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Lipid profile of suckling kids and dams fed combinations of cocoa pod, cassava pulp and Acacia leaves

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ABSTRACT

The grassland pasture of low nutritive value, feeds and climatic factors had led to various responses in blood indices. Cocoa pod and cassava pulp are part of agro-industrial by products that could be used as ruminants feed. The serum lipid profile of West African Dwarf does and kids fed dietary combinations of cocoa pod, cassava pulp and Acacia leaf silage was evaluated in this study using 20 West African Dwarf (WAD) does aged 12-13 months with average body weight of 14.35±0.21kg and kids of 2.5±0.00kg. They were divided randomly into five treatment groups and each treatment consisted of 4 goats per replicate and thereafter subjected to completely randomized design for 90 days feeding trial. The diets contained four levels of fermented cocoa pod at 0, 5, 10, 15 and 20 and cassava pulp at 60, 55, 50, 45, 40 percent levels respectively while 40% cut across the groups. Results showed that combinations of the silage had significant ($p<0.05$) effects on lipid profile of both does and kids. The results revealed that does and kids fed T5 (20:40:40) had high ($p< 0.05$) HDL cholesterol than the control goats on day 30 and 90. Serum HDL cholesterol increased ($p< 0.05$) in T5 (20:40:40) as sampling day progressed. However, serum glucose, VLDL cholesterol, LDL cholesterol and triglycerides level had low values in T5 (20:40:40) which was significantly different at ($p<0.05$). This study concludes that cocoa pod could be incorporated into the diet of goats up to 20% without posing health hazards on the animals.

Keywords: Cocoa pod, Cassava pulp, Acacia leaf, Serum Lipid profile, West African Dwarf Goats

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INTRODUCTION

Goats play an important socio-economic role in the rural areas where most of the peasant farmers live and form a major part of their cultural lives and system [1]. Notwithstanding the importance of goats, its production is still hindered as a result of shortage of feed both in quantity and quality at some seasons of the year. The challenges of availability and affordability of feeds have therefore push researchers to find alternative sources of feeds that are sustainable and are not consumed by human beings. Cocoa pod which is an agro-by product, has been identified as one of such alternatives. In order to reduce feed cost and make feed available throughout the seasons, farmers have resolved to the use of non-conventional feed ingredients like agro industrial by products in animal feeds [2]. In small ruminants, especially during pregnancy, lactation and neonatal period, there are phases which modify the metabolism of dams and offspring [3]. The specific changes taking place during pregnancy and lactation are very important in clinical practice because all metabolic functions vary during these physiological phases in order to satisfy the demands of the foetus, placenta and uterus, and also to cope with milk production.

If an animal is unable to consume enough feed to meet maintenance requirements, it uses body reserves, resulting in increases in serum NEFA and urea, due to adipose and protein catabolism. Cholesterol is a precursor of the steroid hormones, and varies during the oestrus cycle, gestation and lactation. Hypercholesterolemia is a lipoprotein metabolic disorder characterized by high serum low density lipoprotein and blood cholesterol and one of the most important risk factors for the development of cardiovascular diseases [CVD] and lipid abnormalities [4]. Clinical trials have demonstrated that intensive reduction of plasma Low Density Lipoprotein Cholesterol levels could reverse atherosclerosis and decrease the incidence of cardiovascular diseases [CVD]. Continuous ingestion of high amounts of saturated fats and cholesterol are directly related to hypercholesterolemia and susceptibility to atherosclerosis [5]. Generally, high-fat diets, high sucrose/fructose diets, diets high in saturated fats and restricted in certain essential nutrients, like choline and methionine, have been shown to cause obesity and fatty livers in a number of different strains and species of rodents. High-fat western diets induce extreme hypercholesterolemia and also led to some metabolic syndrome such as weight gain, decreased High Density Lipoprotein levels, obesity, hypertriglyceridemia hyperinsulinemia, and insulin resistance. Lipid structure, composition, configuration, in addition to excessive fat and cholesterol consumption are also believed to affect the lipid profile in the plasma.

MATERIALS AND METHODS

Experimental Site

The study was carried out at the Teaching and Research farm of the Department of Animal Science, Landmark University, Omu Aran, Kwara State, Nigeria.

Experimental Animals and Design

Twenty sexually mature WAD goats does aged 7-8 months with average body weight of 9±0.00kg were sourced from livestock market at Otun Ekiti, Nigeria. After 14 days of acclimatization, the animals were allotted to five dietary treatments in a completely randomized design with 4 animals per treatment in an intensive system of management.

Experimental Procedure

Experimental Animals and Management

The experimental animals were kept in well ventilated pens [3m x 1.5m] as described by Olawoye [6]. All the goats were weighed and randomly allotted to different dietary groups [Table 1]. The animals were dewormed by using a broad spectrum anthelmintic [Super Ivermectin], according to the body weight and sprayed with acaricide [Parannex] against external parasites. *Ox-tetracycline* [OTC] 20% was administered to all the goats to control *Contagious Caprine Pleural pneumonia* [CPPP]

before onset of the experiment. The experimental diets comprised ensiled combinations of cassava pulp, cocoa pod and Acacia leaf [Table 1]. The goats were fed with experimental diets for 150days gestation period with cool, fresh drinkable water which was supplied *ad libitum*.

