straws are usually available in abundance at the

beginning of the dry season starting October – November annually. These crop residues are almost entirely intended for domestic animal feeding and as such they are systematically collected for feeding animals in stalls at home or by grazing cattle. This utilization apart from livestock consumption represents another source of income for the rural dwellers in the study area because they can be packed and made available for sale by the farmers who do not produce animals but in the study area farmers do not trade these crop residues as they do leave them on the farm for consumption of cattle or pack some home for consumption of sheep and goats (FAO, 2014).

The use of low cost crop residue and by-product supplement diet in the Treatment group gave birth weights 2.05 kg, 1.85 kg and 2.10 kg for the goat kids in T1, T2 and T3 respectively as presented in Table 2. Although this is low compared with 3.68 kg average birth weights of Boer goat kids as reported by Andries (2013) in a growth performance study of Boer goat kids. The differences and lower birth weights may be due to factors that generally affect birth weight which include sex, season of birth, breeds and animal management practices. However, difference in breeds and animal management practices can be regarded as the major factors responsible for the low birth weight because average birth weight of the goat kids in this study were similar to average birth weight of goat

Table 2. Comparative weights of the goat kids at birth and at weaning.

Parameters	T1	T2	T3
Birth weight (kg)	2.05	1.85	2.10
Minimum birth weight (kg)	1.80	1.50	1.50
Maximum birth weight (kg)	2.40	2.20	2.50
Weaning weight (kg)	5.05	7.16	7.38
Minimum weaning weight (kg)	4.78	7.00	7.26
Maximum weaning weight (kg)	5.20	7.26	7.46

**Chart 1.** Weight of the goat kids at birth (in Kg).**Chart 2.** Weight of the goat kids at one week old (in Kg).

kids reported by (Peter et al., 2015) in a study carried out in Ghana on West African Dwarf goats which is the breed of goats used in this study. Pre-weaning growth of the goats was 3.00 kg, 5.31 kg and 5.28 kg for the goat kids in Treatments 1, 2 and 3 respectively while average daily gain of the goat kids were higher for kids whose dam were fed supplemented diets although the difference was double between non-supplemented group (T1) and the supplemented groups (T2 and T3). There is also significant difference between group fed only the concentrate (T2) and the group fed both concentrate and crop residues (T3) in the study. The goat kids in T2 although had highest daily weight gain weaning weight compare with T3 goat kids this showed that once the goat dams are fed compounded supplement diet, provision of crop residues may not be necessary. The higher weight gain in the Treatment groups T2 and T3 were attributed to the influence of the supplemental feeding provided in the study. The growth rates in the kids of goat fed the supplement diets was higher not only because of the their dams had better feed supply but can also be linked with possible better nutrients digestibility which conferred on the capacity for higher dry matter intake and corresponding higher body reserve which promote milk production. This is evident because all through the experimental period the treatment group goat kids despite similar birth weight with the non-supplemented group had higher body weight changes as presented in the charts (1 - 5) below.

The goat dams fed supplement diets were able to produce more milk because of the higher nutrients intake from the supplement diets which allowed them to produce more milk as a result of improved nutrition for better kids' performance than the kids of the non-supplemented group. These observations agreed with propositions of Luginbul (2002) and Steve (2001) which stated that growth during pre-

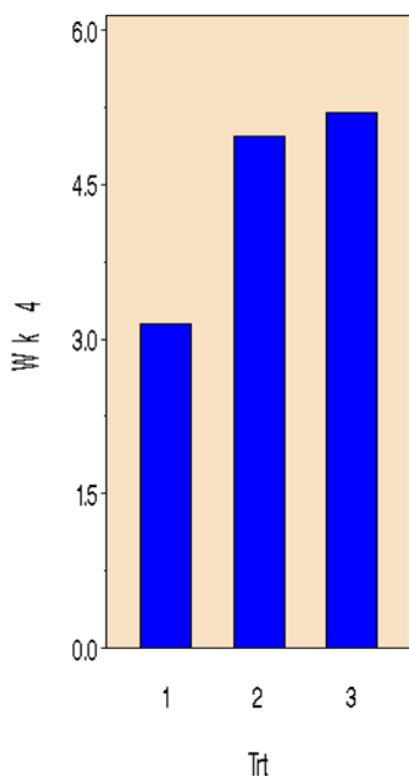


Chart 3. Weight of the goat kids at four weeks old (in Kg).

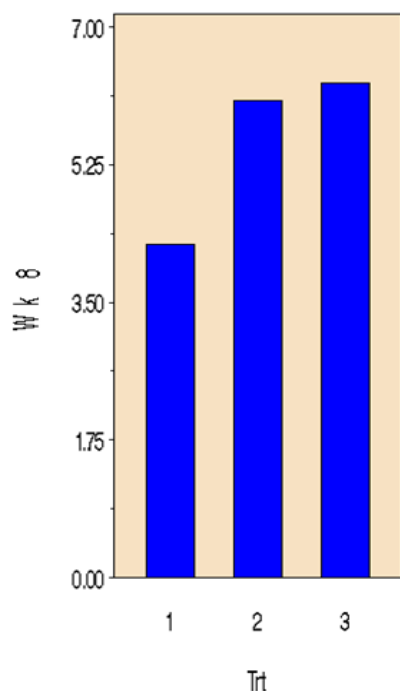


Chart 4. Weight of the goat kids at eight weeks old (in Kg).

