
EFFECT OF SORGHUM MEAL-BASED CONCENTRATE ON MILK YIELD, MILK COMPOSITION AND CHEESE WEIGHT OF WEST AFRICAN DWARF GOAT AT EARLY LACTATION

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ABSTRACT

This study aims to investigate the effect of sorghum meal-based concentrate on milk yield, milk composition, and cheese weight at early lactation of West African Dwarf Goat. A total of Fourteen (14) West African Dwarf (WAD) Goats with initial live weight ranging from 12 to 24kg in their third and fourth parity were divided into two groups; a control group (maize) and a treatment group (Sorghum) four weeks. All data obtained were analyzed using T-test The study findings suggest that sorghum meal-based concentrate can be a useful strategy to improve milk yield and quality at early lactation of West African Dwarf goats, with potential benefits for cheese product.

Keywords: Sorghum, milk yield, lactation, West African Dwarf goat

INTRODUCTION

Goat milk which is rarely utilized for human consumption due to social belief (Adewumi *et al.* 2009, Emrobowansan *et al.*, 2019,) were found to be a fundamental food in the diets of many cultures (Silanikove *et al.*, 2010). Goat milk is highly nutritious and contains a higher proportion of small fat globules which are more easily digestible. Its casein during digestion forms a better constituent and more friable coagulum than cow's milk. Goat milk provides a ready source of nutrient particularly protein, calcium, phosphorus and lactose. Belewu (2001) reported goat milk to be useful in the treatment of dyspepsia, peptic ulcer, pyloric stenosis, liver dysfunction jaundice and biliary disorder. There is growing awareness on the importance of goat as source of milk for man (Malau-Aduli *et al.*, 2004, Adewumi *et al.*, 2015). However, the over 440 million goats (worldwide) produce an estimated 4.8 million tonnes of milk that is predominantly consumed locally or processed into various milk products such as cheese, yoghurt and ice cream. Thus, goats produce considerable amount of milk that contributes to national milk production. Maize is used majorly as food for humans and animals generally. At times, maize could be scarce so sorghum can be used as a replacement since its grains have good nutritional values similar to corn, with an average composition of 70% carbohydrates, 14% protein, 3% fat, 2% fiber and 1.5% ash (Behling *et al.*, 2017). According to the same author, the protein concentration can vary between 8.3 and 15.5%, and may exceed that found in corn grain (10%). Thus, the aim of this study is to investigate the effects of replacing maize with sorghum on milk yield, milk composition and cheese weight of WAD goat at early lactation.

MATERIALS AND METHODS

Experimental Animals and Management

A total number of twelve (14) West African Dwarf (WAD) Goats with initial live weight ranging from 14 to 24kg in their third and fourth parity were used for this study at the Goat Unit of the College of Animal Science and Livestock Production Teaching and Research Farm, University of Agriculture, Abeokuta, Nigeria. The animals were housed intensively in a well-ventilated individual pens, disinfected with izal solution two weeks prior to the experiment. On arrival, the goats were quarantined for 14 days and during this period: they were given prophylactic treatments consisting of deworming with 1ml/kg Bodyweight of Albendazole for the kids and subsequently injected with 1ml/kg Bodyweight of ivermectin for the dams to eliminate both internal and external parasites respectively, pour-on were also used for both the dams and the kids. The animals were adapted to pen environment for 14 days and fresh cool clean water were also supplied *ad libitum*. After adaptation period, the experimental diets were given early in the morning while cassava or Gmelina hay were given in the afternoon by 4:00pm daily. The fourteen (14) West African Dwarf Goat (WAD), immediately after births were randomly allocated on weight equalization to two dietary treatments. Seven (7) Goat were in each treatment. Table 1 shows the experimental diet composition.

Table 1: Gross composition of experimental diet

Experimental diet	Maize (control)	Sorghum
Test grain	52	52
Barley	28	28
Palm kernel cake	14	14
Groundnut cake	2	2
Bone meal	2	2
Limestone	1	1
Salt	1	1
Calculated		
Protein	14.52	15.46
Fat	4.72	4.20
Fiber	6.18	6.18
Calcium	0.96	0.98
Available phosphorus	0.38	0.50
Lysine	0.50	0.56
Methionine	0.27	0.23
ME	2,615.40	2,527.00

Milking of Animals

Within 24hr after kidding, the dams and kids were weighed to know the parturition weight and birth weight. Also, the body and udder measurements will be taken. The kids were allowed to suckle the dams for 7 days postpartum to consume colostrum and establish strong dam-kid relationship to forestall rejection of kids by their dams. Hands milking of the animals were done between 06.00hr and 07.00h for two consecutive days at 21 and 42 days to avoid kid mortality as they are non-dairy animals. The kids were separated from the dam over-night for 14h overnight (19.00h-07.00h) and re-introduced to their dams after milking and offered cracked barley, groundnut cake, bone meal, limestone and salt. The milk was collected using 500ml graduated plastic beaker and weighed thereafter. Values obtained were multiplied by a factor of 2 to get the milk yield for 24hr (Otaru, 2020). A portion of the milk (50ml) from each dam were stored at -4^oC and used to determine the composition of the milk by methods of AOAC, 2005. The weights of cheese were measured using gram sensitive scale and were recorded as cheese yield. Volumes of whey produced from each milk sample were measured using measuring cylinder. These were also recorded as whey yield.