Table 1: Dietary Compositions of combinations of cocoa pod, cassava pulp and Acacia fed West African Dwarf Does [%] Feed Ingredients

	Control				
	T_1	T_2	T_3	T_4	T_5
Cocoa pod	0.00	5.00	10.00	15.00	20.00
Cassava pulp	60.00	55.00	50.00	45.00	40.00
Acacia leaf	40.00	40.00	40.00	40.00	40.00
Total	100.00	100.00	100.00	100.00	100.00

Data Collection

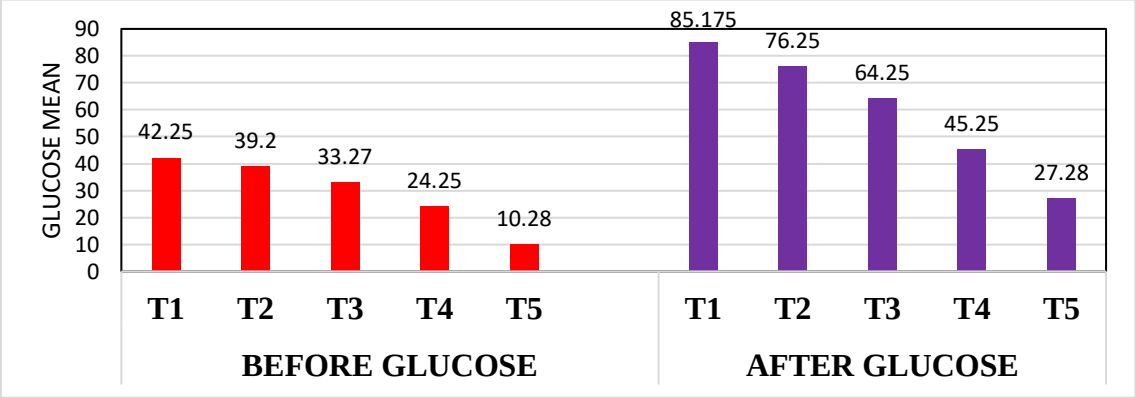
Blood Collection and Determination Serum Lipid Profile

After kidding, blood samples from dams and kids were collected through jugular venipuncture into plain serum bottles on 30 and 90 days of the experiment. The blood samples were centrifuged at 4000g for 15 min and the resulting supernatant was collected into centrifuged tubes and stored at −80°C until further analysis. The serum total cholesterol, high density lipoprotein [HDL] cholesterol, triglycerides and glucose was determined using automatic analyzer [Automatic analyzer 902, Hitachi, Germany]. The low-density lipoprotein [LDL] cholesterol was estimated: LDL cholesterol = Total cholesterol - HDL cholesterol- very low-density lipoprotein [VLDL] cholesterol. Where VLDL cholesterol = Triglycerides/5 as described by Yeom *et al.* [7] The lipid profile obtained from West African Dwarf does fed combinations of cocoa pod, cassava pulp and Acacia leaf [T1-T5] and kids suckled dam fed this silage were subjected to standard methods of statistical analysis using windows-based SPSS [8]. The analysis of variance [ANOVA] test was used and Level of significance was set at $p<0.05$.

Results

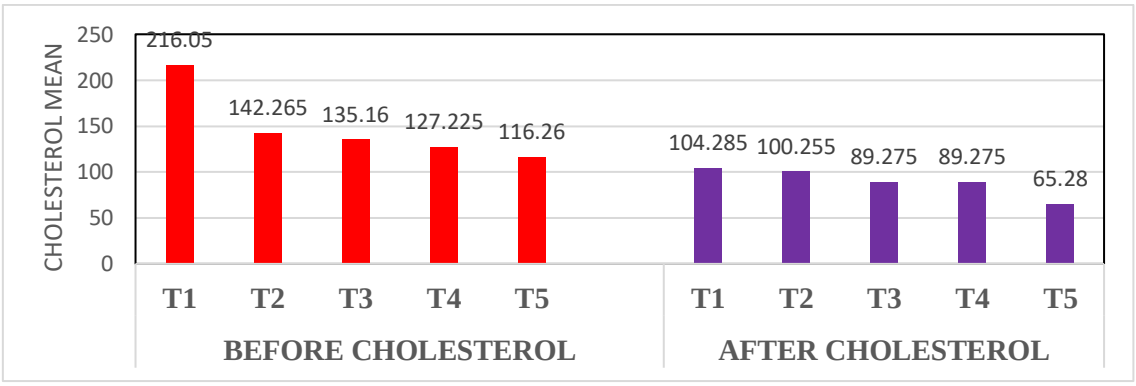
The lipid profile of does fed graded levels of combinations of cocoa pod, cassava pulp and Acacia leaf and kids suckled this silage are shown in Figure 1-12. Diets and sampling days had significant [$p<0.05$] effects on the concentration of serum glucose, VLDL cholesterol, LDL cholesterol and triglycerides. Goats fed T5 [20:40:40] had high *[p*< 0.05] High Density Lipoprotein cholesterol than the control goats on day 30 and 90. Serum HDL cholesterol increased [*p*< 0.05] in T5 [20:40:40] as sampling day progressed. However, serum glucose, VLDL cholesterol, LDL cholesterol and triglycerides level had low values in T5 [20:40:40] which was significantly different at [$p<0.05$] in both does and kids.

