World Journal of Innovative Research (WJIR)
ISSN: 2454-8236, Volume-8, Issue-4, April 2020 Pages 67-73

Studies on Correlation and Linear Regression Analysis between Milk Yield (Offtake) and Milk Composition in Grazing Lactating White Fulani Cows

G. O. Tona, D. O. Ogunbosoye, O.O. Adewumi, A. A. Akingbade, Y. B. Alaanu

***Abstract*— This study investigated the relationship in the milk yield (offtake) versus the milk nutrients composition in eight grazing lactating White Fulani cows. The milk yield (offtake) and milk composition (proximate composition, minerals and vitamins) data were subjected to measurements of means, linear correlation and linear regression coefficients. The experiment was carried out in a completely randomized design, with 8 milking cows and 22 milking readings per cow during one lactation period. The mean milk yield ranged from 3.00 to 4.50 L/day. There were positive and significant correlation between milk yield and ash (r= 0.74, P< 0.05), milk yield and riboflavin (r= 0.71, P< 0.05). The milk protein was positively and significantly correlated to calcium (r= 0.73, P< 0.05), potassium (r= 0.79, P< 0.05) and phosphorus (r= 0.72, P< 0.05). The regression analysis showed that manganese (Mn) had the greatest effect of 84.99 % determinant of the milk yield. Whereas protein content was negatively correlated (r= - 0.10) and had a negative effect in relationship to milk yield, and this imply that the protein level of the feed consumed by the cows was very low. In conclusion, the results of the multiple regression analysis indicated in the last step that milk protein, fat, carbohydrate, potassium, manganese, thiamine, and vitamin A were the most important variables to be considered when assessing the contribution of the various nutrients to milk yield in the grazing White Fulani cows. Thus, the best equation based on this study for predicting milk yield (offtake) with R^2=1, 100% is**

MY=-45.429-1.389PR+6.828MF+1.130CARB-0.079K+84.988Mn-17.762THM+0.262Vit.A.

***Index Terms*— Milk yield, milk composition, linear relationships, White Fulani cows.**

I. Introduction

In most West African countries, White Fulani cattle are kept for meat, dairy, hides and draught. Food and Agricultural Organization [1] reported that the dairy industry in Nigeria produces an estimate of 450,000 tons of milk per annum. However, this production was found to be inadequate to satisfy the dairy demands of Nigerians. Consequently, protein deficiencies had become a common phenomenon in Nigeria, especially among the poor segment of the society, which constitute majority of the populace. Also, local production of dairy supply in Nigeria was far below the annual demand which was estimated at 1.45 billion litres by 2010 [1]. The milk supply in Nigeria was earlier reported [2] not to be sufficient to meet consumers need either as fresh milk or fermented milk. Food and Agricultural Organization [1] stated that the Nigerian dairy sector is primarily demand driven and not by the supply situation. Instead of taking advantage to invest in dairy farming, the gab was usually bridged by mass importation of dairy products into the country. In 2008 alone, Nigeria imported an average of 46,853 metric tonnes of whole dried milk valued at US$80,000,000; dried skimmed milk of 29,267 metric tonnes, valued at US$13,827,000 and whole evaporated milk was 8,053 metric tonnes, valued at US$22,725,000 [1].

In Nigeria, cattle provides more than 90 % of the local domestic milk output [3], with White Fulani or Bunaji breed recognized as the principal producer. Unfortunately, the domestic output of about 407,000 metric tonnes of milk [4], from an estimated 14 million cattle [5] could hardly satisfy the dairy demands of the ever increasing population of Nigerians [6]. This is because the genotype of the African breeds of cattle was found to only produce an average milk yield of 1.27 litres per cow/day during the wet season and less than 0.36 litres during the dry season [7]. However, the European breeds of cows could produce a minimum of 6 litres per cow/day [8] under tropical environment.

Poor nutrition [9] and low reproductive performance [4] were highlighted as some of the major factors that affected milk production from our indigenous cattle breeds. The agro-pastoral system of cattle production in Nigeria provides nourishment for stock only on range and this is presented with difficulties especially in the dry season. The low nitrogen content of dry season fodder usually confer severe nutritional stress on ruminant livestock with the result that cattle grazing these poor quality forages without supplementation experience weight loss, reduced growth rate and decline in milk production. Again, the use of conventional feedstuffs such as maize, soybean cake and