Cheese Preparation and Preparation of Calotropis

Calotropis procera (Sodom apple) scalp (milk liquid) was dropped in water at ratio one to one to form a mixture of 30ml and mix with the raw milk and was gently heated in a Metal pot over a slow burning fire. The milk was heated to bring the temperature to 45 degree Celsius.. 30mls of pale green extracted Sodom apple solution were measured and added to the warmed milk. Heating will continue until clotting begins. The heating of the curds will continue to boiling point and was maintained at boiling for about 3-4mins to inactive the plant enzymes, facilitates whey expulsion and form curd. The loose curds will then be poured into a 1mm sieve to allow the whey to drain for 20 min and cool for 2 hours after which no dropping whey is observe from the sieve. Cheeses formed were cut into blocks.

Statistical Analysis

All data obtained were analyzed using T-test procedure.

Results

Effect of sorghum based-mealon milk yield, milk composition and cheese weight of West African Dwarf from first week to fourth week is shown in table 2. All parameters measured were not significantly affected ($P > 0.005$).

Table 2: Effect of sorghum based meal on milk yield, milk composition and cheese weight on West African Dwarf Goat

Parameters	Maize	Soeghum	P-Value
Milk yield (ml)	180.60±28.00	218.40±33.00	0.40
Weight (kg)	20.89±1.20	19.97±13.01	0.48
Fat (%)	7.12±1.70	5.53±1.00	0.45
SNF (%)	8.47±0.10	8.45±0.35	0.57
Density	19.02±0.44	18.62±0.95	0.71
Lactose (%)	4.91±0.05	4.79±0.21	0.59
Salt (%)	0.02±0.02	0.90±0.05	0.65
Protein (%)	3.50±0.04	3.41±0.37	0.60
Temp. sample	28.51±0.37	28.54±0.24	0.95
Freezing point	0.62±0.01	0.31±0.21	0.20
Ph.	7.94±0.27	7.87±0.21	0.86
Conductivity	3.70±0.11	3.71±0.11	0.90
Cheese (g)	33.10±4.00	34.70±6.20	0.87
Whey (ml)	34.50±7.40	44.70±9.80	0.42

DISCUSSION

Based on Min *et al.*'s (2005) research, it was found that dietary characteristics have an impact on milk yield and composition in dairy goats, given their genetic limitations. Specifically, goats included in the sorghum-based diet produced higher milk yield in comparison to those on the maize-based diet. These findings differ from earlier studies, like Casper *et al.*, (1990), which indicated a positive relationship between the amount and concentration of metabolizable energy and milk protein or yield. Furthermore, the study observed that milk yield increased over time after giving birth, with the highest yield occurring at weeks 3 to 4 of lactation. This aligns with the observations of James and Osinowo (2004), who reported that West African Dwarf goats typically reach their peak milk production within 3 to 4 weeks of lactation.

The findings in the current study, which observed similarities in milk yield and composition between West African Dwarf does on a maize concentrate diet and those on a sorghum diet, contrast with the results from Ukanwoko and Ibeawuchi, (2014). They noted significant differences in milk yield and composition when the does were fed a diet containing Cassava Peel-Cassava Leaf Meal Based Diets. The milk yield in this study is below the range of 139.70 - 233.00g/d as reported by Ahamefule (2005). These divergent values could be attributed to variations in the diets provided. Furthermore, factors such as parity and litter size have been recognized as significant contributors to milk yield and composition in lactating animals, as pointed out by Akpa *et al.* (2001). Additionally, there were no significant disparities in the fat content of the goat milk among the various diets. The range of fat values in this study exceeded the 4.74 ± 0.03 reported by Zahraddeen *et al.* (2007). The average chemical composition of the raw milk collected from the West African Dwarf (WAD) goats indicates that the range of crude protein values obtained in this study differed from the values of 4.34% to 4.89% reported by Anya and Ozung (2018) for milk from lactating WAD does. The variation in crude protein values between this study and others could be attributed to differences in diet, breed, individual characteristics, seasonal variations, feeding practices, management, environmental conditions, location, and lactation stage (Park, 2007).

Cheese production involves the coagulation of milk protein, specifically casein (Scott, 1986). In essence, cheese is a dairy product made by acidifying and coagulating milk (Fox *et al.*, 2000). The shelf life of cheese, which ranges from 4 days to 5 years, primarily depends on its variety. The cheese yield from milk produced by lactating West African Dwarf goats fed a diet containing maize meal concentrate and sorghum was not significantly affected. The cheese yield in this study exceeded the average yield suggested by O' Connor (1993) at 20% and the one reported by Omotosho *et al.* (2011) at 32.75%. These differences in results may be attributed to variations in the raw materials used.

Conclusion AND RECOMMENDATION

Lactating goat fed could be fed sorghum diet as it produces more milk and cheese numerically compared to goat fed maize diet.

