# BLOOD METABOLITES OF INTENSIVELY REARED GRAVID WEST AFRICAN DWARF GOATS FED PULVERIZED BIOFIBRE WASTES BASED DIETS

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## ABSTRACT

***Under intensive management, the haematological and some biochemical parameters were studied using twelve (12) West African dwarf (WAD) goats weighing 11.90 – 13.05 kg. Does were fed three dietary treatments; pulverized maize-cob/cassava peel (PMC/CsP), pulverized maize-cob/brewers' grain (PMC/BG) and pulverized maize-cob/cassava peel/brewers' grain (PMC/CsP/BG) such that four individually housed animals, each serving as a replicate. Animals were synchronized using prostaglandin (PGF2α) at 1 ml/10 kg intramuscularly to bring all the animals to oestrus and were then exposed to a proven buck for mating after 24 hour of administration. Prior to synchronization of the animals, three animals from each treatment were randomly selected and blood collected via the jugular vein into different sterilized specimen bottles with or without anti-coagulant (EDTA) for haematological and serum biochemical evaluations respectively. This was repeated at 20 weeks of gestation. The completely randomized design was adopted. Results showed that at the non-gravid and gravid stages, goats on PMC/BG had significantly higher (p<0.05) packed cell volume (PCV), haemoglobin (Hb), mean cell volume (MCV) and mean cell haemoglobin (MCH), while goats on PMC/CsP/BG had significantly increased (p<0.05) white blood cell (WBC). Total proteins, urea, creatinine and alanine amino transferase (ALT) did not show significant difference (p>0.05) in the non-gravid and gravid goats, while aspartate amino transferase (AST) was significantly higher (p<0.05) in the non-gravid goats fed PMC/BG (90.01 iu/l). It can therefore be concluded that diets used in this study did not show adverse implications on the health of the animals hence its suitability as alternative feed source for gravid goats.***

**Keywords:** Pregnant goats, Dietary treatments, Pulverized maize-cob, Cassava peel, Brewers' grain, Intensive management, Haematology, Serum biochemistry

## INTRODUCTION

In the tropics, inadequate nutrition is a great challenge contributing to production losses in ruminant animal production, hence the use of biofibre wastes which are non-conventional feed resources are been explored. Biofibre wastes are fibrous materials considered to be valueless; of no economic importance or value; or environmental enemies which are derived from processing of wood, any agricultural farm produce (Ajayi, 2016). Among such are cassava peels, maize-cobs and brewers' grain. These biofibres may contain compounds that could be deleterious to the health of the animals hence WHO (2003) recommended the use of blood indices as an important medium to ascertain the health, nutritional and physiological status of animal fed biofibre. The nutritional and health status of animals especially pregnant ones cannot be compromised hence the health status of the animal requires close scrutiny and proper

examination of the blood is important (Ibhaze, 2015). However, variations in blood parameters of animals are due to several factors such as altitude, feeding level, age, sex, breed, diurnal and seasonal variation, temperature and physiological status of animals (Mbassa and Poulsen, 2003). This study was conducted to assess the blood profile of gravid West African Dwarf does fed pulverized maize-cob based diets.

## MATERIALS AND METHODS

**Feed Preparation:** Dried maize-cobs were collected from maize sellers and dried cassava peels (mixed varieties) were purchased from a market in Ibadan, Nigeria, while dried brewers' grain was purchased in a wet form from the brewery and sundried. These materials were manually mixed with other ingredients in the proportions specified in Table 1.

**Does Management:** Twelve (12) West African dwarf does weighing 11.90 – 13.05 kg were purchased from a neighbouring village to Ibadan. On arrival, they were treated against ecto and endo parasites with Asuntol and Ivermectin respectively. The experimental design adopted in this study was the completely randomized design of three treatments replicated four times with each animal serving as a replicate. Animals were tagged and randomly allotted to the three dietary treatments such that four individually housed animals form a treatment. Does were fed three isocaloric dietary treatments; pulverized maize-cob/cassava peel (PMC/CsP), pulverized maize-cob/brewers' grain (PMC/BG) and pulverized maize-cob/cassava peel/brewers' grain (PMC/CsP/BG). They were offered fresh feed and water *ad-libitum* daily alongside salt lick.

**Oestrus Induction:** After a two-week acclimatization period, animals were synchronized using prostaglandin (PGF2α) at 1ml/10kg intramuscularly to bring all the animals to oestrus and were then exposed to a proven buck for mating after 24 hour when the does were detected to be on "heat."

