Effects of dried water melon and sweet orange peel (dwmop) meal mixture on the haematological and serum indices of growing rabbits

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ABSTRACT

The objective of the present study was to evaluate effects of dried water melon and sweet orange peel (dwmop) meal mixture on some haematological and serum indices of growing rabbits. A total of sixty rabbits 7-8 weeks old with an average weight of 630 – 645 g were randomly divided into five (5) dietary treatments with three (3) replicates and four rabbits per replicate in a Completely Randomized Design (CRD). The dietary treatments include a control diet with no DWMOP in (T1), T2 (5.0% DWMOP), T3 (10.0 % DWMOP), T4 (15.0 % DWMOP) and T5 (20.0 % DWMOP) respectively. Feed and water were offered ad libitum throughout the experiment which lasted for 12 weeks. Data obtained were used to evaluate the haematological parameters (PCV, RBC, Hb, MCV, MCH , MCHC, WBC and its differentials ), some serum biochemical indices (Albumin, globulin, total protein, creatinine, bilirubin, AST and ALT). All the haematological parameters measured were significantly (P<0.05) different among the treatments. Total protein, bilirubin and creatinine values were not significantly (P>0.05) influenced by DWMOP, however, glucose level and activities of ALP and AST were significantly (P<0.05) affected by DWMOP. It was concluded that inclusion of DWMOP at 20 % in the diet of rabbits does not have any deleterious effect on the health status of the animal.

Keywords: Growing rabbits; Agro industrial by-products; haematology; serum indices.

1. INTRODUCTION

Citrus plants belonging to the family Rutaceae which include fruits such as orange, lime, lemon, sour orange and grapefruit appear as a well known promising source of multiple beneficial nutrients for human beings. Processing of citrus by-products potentially represents a rich source of phenolic compounds and dietary fibre, owing to the large amount of peel produced. These citrus fruit residues, which are generally discarded as waste in the environment, can be referred to as potential vitamin sources. Due to their low cost and easy availability, such wastes are capable of offering significant low-cost nutritional dietary supplements. The utilization of these bioactive rich citrus residues can provide an efficient, inexpensive, and environment-friendly platform for production. Shortage of national feed resource particularly in developing countries has necessitated the investigation of novel sources of feedstuff. For instance, dried sweet orange peel (DSOP) is exactly a potential source of some valuable nutrients for poultry feed as a source of natural antioxidants. DSOP is also a good source of calcium, but very low in phosphorus and carotene. Based on some observed data, dried and/or pelleted citrus pulp is one of the most desirable energy feeds and can be considered in feeding programs as a feed with high digestible nutrient content. Arthington and Pate (2001) estimated that the waste from feeding wet citrus pulp could be as high as 30%. Although it is very palatable to grazing animals, it is typically uneconomic to feed wet pulp because of the increased cost of shipping (Kunkle et al., 2001).

Rabbit production for fast meat yield is, however, affected by inadequate and high cost of feed ingredients brought about mainly by the stiff competition between man and monogastric animals for grain and oilseeds (Agunbiade et al., 2002). The favourable attributes of the rabbit which has projected it as a target species for curtailing protein malnutrition cannot be realized because of the high cost of conventional feedstuffs. Animal nutritionists in collaboration with livestock producers have thus intensified the search for less costly and readily available alternative feed materials. It is observed that the increasing mechanization of crop farming in developing economies has led to a rise in the tonnage of agro-allied by-products most of which lies waste. One of such wastes could emanate from the citrus, a major fruit of sub-tropical region (Rice and Rice, 1987).

Sweet orange (Citrus sinensis) production in Nigeria is significant, with heavy direct consumption due primarily to few and small capacity processing industries to convert the fruit to juice, concentrate and canned fruit. Nigeria produces 3% of fresh citrus in the world and Africa produces 3,741,000 ton of different varieties of citrus fruits of which Nigeria contributes 3,240,000 ton (FAO, 2004).

Both Watermelon peel and sweet orange peel meal are waste products not competed for by man. They are readily available and not sold, hence would help to reduce the cost of production. They generally litter the environment and...
thereby constitute environmental nuisance in some locations. The unavailability and expensive nature of cereals (maize and sorghum) stemming directly from its use as staple human food as well as major feed ingredients in Nigeria creates the problem of rising feed cost. This unprecedented increase in the cost of feed has made the price of some products beyond the reach of the average Nigerian (Ahaotu et al., 2011). Sweet orange fruit meal has been observed to be a source of caloric and protein comparable with maize (Aggey, 2003). The utilization and incorporation of both dried watermelon peel and sweet orange peel meal into rabbit feed will go a long way in increasing rabbit production and utilization.

