



Haematological and Serum biochemical indices of Hyla weaner rabbits fed watermelon waste with wheat offal

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Abstract

Watermelon rind is a fruit waste that can be converted into livestock feed by combining it with wheat offal as an absorbent. This non-conventional feedstuff can be included in the diet of livestock to replace. This study was conducted to evaluate the haematological and serum biochemical profiles of Hyla weaner rabbits Fed Wheat Offal-Carried Watermelon Rind (WOWR). Forty-five six weeks old Hyla weaner rabbits were randomly selected and housed individually. Five concentrate diets comprising 0%, 10%, 20%, 30% and 40% WOWR (wheat offal-carried watermelon rind) were compounded and fed to weaner hyla rabbits based on 4% of their body weights (at an average weight of 1.02kg per rabbit). The feeding trial lasted 20 weeks. The analysis of blood components, packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), platelet, haemoglobin concentration (HB), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) showed that there were significant ($p < 0.05$) differences among the rabbits fed experimental diets. There were no significant differences in the neutrophils, leucocytes, basophils, lymphocytes and monocytes of rabbits fed the different levels of WOWR ($p > 0.05$). The result of the serum Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT) and Alkaline phosphatase (ALP) of rabbits fed 10% to 40% WOWR was significantly ($p < 0.05$) lower than that of the control group (0% WOWR). It is concluded that feeding watermelon rind with wheat offal as absorbent (WOWR) at the different inclusion levels had no adverse effect on the rabbits and could be used as a novel experimental diet for rabbits' management to replace maize.

Keywords: Hematology, hyla weaner rabbits, serum biochemical, watermelon rind, wheat offal.

Introduction

Hyla rabbit is a meat breed with high productivity, growth rate, high disease-resistant, and more than 96 % survival rate of growing rabbits (Yamani, 1994). Nizza and Moniello (2000) reported that Hyla rabbits can attain a weight of 2750 g in 90

days. Hyla rabbit is reported to be a productive breed that is used in many crossbreeding programs (Hamouda et al., 1990). It was introduced at the experimental level in hot and humid countries like Benin, Ghana and Nigeria. Among monogastric animals, rabbits utilize fibrous materials for the production of meat. Gidenne (2000) reported that rabbit has low utilization of the fibrous fraction due to the rapid passage of feed through the gastrointestinal tract. However, through the caecotrophic activity, the digestibility of nutrients is incremented (Machado et al., 2012).

The high cost of formulated concentrates and pelletized feeds, compounded from conventional ingredients, including maize and soybean militates against increased rabbit production (Agunbiade et al., 2001). Rabbits have the ability to convert forages and other farm byproducts that are not consumed directly by humans into highly

nutritious meat. As a result, the development of alternative feedstuffs in rabbit nutrition will continue to receive attention in Nigeria as long as the feed sources continue to be scarce and expensive. The utilization of unconventional feedstuffs and forages which are not consumed by humans can be used to produce animal feeds (Asar et al., 2010). Among such alternatives is the use of watermelon waste which is found to be abundant in minerals and vitamins and can be used to feed animals like rabbits due to fast-growing characteristics and their ability to convert tropical forages and agricultural by-products to meat. It was suggested by Bawala et al. (2008) that nutritional studies should not be limited to performance, carcass quality and protein intake alone, but the effect on blood constituents is also relevant. There is a need to evaluate the blood parameters of animals fed with non-conventional feeds such as WOWR in order to ascertain the effect of the different inclusions on the health status of the animals (Mahgoub et al., 2008). Blood examination allows investigating the presence of several metabolites and other constituents and helps detect conditions of stress, which can be nutritional, environmental or physical (Aderemi, 2004). Haematological parameters are those factors in the blood whose levels are usually determined to assess the degree of the well-being of an animal. They are

important in feeding trials because it has been established that feed components affect blood constituents (Harper et al., 1979). The blood parameters of animals present the occasion to study the pathological, physiological and nutritional state of the animal (Doyle et al., 2006), which then aids in nutritional and/or environmental stress diagnosis (Aderemi, 2004). Furthermore, for blood analysis, a readily available and fast means of assessing the health status (Anosa, 1983), clinical evaluation for the survey of physiological or pathological conditions (Bush, 1991), and a diagnostic/prognostic evaluation of various diseases in animal (Nottidge et al., 1999). According to Schalm et al. (1975), blood pictures of animals might be influenced by certain factors, one of which is nutrition. Swenson (1970) and Addass et al. (2012) posited that nutrition affects the blood values of animals.