Lipid Profile in West African Dwarf Does fed combinations of cocoa pod, cassava pulp and Acacia leaves



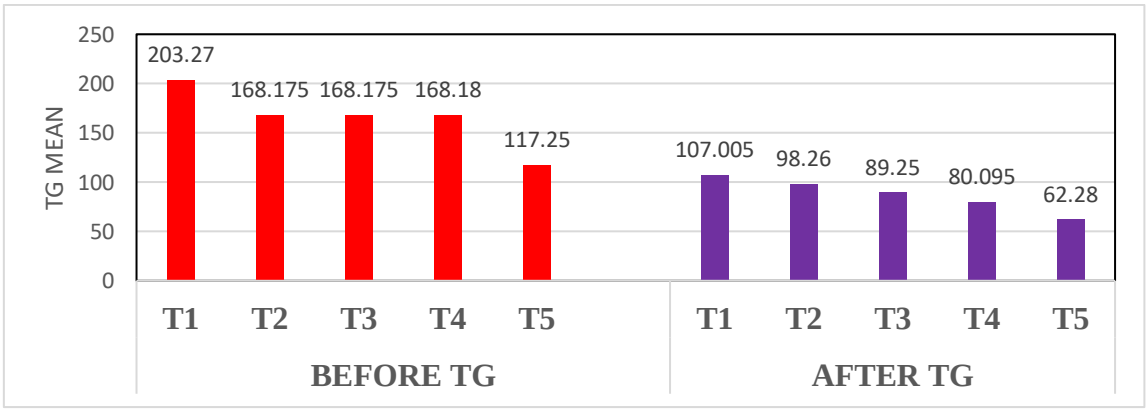
Before = 30 days blood sample collection After =90days blood sample collection

Figure 1: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on blood lipid profile in Does. Does were fed this silage for the 90 days of experimental period. Blood was collected at 30 days and 90 days and Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD.



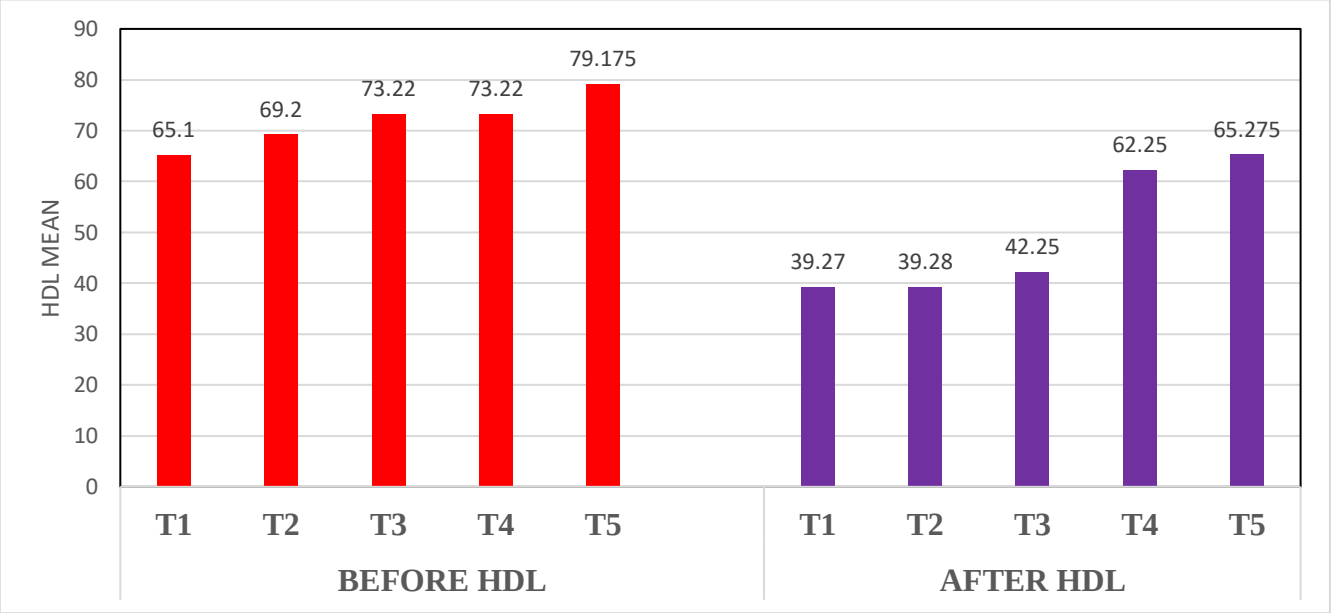
Before = 30 days blood sample collection After =90days blood sample collection

Figure 2: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on blood lipid profile in Does. Does were fed this silage for the 90 days of experimental period. Blood was collected at 30 days and 90days; Total cholesterol of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05.



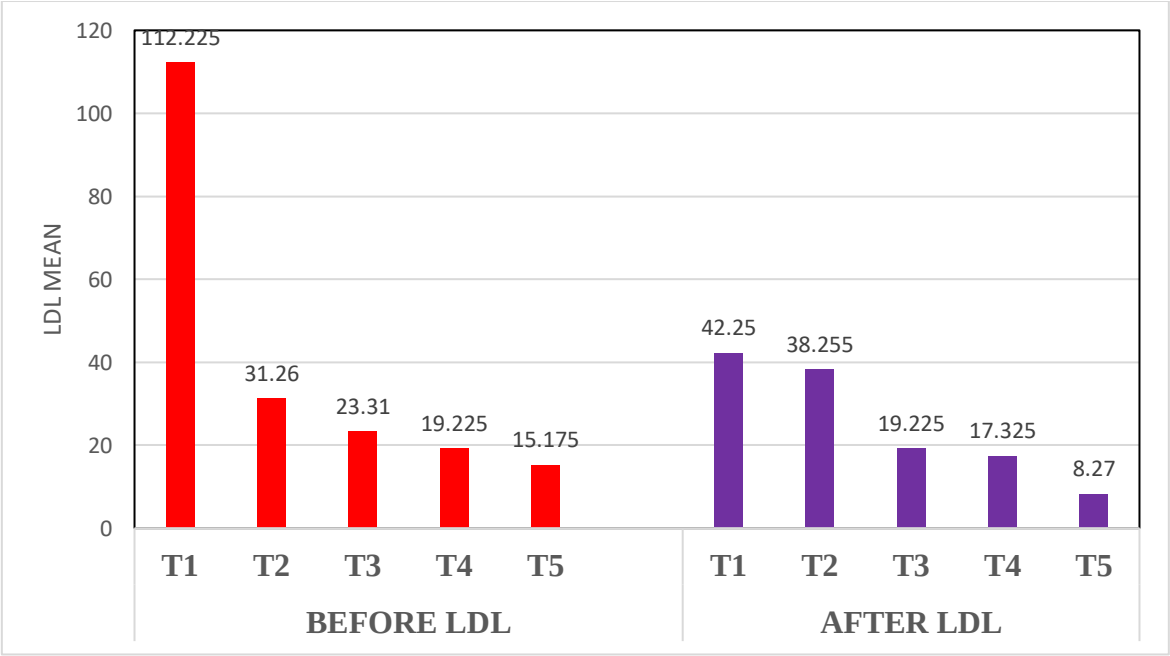
Before = 30 days blood sample collection After =90days blood sample collection