Therefore this experiment was carried out to examine the effects of dried water melon and sweet orange peel (DWMOP) meal mixture on the haematological and serum indices of growing rabbits.

2. MATERIALS AND METHODS

Experimental Site
The experiment was carried out at the University of Abuja Teaching and Research Farm, Animal Science Section, Main Campus, along Airport Road, Gwagwalada, Abuja-Nigeria, located between latitude 8°57′ and 8°55′N and longitude 7°05′ and 7°06′E.

Source of test material and preparation
Freshly cut water melon peel and sweet orange peel (Citrus sinensis) were collected from the popular Orange Market, Mararaba/Nyanyan, a suburb market between Nasarawa state and the FCT Abuja. The samples were thoroughly washed under running water to remove sand particles after which they were sliced to smaller pieces using a home choice knife, and sun-dried. The pulp of the watermelon was carefully scraped off to obtain the rind. The samples were oven dried at 60-70°C for two days, pulverized separately to obtain the water melon rind meal and orange peel meal and stored into an air tight container for further analysis.

Pre-experimental operations
Prior to the commencement of the experiment the rabbit hutches were properly cleaned and disinfected, electrical fittings were put in place and foot bath was placed to ensure proper biosecurity.

Animals and their management
A total of sixty rabbits of 7-8 weeks old with an average weight of 630 – 645 g were sourced from the National Animal Production Research Institute (NAPRI) Zaria, Kaduna State and used for the experiment. Animals were weighed before the commencement of the experiment to obtain the initial body weight, housed in an all wired hutch and randomly divided into five (5) dietary treatments with three (3) replicates and four rabbits per replicate in a Completely Randomized Design (CRD). Animals were allowed two weeks of acclimatization, feeders and drinkers were made available in each hutch. The drinkers were washed regularly before fresh water was frequently served ad-libitum and other prophylactic treatment was administered throughout the experimental period which lasted for 12 weeks.

Formulation of experimental diets
The watermelon peel and the orange peel were mixed together at 50/50 to obtain (DWMOP). The test material was mixed with other ingredients to form five experimental diets. DWSOP was partially used to replace maize at 0%, 5 %, 10 %, 15 % and 20 % respectively.

Measured parameters
Feed intake (g/rabbit) = Feed offered (g) - Leftover (g)
Mortality was recorded as it occurs.

Blood analysis
On the 10th week of the experiment, blood samples were collected from the vein of three randomly selected rabbits per treatment. Blood was collected in sterile vials in the morning time between 07:00 am and 10:00 am hours before the rabbits get access to feed. The bleeding procedure was the method described by Schalm et al. (1975). The blood samples were analyzed for some haematological and serum biochemical parameters; blood samples for haematology were collected into bottles containing Ethylene Diamine Tetra Acetate (EDTA). The haematological parameters such as Pack cell volume (PCV), Red blood cell (RBC), White blood cell (WBC), Haemoglobin concentration (Hb) and absolute counts of lymphocytes and monocytes were computed according to the method of Jain (1986).

Blood samples that were meant for serum chemistry were collected into bottles free of any anticoagulant. It was centrifuged for 10 minutes and the serum was separated and analyzed. Albumin, globulin and serum total protein were determined by Biuret reactions (Bush, 1975) and cholesterol (Roschianet et al., 1974). ALT and AST were determined colourimetrically (Reitman and Frankel, 1957). Total glucose and cholesterol levels were determined as described by (Toro and Ackermann, 1975).

Phytochemical analysis of DWMOP

Proximate analysis of experimental diet was determined using methods described by AOAC (2000). Phytochemical screening of DWMOP was analyzed according to methods outlined by Harbone (1973); Trease and Evans (1983).

Statistical analysis
All data were subjected to one -way analysis of variance (ANOVA) using SPSS (18.0) and significant means were
separated using Duncan multiple range tests (Duncan, 1955). Significant was declared if P \leq 0.05.

| Materials          | T1   | T2   | T3   | T4   | T5   |
|--------------------|------|------|------|------|------|
| Maize              | 55.20| 52.44| 50.20| 42.67| 34.14|
| Wheat offal        | 30.00| 30.00| 30.00| 30.00| 30.00|
| DWMOP              | 0.00 | 2.76 | 5.24 | 7.53 | 8.53 |
| Soya meal          | 9.74 | 10.74| 10.74| 10.74| 10.74|
| Groundnut cake     | 1.26 | 5.26 | 5.26 | 5.26 | 5.26 |
| Limestone          | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bone meal          | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Lysine             | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Methionine         | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Premix             | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt               | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total              | 100.0| 100.0| 100.0| 100.0| 100.0|