weaning period is largely determined by maternal milk production and competition for it amongst litter mates. From these, it can also be stated that the kids of goats in T2 and T3 will have better post-weaning performance as well as yearling growth than the kids of goats in T1 thereby bringing more income and produce more meat for consumption. This is possible because the higher pre-weaning growth rate the higher the eventual yearling weight (Boro et al, 2011 and Peter et al., 2015). The lower pre-weaning daily weight gain 25.00 gday^{-1} in the control group T1 cannot be associated with preferences or baize in management practices or related to any factor given to treatment T2 and T3 other than the nutrition because the average daily weight gain of the kids in the control group were similar to average daily weight gain reported for goats kids in studies earlier carried out on goat kids (Turkson et al., 2004; Bosso et al., 2007; Deribe and Taye, 2013; and Peter et al., 2015). All management practices were the same for the animals except feeding experimentation which is the only factor that can influence the goat kids pre-weaning growth differences in this study. Table 3 give weekly body weight changes in the goat kids which showed higher pre-weaning weight gain in the kids of groups fed supplemental diets. The higher pre-weaning weight gain in the goat kids whose dams were fed the experimental diets can be linked to possible better protein and energy intake and better digestibility by the goat dams because the concentrate is higher in nutrients compare with forage plants and it was also fed at regulated quantity (500 g daily) which prevent possible fibre dense effects of the crop residues used in the study. The concentrate diets stimulated rumen microbial environment which lead to liberation of nutrients from the forages (Dutta et al, 1999). This is evident again because of higher pre-weaning weight gain of T3 goat kids whose dams were fed both the concentrate diet and other straw. From this, it can be deduced that the concentrate diet improve rumen degradation for production of volatile fatty acids which allowed the goat dams to have enough energy that made them to produce more milk for their kids. The superior performance of the kids can be used as a measure of milk production performance of the goat because all the kids depend majorly on the milk for that period of their lives when the study was carried out in all the treatments.

Extensive forage grazing is the major source of

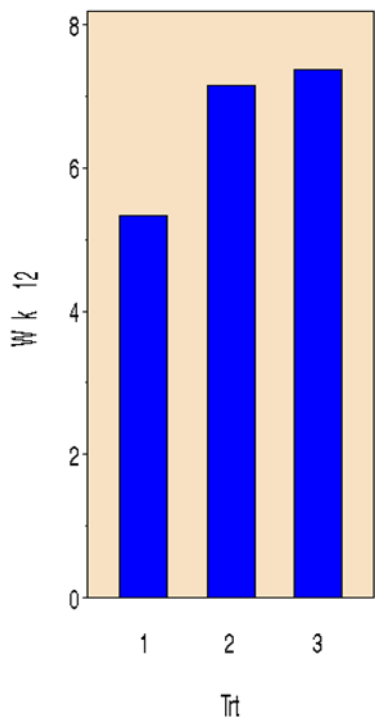


Chart 5. Weight of the goat kids at weaning by twelve weeks old (in Kg).

Table 3. Weekly body weight changes of goat kids in the experiment.

Weeks	T1	T2	T3
1	2.30 ^b	3.36 ^a	3.30 ^a
2	2.50 ^b	3.60 ^a	3.50 ^a
3	2.80 ^c	4.70 ^b	4.92 ^a
4	3.14 ^c	4.97 ^b	5.19 ^a
5	3.42 ^c	5.24 ^b	5.46 ^a
6	3.69 ^c	5.52 ^b	5.74 ^a
7	3.96 ^c	5.79 ^b	6.01 ^a
8	4.23 ^c	6.06 ^b	6.28 ^a
9	4.51 ^c	6.34 ^b	6.56 ^a
10	4.78 ^c	6.61 ^b	6.83 ^a
11	5.05 ^c	6.88 ^b	7.10 ^a
12	5.33 ^c	7.16 ^b	7.38 ^a

Means with different superscripts across the rows are significantly different.

study area but this is now under challenges of poor yield and productivity due to climatic fluctuations effects but this study showed that strategic nutrients supplementation is a strong means of improving animal performance on free range grazing because kids of the goat dams fed supplemented diets gave superior performance compare with their peer from other dams despites poor forage composition. The experimental diets served as complement for poor pasture nutrients composition in the forages. It was also a perfect approach because high cost associated with the use of conventional concentrates and finished feed was also attenuated with the use of crop residues and agro-industrial by-products in this study.

CONCLUSION

The research concluded that there is huge market available for goat products produce in the study area and huge prospects for the use of unconventional feedstuffs such as corn bran, rice bran, rice straw and cassava peel for goat consumption in the study area. Experimental supplements improved pre-weaning weight gain of goat kids, the supplement diet is cheap and is a potential diet for better goat yearling weight gain and early attainment of reproductive weight hence the study recommend full scale evaluation of yearling and reproductive performances of goat kids with superior performance at pre-weaning in response to supplemental nutrition for their dams.

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