Figure 3: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on blood lipid profile in Does. Does were fed this silage for the 90 days of experimental period. Blood was collected at 30 days and 90days; Triglycerides of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05.



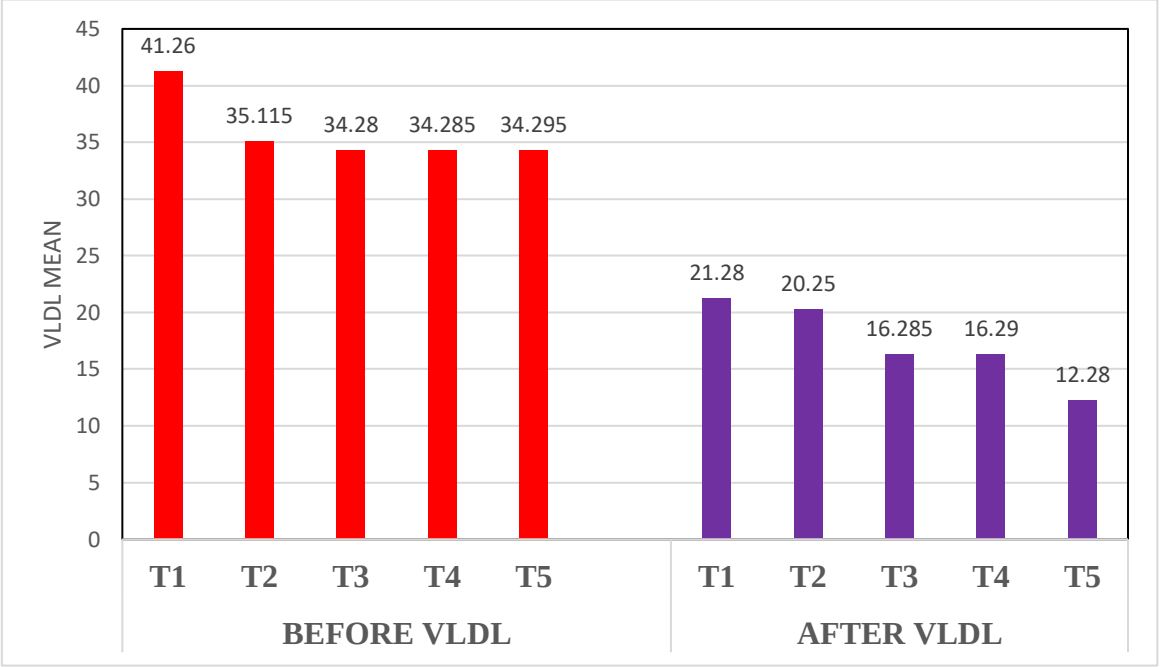
Before = 30 days blood sample collection After =90days blood sample collection

Figure 4: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on blood lipid profile in Does. Does were fed this silage for the 90 days of experimental period. Blood was collected at 30 days and 90days; High Density lipoprotein of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05



Before = 30 days blood sample collection After =90days blood sample collection

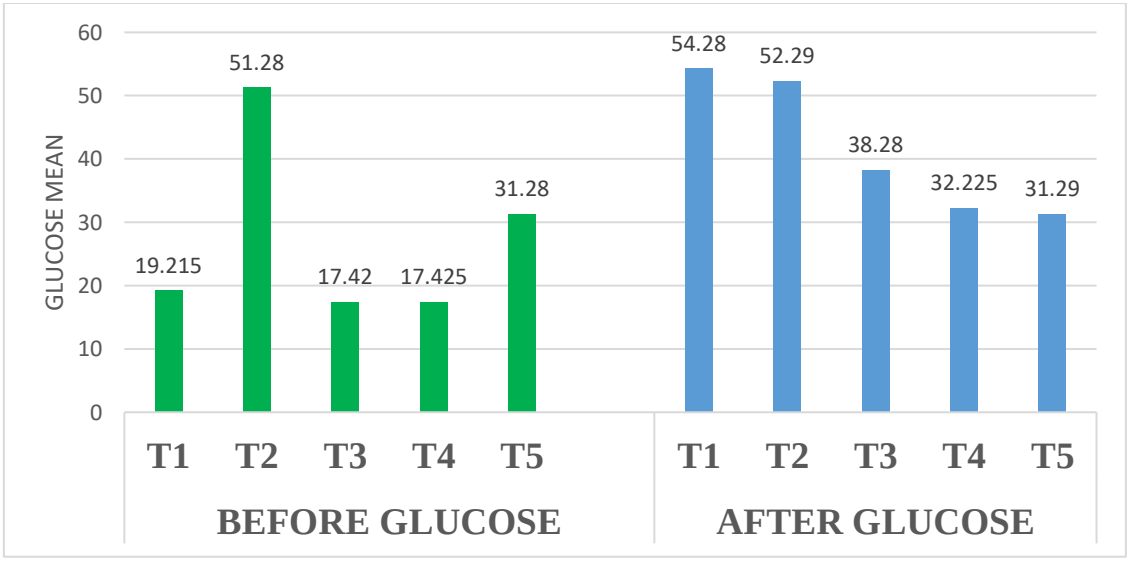
Figure 5: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on blood lipid profile in Does. Does were fed this silage for the 90 days of experimental period. Blood was collected at 30 days and 90days; Low Density lipoprotein of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05.