REFERENCES

- Adewumi, O.O., Oke, O. B. and Adewumi, B.A. (2009):** Milk yield, milking time, milk flow rate of lactating West African Dwarf, Yankasa ewes and their crossbred. *American Society of Agricultural and Biological Engineers (ASABE)*. asae.frymulti.com/azdez.asp. Published by ASABE. elibrary.asabe.org/azdez.asp?JID.5andAID=28305andCID.....T.USA
- Adewumi, O. O., Lawal-Adebawale, O. A. and Adegbemile, D. A. (2015):** Assessment of farm families' acceptability of small ruminants' milk for consumption in selected rural communities in Ogun State, Nigeria. *International Journal of Agricultural Extension and Rural Development (JAERD)*. 7(4):135-141.
- Ahamefule, F. O, Ibewuchi, J. A. and Ejiofor, C. A. (2003).** A comparative study of constituents of cattle and goat milk in a hot humid environment. *Discov. And innov.* 15(1/2): 64 – 69.
- Ahamefule, F. O., 2005.** Evaluation of Pigeon pea-cassava peel based diets for goats in south-eastern Nigeria. Ph.D. Thesis. College of Animal Science and Production, Micheal Okpara University of agriculture, Umudike, Nigeria.
- Akpa, G.N., Asiribo, O.E., Oni, O.O., Alawa, J.P., Dim, N.I. (2002):** Milk Production by Agropastoral Red Sokoto Goats in Nigeria. *Trop Anim Health Prod* 34: 525-533.
- Anyu, M. L. and Ozung, P. O. (2018).** Composition of colostrum and milk of west Africa dwarf goat. (WAD) does feed cassava peel based diets supplemented with Africa yam beans (*Sphenostylis stenocarpa*) concentrate in the humid zone of Nigeria. *Online Journal of Africa Feed Research*,8(5): 112 – 119.
- Association of Official Analytical Chemists (AOAC), 2005:** Methods and determination of moisture. AOAC Referee 17, 5–9.
- Belewu 2001:** Nutritional and Rheological evaluation of West African Soft cheese made from coagulant (*Calotropis procera*) during storage, Ruminant Nutrition Dairy Science Laboratory department of animal production, University of Ilorin, Kwara State, Nigeria. Vol. 6 No. 3
- Behling Ronan 2, Sabina Valange, Gregory chatel and juan Carlos. (2017)** Sonocatalysis: Pathway for Valorization of Lignocellulosic Biomass and Derivatives. Pmc 5396383
- Casper, D. P., Schingoethe, d. J and Eiseenbeize, w. a. 1990.** Response of early lactation of dairy cows fed diets varying in source of non-structural carbohydrate and crude protein. *Journal of dairy science* 73: 1039-1050. [Abstarct].
- Emrobowansan, M. I., Busisiwe, G., Micheal, A. (2019):** Farmers' perception and wereingness to consume goat milk and goat milk products: A case study of the Central Eastern Cape, South Africa. *Pastoralism*, 9, Article: 3.
- Fox, P. F. 2000.** Avanced dairy chemistry. Vol2: lipids. 2nd edition. Champman and hall, new York.
- Ibeawuchi, J. A. (1987).** Effects of feeding different levels of brewers' dried grain to lactating cows on yield and composition of milk. *Bull Anim. Hlth. Prd. Afr*, 35:160 – 164.
- James, I.J., Osinowo, O. A and Ajegbile, L. T. 2005.** Factors affecting milk yield in West African Dwarf Goats. *Proceedings of 30th annual Conferneec of Nigeria society of animal production, 20th-24th march, 2005, University of Nigeria, Nsukka, 30: 19-21.*
- Min, B.R., Hart, S.P. Shalu, and Scatter, L, D. 2005.** The Effect of Diets on milk production and composition, and lactation curves in pastured dairy goat. *Journals Dairy Science* 88: 2604-2615.
- O'Connor, C. B. 1993. Traditional cheese making manual.** ILCA (International Livestock Centre for Africa), Addis, Ababa, Ethiopia. 24pp.
- Omotosho, O. M., Babayemi, O. J. Afolabi, K. d. and Fabowale A. A. 2010.** Evaluation of wheat ofal, cssava starch residue and cassava peel as supplement in fattening white Fulani cattle. *Proceedings of 15th Annual conference of Animal Science of Association of Nigeria, 13-15th September, 2012, University of Uyo, Nigeria. Pp. 579-582.S*
- Scott, R., 1998. Cheese making practice.** New York Kluwer Academics. Pp 11-14, 37-38, 123-127, 224, 277-279, 281-284 and 359-361.

Silanikove N., G. Leitner, U. Merin, C.G. Prosser 2010: Recent advances in exploiting goat's milk: Quality, Safety and production aspect. Vol. 89, issues 2-3, April 2010, pp 110-124.

Zahraddeen, D. Butswat, I.S.R and Mbap, S.T 2007. Evaluation of some factors affecting milk composition of indigenous goats in Nigeria; Livestock research for rural development volume 19, article #166. Retrived September 13, 2021, from <http://www.lrrd.org/lrrd19/11/Zahr19166.htm>.