G. O. Tona, Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria
D. O. Ogunbosoye, Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria **O.O. Adewumi,** Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria
A. A. Akingbade, Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria
Y. B. Alaanu, Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria

groundnut cake to enhance production has become unprofitable and thus not appropriate owing to their exorbitant costs and erratic supply [10]. It is in this light that non-conventional energy and protein materials are presently being exploited for feeding livestock and indeed for cattle production in Nigeria. Such materials usually would be nutritious, non-toxic, cheap, available and generally acceptable to animals and they could also have low human utilization. The nutrition profile of diets offered to lactating animals has been reported to influence the final milk product [11]. Adewumi *et al*. [12] thus mentioned that there is the need to determine the optimum levels of crude protein and other nutrient supplements fed in the diet of the lactating animal that could result to the highest milk yield, and as such the crude protein and other nutrients could be in adequate quantities and such excess quantities might not be excreted as urine. The correlation between two quantitative variables measures the strength of a linear relationship between them. The co-efficient of determination (R^2) gives the proportion or magnitude of variation in one variable associated with changes in the other variable. Thus, the aim of this study was to investigate the effect of various nutrients in the diet of lactating White Fulani cows and to predict or assess their contribution to milk yield.

II. MATERIALS AND METHODS

A. Duration, Ethical Approval and Study Location

The experiment was conducted from October, 2018 to August, 2019 (one lactation period of 11 months). Prior to the conduct of this research work, informed consent was sought from the local farmer. The experiment was carried out at Surulere South Local Government Area (LGA), Iya Olooje Gaa Temidire, Ogbomoso, Oyo State, Nigeria. Ogbomoso is located in the derived Savanna Zone of Nigeria. It lies on longitude 4^0 15' East of Greenwich Meridian and Latitude 8^0 15' North of the Equator, Oguntoyinbo [13], as reported in the research by Tona [14]. The altitude is between 300m and 600m above the sea level and the mean annual rainfall and temperature are 1500mm and 27^0C respectively. The transhumance farming system is practised here. This system allows for a degree of permanent housing to be built in the wet season grazing areas. Some form of village community is developed and there is an active trading in milk especially during the wet season and purchase of consumer goods. At the end of cropping seasons, where such transhumant communities are adjacent to arable farmers, the pastoralist is allowed to graze his animals on crop stubble and in exchange, the farmer is left with valuable manure.

B. Experimental Animals, Management and Feeding

Eight second parity lactating White Fulani cows weighing 245.00 ± 15 kg with similar milk production were selected from a herd of about 165 cattle for this research work. The animals were identified by the use of number tags attached to neck belts. This cattle herd was managed under the extensive grazing system and the calves were allowed to suck milk freely from their dams throughout the period of the experiment. All the experimental animals were conducted out daily by herdsmen for free grazing from 8.00 am to about 2.30 pm. The cattle herd had access to various types of forages such as grasses, browse plants and forage legume plants. Daily drinking water was made available to the herd from streams in the Local Government Area.

C. Determination of Milk Yield, Experimental Design, Milk Composition and Chemical Composition of Selected Forages from the Grazing Land

The cows selected for this study were hand-milked twice daily between 7.00 and 8.00 am and also at 3.00 pm till 4.30 pm. The calves were separated from their dams for about 12 hours prior to the measurement of milk yield on each test-day and observation was made at 14 days intervals. Milk yield was measured using a cleaned plastic measuring cylinder graduated in mls. The experiment was carried out in a completely randomized design, with 8 milking cows and 22 milking readings per cow during one lactation period. Proximate analysis of the milk samples was carried out as outlined by AOAC [15]. Atomic absorption spectrophotometer was used to determine the mineral elements content in the milk and forage samples. Chemical composition of *P. maximum* and *P. biglobosa* browse plant harvested from the grazing land by the methods of AOAC [15]. More details on the determination and calculation of the chemical composition are as presented by Ogunbosoye *et al*. [16] and Tona *et al*. [17].

D. Statistical Analysis

Data generated were analyse using one way analysis of variance (ANOVA) and Tukey's studentised test was used to separate means where there was significant difference at $P< 0.05$. Data were also subjected to statistical analyses using the Pearson correlation and regression procedures of SAS [18].

III. RESULTS

Chemical composition of the *Panicum maximum* grass and *Parkia biglobossa* legume forage (Table 1) and macro-mineral composition in *Parkia biglobossa* (Table 2) are as presented. These forages are found growing in the grazing land. The means of the milk yield (offtake) and milk composition are as shown in Table 3. In Table 4 is presented the Pearson correlation values of the milk yield (offtake) and milk composition of White Fulani cows. Table 5 shows the stepwise multiple regression analysis between the milk components of the White Fulani cows.