Before = 30 days blood sample collection After =90days blood sample collection

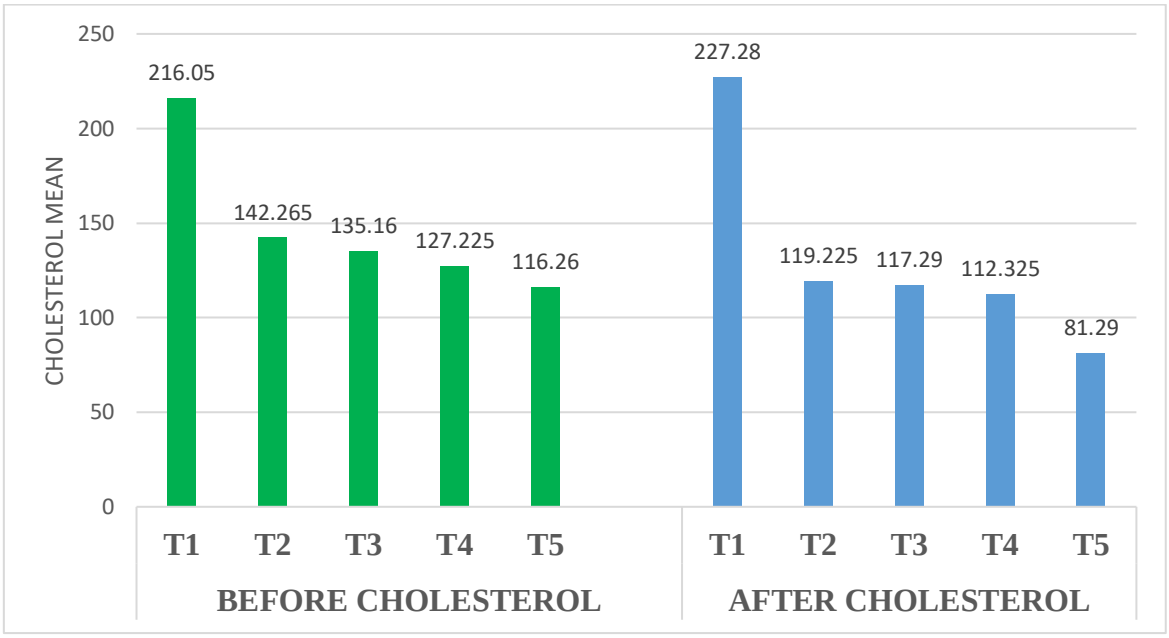
Figure 6: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on blood lipid profile in Does. Does were fed this silage for the 90 days of experimental period. Blood was collected at 30 days and 90days; Very Low-Density lipoprotein of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05.

Lipid Profile in West African Dwarf Kids of dams fed combinations of cocoa pod, cassava pulp and Acacia leaves



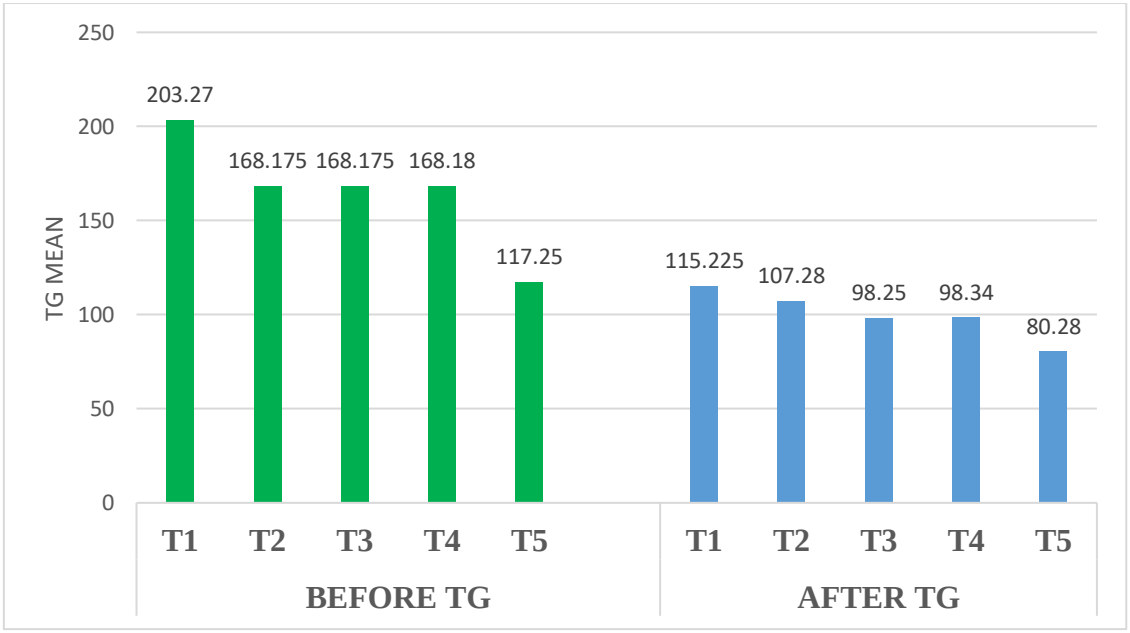
Before = 30 days blood sample collection After =90days blood sample collection