Due to established facts that feed components affect blood constituents (Harper et al., 1979) and paucity of information on the effect of inclusion of agro-industrial by-products on haematological and serum biochemical indices of rabbits. Thus, this study sought to evaluate haematological and serum biochemical parameters of Hyla weaner rabbits fed wheat offal-carried watermelon rind.

Materials and Methods

Experimental site

The study was conducted at the students' project site of the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan. A total number of forty-five (45) Hyla weaner rabbits (six weeks old) were used for the experiment. The rabbits were purchased from Anurex Integrated Farm, Omiadio, Ibadan.

Management of experimental animals

The animals were housed in individual cages and were acclimatized for two weeks before the commencement of the experiment. The rabbits were provided with water ad libitum while feed was served twice daily. The experiment lasted for 20 weeks. The diets were fed to weaner Hyla rabbits based on 4 % of their body weights (at an average weight of 1.02 kg per rabbit).

Preparation of experimental diet

Fresh watermelon rind was obtained from Ooje market in Ibadan. The watermelon rind was thoroughly rinsed with water to remove sand particles. The rind was cut into smaller pieces and ground with a milling machine. The blend of wheat offal-carried watermelon rind (WO: WR) was prepared in a ratio of 1:1; the blend WR was thoroughly mixed with WO by hand until the fluid from WR was not superfluous (Makinde and Sonaiya, 2007). The blend was then sun-dried by spreading thinly on polythene sheets (0.5 mm thickness) on a concrete floor for 3 days. Five concentrate diets were compounded comprising 0, 10, 20, 30 and 40 % levels of inclusion of wheat offal-carried

watermelon rind meal (Table 1).

Blood sampling

In the 16th week of the study, blood samples were collected from the experimental animals via the jugular vein in the morning before feeding in order to measure the haematological and serum biochemical indices. The blood sample was emptied into two sets of well-labelled sample bottles, one containing ethylene diamine tetra-acetate (EDTA) as an anti-coagulant while the other contained no anti-coagulant. The sample containing anti-coagulant was used for the determination of packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), platelet (PLAT), haemoglobin (HB), neutrophil (N), lymphocytes (L), monocytes (M), eosinophils (EOS), basophils (BAS) = mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) while sample without anti-coagulant was used to analyse the serum biochemical profiles (glucose, sodium, potassium, chloride, bicarbonate, fluoride, creatinine, calcium, total protein, albumin, globulin, bilirubin, blood count, aspartate aminotransferase (AST), alkaline phosphatase (ALP), alanine aminotransferase (ALT), total cholesterol, triglycerides (TG), high-density lipoprotein (HDL) and low-density lipoprotein (LDL) of the rabbits fed the experimental diets. All haematological parameters were determined by conventional laboratory methods of Baker and Silverton (1982); Bitto and Gemade (2001), while serum metabolites

were determined by methods described by Ochei and Kolhathar (2007). The readings were carried out using a photo spectrometer in the laboratory.

Statistical analysis

Data obtained were statistically analyzed with the General Linear Model of SAS (2008) and the Duncan New Multiple Range Test option of SAS (2008) was used to detect significant differences among means.

Results and Discussion

Haematological parameters of Hyla weaner rabbits fed graded levels of WOWR are presented in Table 2. Results revealed significant effects ($P < 0.05$) of the experimental diet as there was an increase in the values of packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), platelet, haemoglobin concentration (HB), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). This is contrary to the report of Alagbe (2018) who reported no significant difference in the haematological traits but it is similar to the report of Ekine et al., (2018), who reported a significant effect on the PCV, HB, RBC, WBC and platelet. Rabbits on 30% WOWR had the highest numerical values of PVC, RBC, WBC, HC, and MCHC than rabbits on other experimental diets. Rabbits on a diet of 0%

Table 1: Feed composition of the experimental diets

Ingredients	0% WOWR	10% WOWR	20% WOWR	30% WOWR	40% WOWR
Maize	40.00	30.00	20.00	10.00	0.00
WOWR	0.00	10.00	20.00	30.00	40.00
Soybean meal	5.50	5.50	5.50	5.50	5.50
Palm kernel cake	30.00	30.00	30.00	30.00	30.00
Groundnut cake	5.00	5.00	5.00	5.00	5.00
Rice bran	12.00	12.00	12.00	12.00	12.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	2.00	2.00	2.00	2.00	2.00
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