Table 1: Chemical composition of *Panicum maximum* grass and *Parkia biglobosa* legume forages

Chemical components (%)	*Panicum maximum*	*Parkia biglobosa*
Dry matter	53.00	65.75
Crude protein	6.95	19.80
Ether extract	3.10	4.10
Crude fibre	33.20	31.35

Ash	5.60	9.10
Nitrogen free extract	4.15	1.40
Gross energy (Kcal/kg)	4523.10	ND
Neutral detergent fibre	64.05	60.31
Acid detergent fibre	41.34	48.58
Hemi-cellulose	22.71	11.73
Non fibrous carbohydrate	20.30	6.69

ND= not determined.

Table 2: Macro-mineral composition in *Parkia biglobosa*

Parameter	Concentration (%)
Calcium	1.25
Magnesium	0.65
Phosphorus	0.31
Potassium	3.20
Sodium	0.44

Table 3: Means of milk yield (offtake) and milk composition of White Fulani cows

Variables	N	Mean	SD	Minimum	Maximum
Milk yield (L/day)	8	3.88	0.64	3.00	4.50
Total solids (%)	8	13.80	0.42	13.27	14.40
Protein (%)	8	3.57	0.19	3.23	3.80
Milk fat (%)	8	3.55	0.09	3.43	3.67
Ash (%)	8	0.79	0.07	0.70	0.90
Carbohydrate (%)	8	5.76	0.32	5.37	6.13
Lactose (%)	8	4.86	0.20	4.63	5.17
pH	8	6.43	0.17	6.20	6.70
Calcium (mg/100g)	8	223.54	4.03	220.00	231.67
Magnesium (mg/100g)	8	25.21	3.01	21.67	30.00
Potassium (mg/100g)	8	16.67	1.78	15.00	20.00
Sodium (mg/100g)	8	236.04	4.36	231.67	245.00
Phosphorus (mg/100g)	8	81.00	1.97	78.33	83.33
Zinc (mg/100g)	8	0.35	0.07	0.23	0.43
Manganese (mg/100g)	8	0.02	0.00	0.01	0.02
Vitamin C (mg/100g)	8	0.75	0.07	0.63	0.83
Thiamine (mg/100g)	8	0.05	0.01	0.04	0.06
Riboflavin (mg/100g)	8	0.13	0.01	0.12	0.14
Niacin (mg/100g)	8	0.53	0.06	0.43	0.60
Vitamin A (µ g/100g)	8	98.83	1.86	92.00	96.33

N= number of animals, mean= mean sum of all the individual parameters divided by the number (N), the standard deviation (SD) = square root of variance, minimum = lowest of the observations and maximum = highest of the observations.

Table 4: Pearson correlation values of the milk yield (offtake) and milk composition of White Fulani cows

Parameters	MY	TS	PR	MF	Ash	CARB	LACT	pH	Ca	Mg	K	Na	P	Zn	Mn	Vit. C	THM	RB	NCN
Milk yield (MY) (L/day)	1																		
Total solids (TS) (%)	0.304																		
Protein(PR)(%)	-0.097	0.561																	
Milk fat (MF) (%)	0.435	-0.225	0.155																
Ash (%)	0.740*	0.666	0.124	-0.042															
Carbohydrate (CARB) (%)	0.126	0.863**	0,406	-0.344	0.488														
Lactose(LACT) (%)	0.565	0.760*	0.643	0.370	0.538	0.508													
pH	0.835**	0.230	0.178	0.000	0.718*	0.029	0.306												
Calcium (Ca) (mg/100g)	0.288	0.576	0.729*	0.427	0.159	0.313	0.818*	0.062											
Magnesium (Mg) (mg/100g)	0.632	0.646	0.494	0.293	0.450	0.360	0.896**	0.509	0.846**										
Potassium (K) (mg/100g)	0.417	0.566	0.789*	0.313	0.402	0.437	0.733*	0.329	0.774*	0.739*									
Sodium (Na) (mg/100g)	0.693	0.766*	0.493	0.288	0.708*	0.609	0.810*	0.483	0.732*	0.797*	0.818*								
Phosphorus (P) (mg/100g)	0.396	0.294	0.715*	0.614	0.352	0.202	0.639	0.145	0.541	0.455	0.815	0.601							
Zinc(Zn) (mg/100g)	0.108	0.317	0.695	-0.081	0.294	0.069	0.367	0.372	0.414	0.439	0.710*	0.356	0.538						
Manganese (Mn)(mg/100g)	0.313	0.315	0.557	0.209	0.134	0.056	0.644	0.400	0.719*	0.813*	0.625	0.409	0.385	0.710*					
Vitamin C (Vit. C) (mg/100g)	0.377	0.272	0.634	0.321	0.184	-0.035	0.616	0.440	0.730*	0.777*	0.804*	0.524	0.594	0.813*	0.938**				
Thiamine (THM)(mg/100g)	0.355	0.588	0.618	0.447	0.302	0.207	0.824*	0.107	0.920**	0.792*	0.591	0.684	0.455	0.324	0.665	0.609			
Riboflavin (RB) (mg/100g)	0.713*	0.716*	0.442	0.031	0.753*	0.493	0.751*	0.754*	0.589	0.846**	0.793*	0.859**	0.494	0.627	0.644	0.707*	0.531		
Niacin (NCN) (mg/100g)	0.909**	0.005	-0.220	0.539	0.460	-0.126	0.338	0.769*	0.266	0.530	0.370	0.563	0.308	0.057	0.296	0.411	0.257	0.561	
Vitamin A (Vit. A) (mg/100g)	0.709*	0.494	0.036	-0.203	0.865**	0.270	0.371	0.918**	0.124	0.495	0.413	0.591	0.185	0.514	0.364	0.410	0.194	0.833*	0.553