Figure 7: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on lipid profile in kids of dams fed this silage. Does were fed this silage for the 90 days of experimental period and kids suckled their milk for that period. Blood was collected at 30 days and 90days; Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05



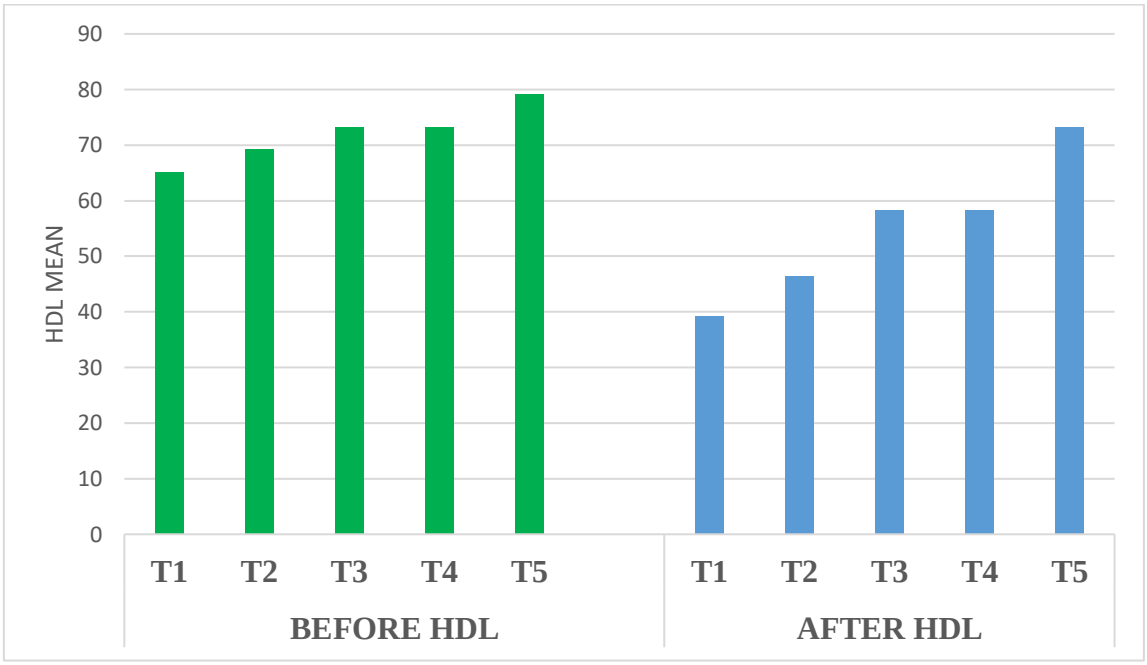
Before = 30 days blood sample collection After =90days blood sample collection

Figure 8: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on lipid profile in kids of dams fed this silage. Does were fed this silage for the 90 days of experimental period and kids suckled their milk for that period. Blood was collected at 30 days and 90days; Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05



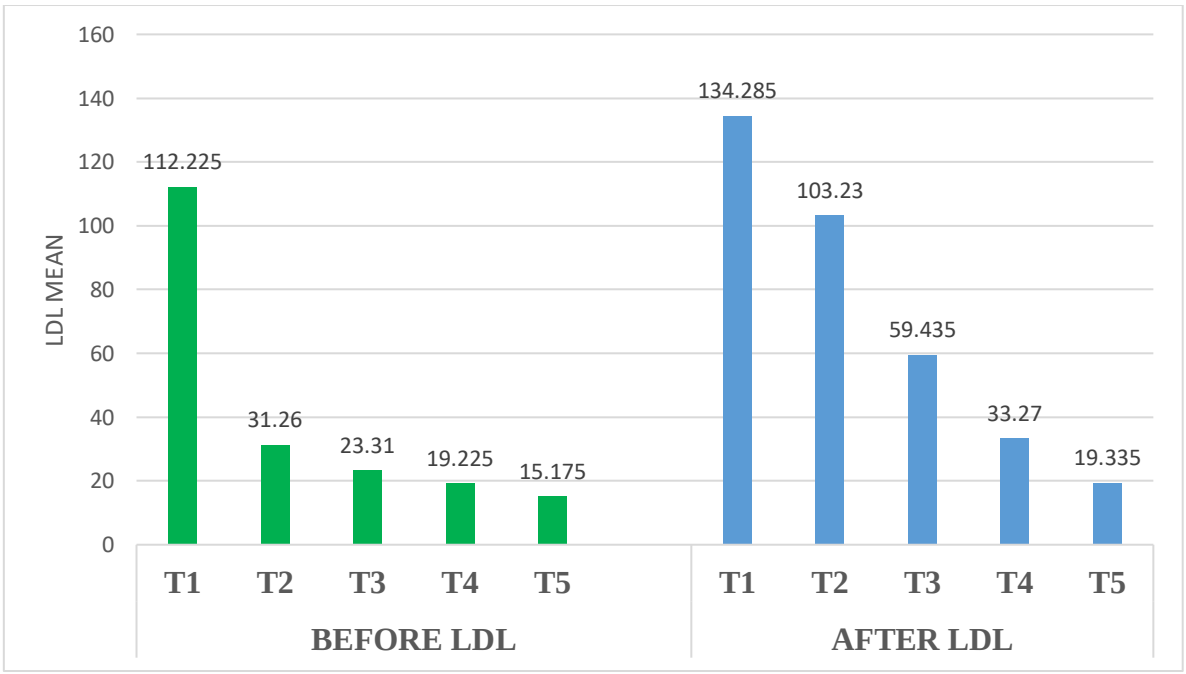
Before = 30 days blood sample collection After =90days blood sample collection