**Blood Collection:** Data collection then commenced when animals did not return to oestrus. Two days to synchronization of the animals, three animals from each treatment were randomly selected and blood collected via the jugular vein into sterilized specimen bottles and at 20 weeks of gestation, blood was collected from same animals earlier bled at the commencement of the study. This was done to give an insight of the health status of the animals before pregnancy and during pregnancy.

**Haematological and Biochemical Analysis:** The haematological indices were determined as described by Olafadehan (2011), serum total protein and its components were obtained as described by Akinrinmade and Akinrinde (2012). Serum enzymes; Alanine transaminase (ALT) and Aspartate transaminase (AST) were determined according to the methods of Reitman and Frankel (Olafadehan, 2011) and the metabolites (urea and Creatinine) were determined as described by Eun *et al*. (2009). Mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were calculated from packed cell volume, haemoglobin concentration and red blood cells values as described by Olafadehan (2011):

$$\text{MCV } (\mu^3) = \frac{Packed\ cell\ volume}{Red\ blood\ cell\ coumt(\frac{millions}{\text{mm3}}} x10$$

$$\text{MCH } (\mu\mu g) = \frac{\text{Hb in g/100mlblood}}{Red\ blood\ cell\ count} x10$$

$$\text{MCHC } (\%) = \frac{\text{Hb in}\frac{\text{g}}{\text{100mlblood}}}{Packed\ cell\ volume} x100$$

**Statistical Analysis:** Data obtained at both stages (non-gravid and gravid) were analyzed using one-way analysis of variance (ANOVA) using Statistical analysis software (SAS, 2000) and means were separated using the Duncan Multiple Range Test.

## RESULTS

The ingredient and chemical compositions of experimental diets are shown in Table 1. The crude protein values of diets ranged from 14.66 – 20.18 % with diet PMC/BG having the highest value (20.18 %) and the least (14.66 %) was

**Table 1: Ingredient and chemical composition of experimental diets fed to non-gravid and gravid West African dwarf goats**

| Ingredients | PMC/CsP | PMC/BG | PMC/CsP/BG |
|---|---|---|---|
| **Pulverized Maize-cob** | 28.00 | 28.00 | 28.00 |
| **Pulverized Cassava peels** | 60.00 | - | 30.00 |
| **Palm kernel cake** | 10.00 | 10.00 | 10.00 |
| **Brewers' grain** | - | 60.50 | 30.00 |
| **Urea** | 1.00 | 0.50 | 1.00 |
| **Dicalcium phosphate** | 0.50 | 0.50 | 0.50 |
| **Sulphur** | 0.50 | 0.50 | 0.50 |
| **Chemical composition (%)** | | | |
| **Dry matter** | 90.90 | 90.57 | 90.06 |
| **Protein** | 14.66 | 20.18 | 18.63 |
| **Ash** | 5.32 | 7.36 | 7.96 |
| **Ether extract** | 5.10 | 8.42 | 7.14 |
| **Gross Energy (MJ/kgDM)** | 15.69 | 15.72 | 15.54 |

*PMC/CsP (pulverized maize-cob/Cassava peel), PMC/BG (pulverized maize-cob /brewers' grain), and PMC/CsP/BG (pulverized maize-cob /cassava peel / brewers' grain)*

obtained for PMC/CsP. The diets were isocaloric (15.54 – 15.72 MJ/kg/DM). Haematological indices of gravid and non-gravid goats indicated that the non-gravid goats PCV, Hb, RBC, WBC MCHC, MCH and MCV ranged from 30.02 – 35.02 %, 10.10 – 13.03 g/dl, 7.96 – 8.55 $x10^3/mm^3$, 4.70 – 7.50 $x10^6/mm^3$, 33.33 – 33.71 g/dl, 12.60 – 15.90 pg and 32.70 – 47.90 fL, respectively. For the gravid goats, the values ranged from 22.02 - 28.03 (PCV), 7.31 – 9.30 (Hb), 4.12 – 6.02 (RBC), 12.40 – 15.20 (WBC), 33.18 – 33.21 (MCHC), 8.61 – 22.57 (MCH) and 25.14 – 67.96 (MCV). Results revealed that at both stages MCHC and Hb were not affected ($p>0.05$). Goats on PMC/BG showed higher values of PVC, Hb, MCV and MCH, while WBC was observed to be higher in goats on PMC/CsP/BG (Table 2). Total proteins, albumin and globulin were not significantly ($p>0.05$) different at the non-gravid and gravid goats fed the different fibre rich diets for the 20 weeks periods (Table 3). Serum enzymes and metabolites of goats fed different fibre rich diets showed that in the non-gravid goats, ALT (23.09 – 31.55 iu/l), creatinine (1.20 – 1.26 iu/l) and urea (14.09 – 19.77 iu/l) were not significantly ($p>0.05$) affected but AST (76.95 – 90.01 iu/l) was significantly different ($p<0.05$), while at the gestating period, all the parameters were not significantly affected ($p>0.05$), ALT ranged from 89.28 – 95.28 iu/l, AST (135.29 – 142.2 iu/l), urea (12.11 – 14.21 iu/l) and creatinine (0.82 – 1.12 iu/l) (Table 4).