* = Correlation is significant at the 0.05 level and ** = Correlation is significant at the 0.01 level.

Table 5: Regression analysis between milk yield (offtake) and milk composition of White Fulani cows

Y	Stepwise selection of parameters	Regression equation	R^2	P value
Milk yield (MY)	Step 1	MY=-2.450+0.458TS	0.092	0.464
	Step 2	MY=-2.357+0.788TS-1.302PR	0.197	0.579
	Step 3	MY=-25.294+1.293TS-2.308PR+5.511MF	0.647	0.204
	Step 4	MY+-15.541+0.263TS-1.277PR+4.199MF+6.678Ash	0.845	0.139
	Step 5	MY=-16.006+0.419TS-1.277PR+4.135MF+6.483Ash+0CF-0.197CARB	0.847	0.340
	Step 6	MY=+0.848-1.124TS-1.4207PR+0.635MF +7.056Ash+0.319CARB+2.872LACT	0.921	0.500
	Step 7	MY=-29.046+0.0827TS-1.003PR+3.900MF+1.105Ash +0.462CARB+0.489LACT+2.429pH	1	----
	Step 8	MY=-28.274-1.023PR+3.725MF+1.386Ash+ 0.0484CARB+0.549LACT+2.364pH+0.004Ca	1	----
	Step 9	MY=-21.182-0.0898PR+3.985MF+2.27Ash+0.460CARB +1.856pH-0.016Ca+0.056Mg	1	----
	Step 10	MY=-45.150+5.034MF+0.059Ash+0.944CARB+3.674pH+ 0.02Ca-0.015Mg-0.127K	1	----
	Step 11	MY=-24.284-0.928PR+4.170MF+2.357Ash+0.572CARB+ 2.108pH+0.040Mg-0.013Na	1	----
	Step 12	MY=-28.719+3.324MF+1.153Ash+0.071CARB+0.380LACT+ 2.889pH-0.024Ca-0.091P	1	----
	Step 13	MY=31.286+3.324MF+1.163Ash+0.336CARB+0.293LACT+ 3.083pH+0.000Ca-2.196Zn	1	----
	Step 14	MY=-30.339+3.635MF+1.686Ash+0.440CARB+2.927pH- 0.004Ca-2.459Zn+18.122Mn	1	----
	Step 15	MY=-34.902+4.554MF+0.494CARB+0.523LACT+3.449pH+ 0.000Na-0.039P-2.238Vit.C	1	----
	Step 16	MY=-32.236-0.418Ash+0.044CARB-0.061LACT+3.806pH+ 0.155P-5.365Zn+25.993THM	1	----
	Step 17	MY=+12.570-1.826PR+3.515MF+2.605Ash-0.069CARB+ 0.071LACT-14.041THM+45.794RB	1	----
	Step 18	MY=11.224+0.172TS+1.928MF+5.696Ash-2.993Zn+ 80.421Mn-33.904THM+4.956NCN	1	----
	Step 19	MY=-45.429-1.389PR+6.828MF+1.130CARB-0.079K+ 84.988Mn-17.762THM+0.262Vit.A	1	----

Y= Dependent variable, R^2=Co-efficient of determination, MY=Milk yield, TS=Total solids, PR=Protein, MF=Milk fat, CARB=Carbohydrate, LACT=Lactose, Ca=Calcium, Mg=Magnesium, K=Potassium, Na=Sodium, P=Phosphorus, Zn=Zinc, Mn=manganese, Vit. C=Vitamin C, THM=Thiamin, RB=Riboflavin, NCN=Niacin and Vit. A=Vitamin A.