0% WOWR - Control (without wheat offal-carried watermelon rind); 10% WOWR: 10% wheat offal-carried watermelon rind; 20% WOWR: 20% wheat offal-carried watermelon rind; 30% WOWR: 30% wheat offal-carried watermelon rind; 40% WOWR: 40% wheat offal-carried watermelon rind

WOWR recorded the highest numerical values of MCV and MCH. However, there was no significant effect of the diets on neutrophils, lymphocytes, monocytes, eosinophils, basophils, L+M and L/M of the rabbits with the highest numerical values of eosinophils recorded in rabbits on diets 20% and 40% WOWR; neutrophils in rabbits on diet 30% WOWR; lymphocytes in rabbits on 40% WOWR; monocytes in rabbits on (0% and 20% WOWR); basophils in rabbits on 0% and 20% WOWR; L+M in rabbits on 40% WOWR and the ratio of L: M in rabbits on 0% WOWR, which is in agreement with Ekine et al. (2018) who also recorded no significant effect on leucocytes and neutrophils. Values obtained for PCV, WBC, PLAT and HB were within the normal range reported for rabbits by Mitruka and Rawnsley (1977). This implies that the dietary treatment did not cause any harmful effects and can supply the needed nutrients to the rabbits. This result is an indication that the ingredient had no negative effect on the blood parameters but instead has the ability to improve these parameters. This result differs from that of Hassan et al. (2021) who reported the PCV value below the normal range. Ahamefule et al. (2008) also reported a fall below the normal range for the PCV values even though there was a significant difference across treatment groups.

Rabbits in all the experimental diets had a normal value range of RBC except rabbits fed 40% WOWR with higher RBC than the normal range. This is an indication of erythrocytosis which makes the blood thicker than it should be and this may increase the risk of blood clots in the rabbits. This result is different from that of Hassan et al. (2021) who reported a decrease in the RBC in their T4 and T5 but similar to that of Suha (2014) with the reported slightly higher RBC counts. Togun et al. (2007) reported that an increase in PCV coupled with a marginal increase in RBC is indicative of more efficient erythropoiesis in

Table 2: Hematological parameters of weaner rabbits fed graded levels of watermelon waste with wheat offal

Parameters	0% WOWR	10% WOWR	20% WOWR	30% WOWR	40% WOWR	... (+)	*Normal R range
PCV (%)	25.00 ^a	36.75 ^b	39.25 ^b	48.00 ^a	38.75 ^b	1.99	31.0-48.86
RBC ($\times 10^9/\text{mm}^3$)	3.57 ^a	6.54 ^b	7.20 ^b	1.04 ^a	7.69 ^{ab}	0.63	5.11-6.51
WBC ($\times 10^9/\text{mm}^3$)	1.89 ^a	3.80 ^{ab}	4.72 ^b	7.46 ^a	4.72 ^b	0.49	5.2-10.6
PLAT ($10^9/\text{l}$)	2.20 ^a	3.40 ^{ab}	1.98 ^b	4.59 ^a	3.52 ^{ab}	0.29	...
HB(g/dl)	7.73 ^a	11.80 ^b	12.55 ^b	15.53 ^a	12.30 ^b	0.68	9.4-15.8
N (%)	63.25	65.50	60.25	65.75	58.75	1.42	...
L (%)	35.75	34.00	38.50	33.75	40.25	1.39	31-32
M (%)	0.75	0.50	0.75	0.50	0.50	0.17	4-13.5
EOS (%)	0.00	0.00	0.25	0.00	0.25	0.07	0.5-5
BAS (%)	0.25	0.00	0.25	0.00	0.25	0.08	-
MCV (fl)	0.07 ^a	0.06 ^{ab}	0.06 ^b	0.05 ^b	0.05 ^b	0.002	-
MCH (pg)	0.0021 ^a	0.0019 ^{ab}	0.0018 ^b	0.0017 ^b	0.00016 ^b	0.0001	-
MCHC(g/dl)	30.93 ^a	32.05 ^a	31.93 ^a	32.34 ^a	31.68 ^{ab}	0.150	-
L+M	36.50	34.50	39.35	34.25	40.75	1.39	-
L/M	26.25	4.13	12.87	17.75	4.63	3.65	-

a, b, c means of different superscripts along the same row are statistically significant ($p < 0.05$)