## DISCUSSION

The crude protein range observed in this study was comparable with the reported values of Ajayi *et al*. (2014) and Adedeji *et al.* (2014) respectively in corncob diets. The PCV values which indicates the relative proportion of plasma and red blood cells obtained for non-gravid does in this study were higher than 22 – 31 % reported by Daramola *et al*. (2005) for healthy female WAD goats, and compared favourably with 36.9 % obtained by Taiwo and Ogunsanmi (2003), but was within the range for gravid does. The range of PCV obtained for gravid doe was similar with the reports of Waziri *et al*. (2010).

The Hb at the non-gravid and gravid goats were comparable with 9.9 g/dl reported by Opara *et al*. (2010) for healthy female WAD goats, indicating the absence of microcytic hypochromic anaemia caused by iron deficiency and improper utilization for the formation of haemoglobin (Olafadehan, 2011). Erythrocytes which transport oxygen from the lungs to body cells were lower than the reports of Waziri *et al.* (2010) for Sahel goats and Daramola *et al.* (2005) for non-pregnant goats, but higher than the findings of Opara *et al.* (2010) for pregnant WAD does. Late pregnancy has been reported to be associated with decreased PCV and RBC counts (Al-Eissa *et al.,* 2012). White blood cells are an indicator of immune response to foreign bodies in the organism. The off shot in the white blood cells observed corroborates with the result of Waziri *et al.* (2010) in Sahel goats. The increase in the white blood cells in the gravid goat agreed with the reports of Waziri *et al.* (2010) who reported an increase in

**Table 2: Haematological indices of non-gravid and gravid West African dwarf goats fed pulverized biofibre wastes based diets**

| Parameter | Non-gravid stage | | | Gravid stage | | |
|---|---|---|---|---|---|---|
| | PMC/CsP | PMC/BG | PMC/CsP/BG | PMC/CsP | PMC/BG | PMC/CsP/BG |
| PCV (%) | 35.02±2.90$^{b}$ | 39.03±2.7$^{a}$ | 30.02±2.49$^{c}$ | 28.03±2.71$^{cd}$ | 28.01±2.56$^{cd}$ | 22.02±2.47$^{e}$ |
| Hb (g/dl) | 11.80±0.93 | 13.01±1.72 | 10.10±1.93 | 9.30±0.72 | 9.30±1.66 | 7.31±0.99 |
| RBC (x10$^{6}$/µL) | 8.55±1.65$^{a}$ | 8.13±1.81$^{a}$ | 7.96±1.39$^{a}$ | 6.02±0.97$^{a}$ | 4.12±0.89$^{b}$ | 8.48±0.74$^{a}$ |
| WBC(x10$^{6}$/mm$^{3}$) | 4.80±0.69$^{c}$ | 4.70±0.69$^{c}$ | 7.50±1.98$^{b}$ | 13.70±1.25$^{a}$ | 12.40±1.14$^{a}$ | 15.20±1.43$^{a}$ |
| MCHC(g/dL) | 33.71±1.93 | 33.33±1.98 | 33.67±1.92 | 33.21±1.85 | 33.21±1.76 | 33.18±1.74 |
| MCH(pg) | 13.80±1.87$^{b}$ | 15.90±1.64$^{b}$ | 12.60±1.88$^{b}$ | 15.45±1.75$^{b}$ | 22.57±1.67$^{a}$ | 8.61±0.67$^{c}$ |
| MCV(fL) | 40.90±2.78$^{c}$ | 47.90±2.07$^{b}$ | 32.70±1.24$^{d}$ | 46.51±2.12$^{b}$ | 67.96±2.95$^{a}$ | 25.14±2.86$^{e}$ |

*Means along the same row with different letter superscripts are significantly (p<0.05) different. PMC/CsP (pulverized maize-cob/Cassava peel), PMC/BG (pulverized maize-cob /brewers' grain), and PMC/CsP/BG (pulverized maize-cob /cassava peel / brewers grain) MCH (Mean Corpuscular Haemoglobin), MCV (Mean corpuscular volume), MCHC (Mean Corpuscular Haemoglobin Concentration), PCV (Packed cell volume), Hb (Haemoglobin), WBC (White blood cells) and RBC (Red blood cells)*