IV. DISCUSSION

The chemical composition of the sampled *P.maximum* grass and *P. biglobosa* legume forages presented in Tables 1 and 2 and these show some of the nutrients and macro-mineral elements that are present in the grazing land available to the lactating cows. The legume forage, *P. biglobosa* (locust beans) could be seen to possess small quantities of macro-mineral elements varying from 0.31% of phosphorus to 3.20% of potassium. These values favourably compared to the values of 0.35% of phosphorus and 2.78% potassium in *P. biglobosa* earlier reported in the research work of Ogunbosoye *et al*. [16]. These nutrients help to meet the dietary needs of the lactating cows. The crude protein content of the diet particularly is required to provide the minimum ammonia level required by rumen micro-organisms for optimum rumen activity. Table 3 showed that the mean milk yield in the experimental cows varied from 3.88 to 4.50 litres. Other values of the proximate, minerals and vitamins nutrients investigated are also depicted in the Table 3.

As presented in Table 4, there occurred positive and significant correlation between milk yield (offtake) versus ash (r=0.74, P< 0.05), riboflavin (r=0.71, P< 0.05), niacin (r= 0.91, P<0.01), and vitamin A (r=0.71, P<0.05). Tona *et al*. [19] reported non significant correlation between milk yield and milk ash (r= 0.36). On the contrary, milk yield was negatively correlated to the milk protein content (r= 0.01), and this implied that the protein level of the feed consumed by the lactating cows was very low. Total solids content had highly significant correlation with carbohydrate/nitrogen free extract (r=0.86, P<0.01). The total solids versus lactose content (r=0.76, P<0.01), total solids versus sodium (r= 0.77, P< 0.05), and total solid versus riboflavin content (r=0.72, P<0.05) was also significant. Milk protein content was positively and significantly correlated with calcium content (r=0.73, P<0.05), milk protein versus potassium (r=0.79, P<0.05) and milk protein versus phosphorus (r=0.72, P<0.05). Milk fat had no significant correlation with any of the variables investigated.

In Table 5, the co-efficient of determination (R^2) values were found to increase from the least with $R^2 = 0.09$, that is 9% prediction (step 1) to the highest value of $R^2 = 1.00$, 100% prediction in steps 7 to 19 (for predicting milk yield (offtake)). Other researchers [20], explained that the result of the step-wise multiple regression analyses indicate that the addition of other milk nutrient variables in the milk yield (offtake) equations, would result in significant improvement in accuracy of prediction. The nutrients given in the last step 19, which are protein, milk fat, carbohydrate, potassium, manganese, thiamine and vitamin A have the highest effect of (R^2=100.00%) determinant of the milk yield (offtake) in the grazing lactating White Fulani cows. Thus, the best equation based on this study for predicting milk yield (offtake) with R^2=1, 100% is MY=-45.429-1.389PR+6.828MF+1.130CARB-0.079K+84.988Mn-17.762THM+0.262Vit.A.

V. CONCLUSION

The results of the multiple regression analyses have shown that the nutrients protein, milk fat, carbohydrate, potassium, manganese, thiamine and vitamin A were the best predictors of milk yield (offtake) in the grazing White Fulani cows. There was also, a positive significant correlation between the milk yield (offtake) and ash content (r= 0.74, P<0.05).

RECOMMENDATION: This study is useful for genetic improvement programs of White Fulani cows. There should be provision of ash or mineral content in the diet, or provision of mineral salt licks on the grazing land to improve milk yield in grazing lactating White Fulani cows. Concentrate diet or feed supplement could also be provided for grazing lactating White Fulani cows.

REFERENCES

[1] Food and Agricultural Organization (FAO) (2010). Production Year Book, UN Publication, Rome. (PVS_GapAnalysisReportNigeria.pdf(application/pdfobject) Accessed on 23/1/2013.

[2] [2] Joseph, J.K. and Olafade, A.A. (1999). Consumer acceptability, preference and quality attribute of fresh milk, "nono'" (fermented milk) and West African soft cheese from cow and goat milk. *Trop. J. Anim. Sci.* (2): 79-103.