Figure 9: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on lipid profile in kids of dams fed this silage. Does were fed this silage for the 90 days of experimental period and kids suckled their milk for that period. Blood was collected at 30 days and 90days; Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05



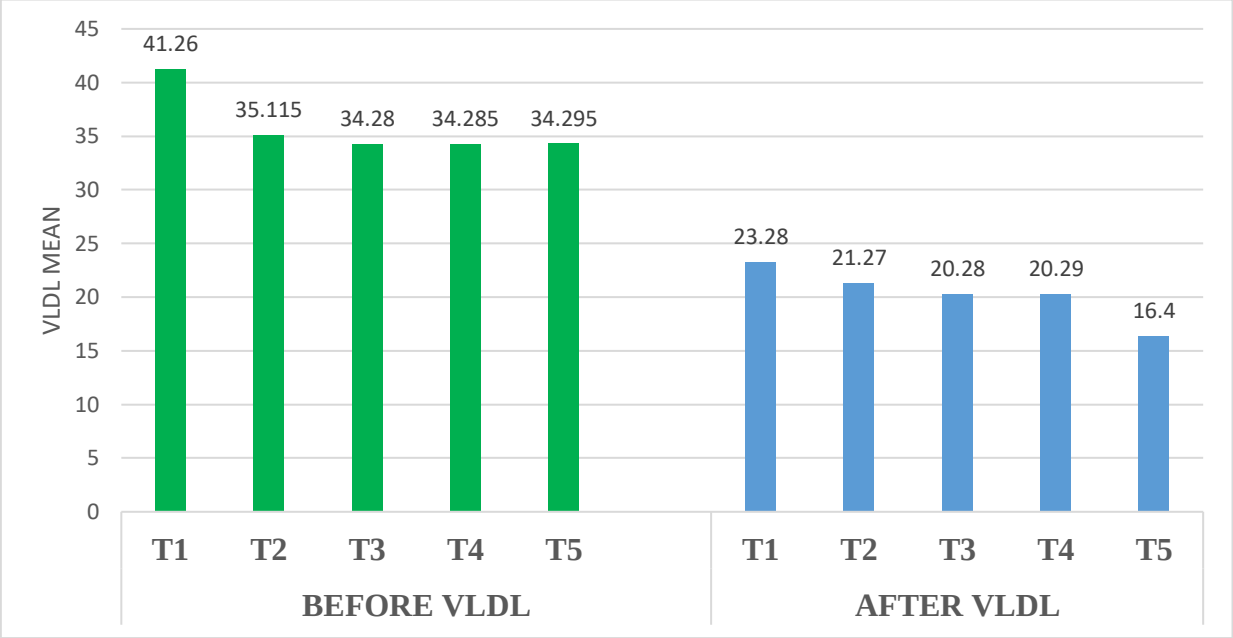
Before = 30 days blood sample collection After =90days blood sample collection

Figure 10: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on lipid profile in kids of dams fed this silage. Does were fed this silage for the 90 days of experimental period and kids suckled their milk for that period. Blood was collected at 30 days and 90days; Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05



Before = 30 days blood sample collection After =90days blood sample collection

Figure 11: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on lipid profile in kids of dams fed this silage. Does were fed this silage for the 90 days of experimental period and kids suckled their milk for that period. Blood was collected at 30 days and 90days; Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05



Before = 30 days blood sample collection After =90days blood sample collection

Figure 12: Effect of combinations of cocoa pod, cassava pulp and Acacia leaf on lipid profile in kids of dams fed this silage. Does were fed this silage for the 90 days of experimental period and kids suckled their milk for that period. Blood was collected at 30 days and 90days; Glucose of each group was determined using Hitachi 911 automated analyzer according to company instruction and values were represented as mean ±SD. *p<0.05.

Discussion

In this present study, it was shown that lipid profile of dams and kids at 30days and 90days consumptions of the ensiled diets revealed that plasma cholesterol and glucose levels were low and there were significant differences with combinations of T5 [20:40:40]. This corroborates the findings of Roy [9] and Dai *et al.* [10] who reported that diet is one of the prominent factors affecting serum biochemical indices in ruminants. It was shown that cholesterol in the serum is associated with the quantity and quality of protein supplied in the diet which indicated that the protein provided by the diets was of good quality to meet the nutritional needs of the animals. The results in this study also revealed that, the concentrations of the triglyceride in the blood plasma of the does and kids was influenced by the diets, this is in agreement with the reports of Njidda *et al*. [11] who indicated that the diets in T5 [20:40:40] supplied the needed amount of protein, cholesterol and triglycerides for the maintenance of their different levels in serum composition.