0% WOWR - Control (without wheat offal-carried watermelon rind); 10% WOWR: 10% wheat offal-carried watermelon rind; 20% WOWR: 20% wheat offal-carried watermelon rind; 30% WOWR: 30% wheat offal-carried watermelon rind; 40% WOWR: 40% wheat offal-carried watermelon rind

PCV = Packed Cell Volume; RBC = Red Blood Cell; WBC = White Blood Cell; PLAT = Platelet; HB = Haemoglobin; N = Neutrophil; L = Lymphocytes; M = Monocytes; EOS = Eosinophils; BAS = Basophils; MCV = Mean Corpuscular Volume; MCH = Mean Corpuscular Haemoglobin; MCHC = Mean Corpuscular Haemoglobin Concentration; SEM = Standard Error of Mean; *Mitruka and Rawnsley (1977)

experimental rabbits. Red Blood Cell (RBC) counts of $7.10 \times 10^6/\text{ml}$ as reported by Bawala et al. (2007) could be due to the harmful effects of high dietary content. This revealed that the experimental animals had good resistance to disease and a corresponding high immunity (Jiwuba et al., 2016). According to Suha (2014), the age of the experimental animal, storage condition and variety of the feed coupled with the environment could be the possible reasons for the increased RBC count.

The values of White Blood Cell (WBC) count in all the experimental diets were significant across treatment groups and within the normal range, but a higher value was recorded in rabbits fed 30% WOWR. A high WBC count is mostly linked to the presence of foreign antigens in the body. Since the value is in the normal range, it shows that the inclusion of 30% WOWR helps to boost the immunity of the rabbits. Alagbe (2018) reported a slight increase in WBC value along with other parameters from diet 1 to 5 although without a significant difference. Ekine et al. (2018) also reported a significantly higher WBC in the control diet. Contrary to this, Ahamefule et al. (2008) reported a significantly normal range of WBC across

treatment groups, while Hassan et al., (2021) reported no significant difference. The presence of a bioactive chemical is responsible for several activities such as antimicrobial, anti-inflammatory, antifungal and antiviral in animals (Tajet et al., 2018). HB, MCH and MCHC Values can be used to determine the efficiency of the bone marrow to produce red blood cells. WBC and its differentials were significantly ($P < 0.05$) affected by the inclusion of watermelon with wheat offal in the diet. This result is in agreement with the reports of Ahemen et al. (2013) but contrary to the findings of Jiwuba et al. (2016).

Serum biochemical indices of Hyla weaner rabbits fed graded levels of WOWR are presented in Table 3. Results revealed significant effects ($P < 0.05$) of the experimental diet on the enhancement and availability of the minerals and electrolytes – sodium, potassium, chloride and fluoride ions to the experimental animals with the highest values depicted in diet inclusions 10% and 40% WOWR mostly. However, there was no significant effect of the diets on the carbonate level of all the experimental animals. Rabbits on 40% WOWR had the lowest numerical values of total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL) and low-density lipoprotein (LDL) than rabbits on other experimental diets.

The range of values obtained for albumin was in line with the reports of Medirabbit (2015) for healthy rabbits insinuating that there was no alteration in the normal systemic protein utilization as well as the proper functioning of the liver (Jiwuba et al., 2016). Similarly, the result of globulin (3.08-3.10g/dl) was in agreement with the findings of Burke (2015) who reported a range of 1.5-3.3 g/dl for healthy rabbits. This revealed that the experimental animals had good resistance to disease and a corresponding high immunity (Jiwuba et al., 2016). In addition, in this study, the experimental diet dose-dependently decreased the serum ALT, ALP and AST levels which were indicative of non-detrimental effects on the hepatic tissues by the diet at all inclusions, although the decrement in these serum enzymes activities was not significant statistically ($P < 0.05$) when compared to the control group (0% WOWR). Aspartate aminotransferase (AST), Alanine Aminotransferase (ALT) and Alkaline phosphatase (ALP) are reliable determinants of liver injury (Moling et al., 2006). The increase in their activities in serum after exposure might be due to the leakage of these enzymes from the liver cytosol into the bloodstream. Interestingly, however, the rabbits that received 10 % and 40 % inclusion of the experimental diet have values of their creatinine levels higher when compared to other treatment groups, but these values still fall within the normal range as documented by Mitruka and Rawnsley (1977).