[3] [3] Walshe, M.J., Grindle, A., Nell, C. and Benchman, M. (1991). Dairy Development in Sub-Saharan Africa. World Bank Technical Paper, No. 135. Africa Tech. Dept.

[4] [4] Olalokun, E.A. (1999). Problems and possibilities for milk production in animal production in the tropics. Ibadan Press, Ibadan, Nigeria. Pp. 43-64.

[5] [5] Resources Inventory and Management (R.I.M.) (1992). Federal Department of Livestock and Pest Control Services. Abuja, Nigeria. Pp. 110-115.

[6] [6] Ibeawuchi, J.A., Chindo, L. and Ahamefule, F.O. (2000). Milk production characteristics of imported Holstein-Friesian cattle maintained in a tropical high altitude environment. *Journal of Sustainable Agricultural Environment* 2: 14-19.

[7] [7] Yuan, X., Lee, H.S. and Kim, S.Y. (2010). Present and future of internet banking in China. *Journal of Internet Banking and Commerce* 15 (1): 678-683.

[8] [8] Direba, H., Gabor, M., Tadelle, D. Getnet, A., Million, T. and Johan, S. (2015). Milk yield and reproductive performance of Pure Jersey dairy cattle in the Central Highlands of Ethiopia. *Livestock Research for Rural Development* 27 (7).

[9] [9] Adegbola, A.A. (2002). Nutrient intake, digestibility and rumen metabolites in bulls fed rice straw with or without supplements. *Nig. J. Anim. Prod.* 29: 40-46.

[10] [10] Akinmutimi, A.H. (2004). Evaluation of sword bean (*Canavalia gladiata*) as an alternative feed resource for broiler chicks. Ph.D Thesis. College of Animal Science and Animal Health, Michael Okpara University of Agriculture, Umudike, Nigeria. Pp. 4-17.

[11] [11] Nnadi, P.A., Kamalu, T.N. and Onah, D.N. (2007). Effect of dietary protein supplementation on performance of West African Dwarf (WAD) ewes during pregnancy and lactation. *Small Ruminant Research* 71: 200-204.

[12] [12] Adewumi, O.O., Okwelum, N., Williams, T.I., James, I.J., Sowande, O.S., Akinlabi, E.T., Osunlaja, A., Omololu, B.A., Mufutau, S.O. and Jinaid, R.O. (2017). Effect of protein levels on milk component, udder parameters, blood and physiological indices of West African dwarf goats. *Nig. J. Anim. Prod.* 44 (2): 161-172.

[13] [13] Oguntoyinbo, J. S. (1978). Climatic Nigeria (Eds). A geography of Nigeria development. Heinemann Nigeria Ltd. Ibadan, Nigeria. Pp. 66.

[14] [14] Tona, G. (2011). Chemical composition and nutrient digestibility of *Panicum maximum* and *Piliostigma thonningii* leaves

fed to West African dwarf rams as dry season feed. *Ozean Journal of Applied Sciences* 4(3): 189-194.

[15] [15] A.O.A.C. (2005).Official Methods of Analysis. Association of Official Analytical Chemists, Washington DC., USA. 18th Edn. Pp. 69-88.

[16] [16] Ogunbosoye, D.O., Tona, G.O. and Otukoya, F.K. (2015). Nutritive evaluation of some browse plant species in the Southern Guinea Savanna of Nigeria for ruminant animals. *Brit. J. Appl. Sci. Technol.* 7 (4):386-395.

[17] [17] Tona, G.O., Oseni, S.O. and Adeyemo, B.Y. (2016). Morning, evening and entire lactation milk yield and composition of Jersey cows under hot and humid tropical environment of Nigeria. *International Journal of Science and Research* 5 (6): 2324-2328.

[18] [18] SAS (2000). Statistical Analysis Systems, Institute Incorporated. SAS/STAT. User's guide version 6. 3rd Edition. Cary. North Carolina, USA.

[19] [19] Tona, G.O., Adewumi, O.O. and Ojo, F.O. (2015). Early lactation milk yield and composition of grazing White Fulani cows fed dietary levels of soya milk residue in the Southrn Guinea Savanna of Nigeria. *Inter. J. Agri. Biosci.* 4 (6):22-26.

[20] [20] Idowu, S.T., Adewumi, O.O. and Tona, G.O. (2017). The relationship among dam's milk parameters, weight, udder parameters, and linear body measurements in West African dwarf sheep at first lambing. *J. Anim. Sci. Livest. Prod.* 1 (1:004) 1-5.