**Table 3: Serum proteins of non-gravid and gravid West African dwarf goats fed pulverized biofibre wastes based diets**

| Parameter (g/dl) | Non-gravid stage | | | Gravid stage | | |
|---|---|---|---|---|---|---|
| | PMC/CsP | PMC/BG | PMC/CsP/BG | PMC/CsP | PMC/BG | PMC/CsP/BG |
| Total proteins | 5.07±0.70 | 4.19±0.45 | 4.80±2.42 | 6.02±0.15 | 5.03±0.26 | 6.74±0.10 |
| Albumin | 3.10±0.78 | 3.10±0.92 | 3.11±1.93 | 3.55±0.23 | 3.57±0.45 | 3.23±0.13 |
| Globulin | 1.97±0.19 | 1.09±0.11 | 1.69±0.17 | 2.47±0.34 | 1.46±0.45 | 3.51±0.59 |

*Means along the same row with different letter superscripts are significantly (p<0.05) different. PMC/CsP (pulverized maize-cob/Cassava peel), PMC/BG (pulverized maize-cob /brewers' grain), and PMC/CsP/BG (pulverized maize-cob /cassava peel / brewers grain)*

**Table 4: Some serum enzymes and metabolites of non-gravid and gravid West African dwarf goats fed pulverized biofibre wastes based diets**

| Parameter | Non-gravid stage | | | Gravid stage | | |
|---|---|---|---|---|---|---|
| | PMC/CsP | PMC/BG | PMC/CsP/BG | PMC/CsP | PMC/BG | PMC/CsP/BG |
| ALT (iu/l) | 31.55±2.93$^{b}$ | 23.09±2.53$^{b}$ | 29.52±2.75$^{b}$ | 90.32±3.91$^{a}$ | 95.28±2.67$^{a}$ | 89.28±2.95$^{a}$ |
| AST(iu/l) | 89.52±3.76$^{b}$ | 90.01±3.85$^{b}$ | 76.95±3.37$^{c}$ | 138.63±4.65$^{a}$ | 142.20±4.64$^{a}$ | 135.29±3.78$^{a}$ |
| Urea | 19.77±2.86 | 14.09±2.56 | 16.36±2.15 | 14.21 ±2.65 | 12.11±2.34 | 14.05±2.68 |
| Creatinine | 1.26±0.18 | 1.26±0.18 | 1.20±0.21 | 1.12±0.28 | 0.82±0.08 | 0.94±0.37 |

*Means along the same row with different letter superscripts are significantly (p<0.05) different. PMC/CsP (pulverized maize-cob/Cassava peel), PMC/BG (pulverized maize-cob /brewers' grain), and PMC/CsP/BG (pulverized maize-cob /cassava peel / brewers grain). Alanine transaminase and (ALT) and Aspartate transaminase (AST)*

the total leukocytes count in pregnant goats around parturition and similar increase was also reported by Igado *et al*. (2011) for pregnant goats at days 50 and 100. The higher values obtained at pregnancy could be due to pregnancy stress which may have triggered the body's immune system to produce more leucocytes for defense. The blood indices (MCV, MCH and MCHC) were within the normal physiological range reported by (Taiwo and Ogunsanmi, 2003). This probably suggests an increase in the release of matured erythrocytes into the circulatory system (Merck, 2012), resulting in absence of anaemic condition in the goats. The serum urea, nitrogen and creatinine were within the normal range for healthy goats. These results suggested that the dietary treatments did not clinically affect the kidney or the liver nor result in any dysfunction of the organ implying better utilization of the protein. The AST obtained at the non-gravid period is consistent with the established range for normal goats. ALT values for goat reported by Kiran *et al.* (2012) were higher than those reported in this study for non-gravid goats but lower than values for gravid goats. The increase in ALT and

AST in goats at the gravid stage relative to the non-gravid stage could have been influenced by the physiological state of the animals. This is in tandem with the report of Onasanya *et al*. (2015) who opined that serum transaminases level can be influenced by reproductive status. Total protein values obtained at the gravid and non-gravid goats were within the range of 5.5 – 10.0 g/dl reported for various ruminant species. The relatively higher total proteins obtained for the gravid does could be a compensation for the requirements of growing foetus for bone tissues and organs formation and quick recuperation of the does after parturition.

**Conclusion:** This study has indicated that goats can be managed intensively without loss of animals, abortion or miscarriages if given adequate attention because during this study, no mortality was recorded. The gravid state of the animal induced some physiological stress that resulted in some metabolic changes which may have altered some haematological and biochemical parameters of the animals.

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