The high-density lipoprotein [HDL] was also high in dams and kids with combinations of T5 [20:40:40] at 30days and 90days of the study which is in tandem with the reports of Bu *et al.* [12] and Shaikat *et al.* [13] who indicated that HDL is a good cholesterol component, so if it is high, it can reduce the risk of coronary heart disease. In contrast, the low-density lipoprotein [LDL] corroborates the findings of Adeyemi *et al.* [14] who reported that low LDL using canola and palm oil as the source of Omega-3 in concentrated feed given to Boer goats. LDL is a lipoprotein that carries cholesterol from the liver to the tissues of the body, then it is known as bad cholesterol. These observations with combinations of 20% cocoa pod, 40% cassava pulp and 40% acacia leaf [T5] before and after were akin to those of Roy *et al.* [9] who reported a significant decrease in triglyceride levels in goats fed 4.5 % sunflower oil or soybean oil compared to those fed the control diet. Contrarily

to Li *et al.* [15] who observed a non-significant difference in triglycerides, VLDL cholesterol and LDL cholesterol in lactating goats fed linseed oil or soybean oil compared with those fed the control diet.

Conclusions

This study had shown that cocoa pod up to 20% will not pose any health problems to the animals since the parameters measured in the blood of the animals were within normal blood range for a healthy animal. This therefore suggests that up to 20% cocoa pod is a good feedstuff for ruminant animals to mitigate dry season feed shortage as an agro by industrial by products.

Further research was recommended to investigate toxicity of this plant at varying substitution levels of above 20% in the small ruminant feeding to prove the safety of this plant. It is also recommended that feeds producers should formulate a ration that would give influence the blood profile positively which would determine the types of ingredients used and consequently the nutrient compositions of the feeds.

Conflict of Interest

Authors declared that there was no conflict of interest

REFERENCES

[1]. Anaeto, M., Tayo, G. O., Chioma, G. O., Ajao, A. O., Peters, T. A. [2009]. Health and nutrition practices among smallholder sheep and goat farmers in Ogun State Nigeria. *Livestock Research for Rural Development*. 21: 11.

[2]. Esong, R.N., Etchu, K.A., Bayemi, P.H., Tan, P.V. 2015. Effects of the dietary replacement of maize with sun-dried cocoa pods on the performance of growing rabbits. *Tropical Animal Health and Production.* 47[7]: 1411–1416.

[3]. Piccione, G., Monteverde, V., Rizzo, M., Vazzana, I., Assenza, A., Zumbo, A., and Niutta, P. P. 2014. Haematological parameters in Italian goats: comparison between Girgentana and Aspromontana breeds. *Journal of Applied Animal Resource.* 42: 434–439.

[4]. Rerkasem, K., Gallagher, P. J., Grimble, R. F., Calder, P. C. and Shearman, C. P. [2008]. *Vascular Health Risk Management*. 4: 1259.

[5]. Asashina, M., Sato, M. and Imaizumi, K. [2005]. Physicochemical and Antimicrobial Properties of Cocoa Pod Husk Pectin Intended as a Versatile Pharmaceutical Excipient and Nutraceutical. *Journal of Lipid Resource*. 46: 2289.

[6]. Olawoye, S. O. [2017]. Replacement value of palm kernel cake for formulated concentrate in West African dwarf goats fed grass silage. PhD report pp. 5-6.

[7]. Yeom, K.H., Van Trierum, G., Hovenier, R., Schellingerhout, A.B., Lee, K.W. and Beynen, A.C. [2002]. Fatty acid composition of adipose tissue in goat kids fed milk replacers with different contents of linolenic and linoleic acid. *Small Rumin. Res*. 43: 15-22

[8]. SPSS 20.0 [2014]. Statistical Computer Software, SPSS Inc., Chicago, IL, USA. ISBN: 0-13-017902-7.

[9]. Roy, A., Mandal, G., Patra, A. [2013]. Evaluating the performance, carcass traits and conjugated linoleic acid content in muscle and adipose tissues of black Bengal goats fed soybean oil and sunflower oil. *Animal feed science technology*. 185: 43–52.

[10]. Dai, X., Wang, C., Zhu, Q. [2011]. Milk performance of dairy cows supplemented with rapeseed oil, peanut oil and sunflower seed oil. *Czech Journal of Animal science.* 56: 181–191

[11]. Njidda, A. A., Hassan, I. T., Olatunji, E. A. [2013]. Haematological and biochemical parameters of goats of semi-arid environment fed on natural grazing rangeland of Northern Nigeria. *Journal of Agriculture and Veterinary Science*, 3[2]: 2319-2380.

[12]. Bu, D., Wang, J., Dhiman, T., Liu, S. [2007]. Effectiveness of oils rich in linoleic and linolenic acids to enhance conjugated linoleic acid in milk from dairy cows. *Journal of dairy science*. 90: 998–1007.

[13]. Shaikat A.H., Hassan M.M., Khan S.A., Islam M.N., Hoque M.A., Bari M.S., Hossain M.E. [2013]. Haematobiochemical profiles of indigenous goats [Capra hircus] at Chittagong, Bangladesh. Journal of Veterinary World, 6[10], pp. 789-793.

[14]. Adeyemi, K. D., Sabow, A. B., Shittu, R. M., Karim, R., Karsani, S. A., Sazili, A. Q. [2016]. Impact of chill storage on antioxidant status, lipid and protein oxidation, colour, drip, loss and fatty acids of semimembranosus muscle in goats. CyTA - *Journal of Food,* 14[3]: 405-414.

[15]. Li, X., Yan, C., Lee, H., Choi, C., Song, M. [2012]. Influence of dietary plant oils on mammary lipogenic enzymes and the conjugated linoleic acid content of plasma and milk fat of lactating goats. *Animal feed science technology.* 174: 26–35.