Conclusion

Based on the results of this study, 30% inclusion of Wheat Offal carried Watermelon Rind (WOWR) is suitable as a

performance enhancer as it did not have an adverse effect on the haematological and serum biochemical parameters of the rabbits. Therefore, the inclusion of watermelon with wheat offal could be used as a novel experimental diet for Hyla rabbit management.

Declaration of interest

There is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported

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Table 3: Serum biochemical profile of weaner rabbits fed graded levels of watermelon waste with wheat offal

Variables	0% WOWR	10% WOWR	20% WOWR	30% WOWR	40% WOWR	SEM (±)	*Normal Range
GLU (mmol/L)	63.00	66.50	65.25	61.25	62.50	1.62	42-89
Na (mmol/L)	139.75 ^{bc}	141.00 ^b	138.50 ^c	139.00 ^{bc}	142.50 ^a	0.44	130-155
K (mmol/L)	3.85 ^b	4.03 ^a	3.93 ^{ab}	3.78 ^{ab}	4.08 ^a	0.04	0.5-4.0
CL (mmol/L)	107.50 ^{ab}	107.50 ^{ab}	105.00 ^{ab}	102.50 ^b	108.75 ^a	0.80	92-120
HCO ₃ (mEq/L)	21.75	21.75	23.25	22.50	21.50	0.29	22-29
FL (mmol/L)	29.00 ^b	40.25 ^a	33.75 ^b	28.50 ^b	44.25 ^a	1.58	-
CR (mmol/L)	0.70 ^b	0.83 ^a	0.70 ^b	0.63 ^b	0.85 ^a	0.02	0.5-2.5
CAL (mg/dl)	7.53 ^{ab}	8.08 ^a	7.05 ^b	6.93 ^b	7.80 ^a	0.13	11-14
TP (g/dl)	6.98	7.18	7.15	7.18	7.25	0.07	5.4-7.5
ALB (g/dl)	3.90	4.10	3.93	3.90	4.15	0.05	2.5-4.0
GLB (g/dl)	3.08	3.08	3.05	3.03	3.10	0.02	1.5-2.5
TB (µmol/L)	0.48	0.65	0.40	0.58	0.55	0.05	3.4-8.5
CB (mg/dl)	0.23	0.30	0.20	0.25	0.30	0.02	-
AST (IU/l)	15.00	13.75	12.50	14.00	13.75	0.39	-
ALT (IU/l)	11.50	11.25	9.50	11.00	11.25	0.35	-
ALP (IU/l)	53.75	52.75	49.50	52.75	51.75	1.51	10-90
TC (mg/dl)	151.50 ^{ab}	157.00 ^{ab}	162.75 ^a	153.00 ^{ab}	148.00 ^b	2.06	-
TG (mg/dl)	52.50	58.00	55.50	51.25	51.25	1.71	-
HDL (mg/dl)	37.00 ^{ab}	41.00 ^{ab}	44.50 ^a	37.75 ^{ab}	34.00 ^b	1.31	-
LDL (mg/dl)	127.00 ^{ab}	133.25 ^{ab}	141.50 ^a	129.25 ^{ab}	117.25 ^b	3.19	-

a, b, c means of different superscripts along the same row are statistically significant ($P < 0.05$)

0% WOWR - Control (without wheat offal-carried watermelon rind); 10% WOWR: 10% wheat offal-carried watermelon rind; 20% WOWR: 20% wheat offal-carried watermelon rind; 30% WOWR: 30% wheat offal-carried watermelon rind; 40% WOWR: 40% wheat offal-carried watermelon rind

GLU = Glucose; NA = Sodium; K = Potassium; CL = Chloride; HCO₃ = Bicarbonate; FL = Fluoride; CR = Creatinine; CAL = Calcium; TP = Total protein; ALB = Albumin; GLB = Globulin; TB = Total Bilirubin; CB = Blood count; AST = Aspartate Aminotransferase; ALP = Alkaline phosphatase; ALT = Alanine Aminotransferase; TC = Total Cholesterol; TG = Triglycerides; HDL = High-Density Lipoprotein; LDL = Low-Density Lipoprotein; SEM = Standard Error Of Mean; *Mitruka and Rawnsley (1977).

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