Calculated analysis

| Parameters         | T1  | T2  | T3  | T4  | T5  | SEM | N.R  |
|--------------------|-----|-----|-----|-----|-----|-----|------|
| PCV (%)            | 29.78 | 31.32 | 38.45 | 44.31 | 45.72 | 0.43 | 33.0 – 47.0 |
| RBC (x10^6/ul)     | 3.00 | 4.41 | 5.00 | 6.20 | 6.55 | 0.13 | 3.00 – 8.09 |
| Hb (g/dl)          | 9.09 | 10.44 | 10.92 | 13.12 | 13.88 | 0.40 | 10.0 – 17.5 |
| MCV (fl)           | 90.44 | 69.80 | 69.64 | 65.31 | 68.94 | 1.88 | 59.0 – 101.5 |
| MCH (pg)           | 32.22 | 29.83 | 29.22 | 27.40 | 22.71 | 0.31 | 15.0 – 32.0 |
| MCHC (%)           | 48.67 | 48.16 | 48.81 | 40.22 | 40.37 | 0.43 | 25.0 – 50.00 |
| WBC (x10^3/ul)     | 9.19 | 9.79 | 10.02 | 15.70 | 17.46 | 0.22 | 5.80 – 20.10 |
| Lympho. (%)        | 48.00 | 59.63 | 59.90 | 59.44 | 61.00 | 1.71 | - |
| Monocytes (%)      | 1.28 | 1.22 | 1.50 | 1.88 | 1.94 | 0.08 | - |

Means in the same row with different superscripts are significantly different (P < 0.05)

PCV: Pack Cell Volume; RBC: Red Blood Cell; Hb: Haemoglobin; MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; WBC: White Blood Cell; N.R: Normal range.

| Parameters       | T1 | T2 | T3 | T4 | T5 | SEM | Range |
|------------------|----|----|----|----|----|-----|-------|
| Albumin (g/dl)   | 3.02 | 3.21 | 3.20 | 3.20 | 3.21 | 0.22 | 3.30 – 4.7 |
| Globulin (g/dl)  | 3.00 | 3.40 | 3.31 | 3.36 | 3.37 | 0.07 | 3.10 – 5.3 |
| Tp (g/dl)        | 6.02 | 6.61 | 6.51 | 6.56 | 6.58 | 0.12 | 4.5 – 7.9 |
| Glu. (Mmol/L)    | 5.33 | 5.05 | 7.22 | 7.60 | 8.30 | 0.46 | 3.83 – 8.32 |
| Creat. (Mmol/L)  | 0.40 | 0.41 | 0.42 | 0.40 | 0.43 | 0.01 | 0.20 – 0.66 |
| Db (µmol/L)      | 0.73 | 0.70 | 0.72 | 0.70 | 0.81 | 0.03 | 0.85 – 0.71 |
| Tb (µmol/L)      | 3.41 | 3.09 | 3.00 | 3.47 | 3.41 | 0.12 | 1.71 – 5.13 |
| AST (iu/L)       | 14.91 | 10.22 | 10.05 | 8.44 | 7.93 | 0.04 | 7.00 – 19.0 |
| ALP (iu/L)       | 21.10 | 17.82 | 13.07 | 13.02 | 13.05 | 0.10 | 13.0 – 26.0 |
Means in the same row with different superscripts are significantly different (P<0.05)

AST: Aspartate aminotransferase; ALP: alkaline phosphate; Glu: Glucose; Creat: Creatinine; Tb: Total bilirubin; Db: Direct bilirubin; SEM: Standard error of the mean.

3. RESULTS

Phytochemical composition of DWMOP meal mixture

Table 2 reveals the phytochemical composition of DWMOP. The phytochemical components contained 1.88 %, 5.47 %, 4.09 %, 1.00 % and 0.75 % for alkaloids, flavonoids, phenols, tannins and saponins respectively.

Hematological parameters of weaner rabbits fed graded levels of DWMOP meal mixture.

Table 3 shows the hematological parameters of weaner rabbits fed graded levels of DWMOP meal mixture. The values for PCV are 29.78%, 31.32%, 38.45%, 44.3% and 45.72% for treatments 1, 2, 3, 4 and 5 respectively. Likewise, values obtained for MCHC are 48.67%, 48.16%, 48.81%, 40.22% and 40.37% for treatment 1, 2, 3, 4 and 5 respectively. The values obtained for WBC are 9.19, 9.79, 10.02, 17.50 and 17.46 for treatments 1, 2, 3, 4 and 5 respectively. The values for Lymphocytes (%) are 30.0, 34.00, 33.13, 33.06 and 33.71 for treatments 1, 2, 3, 4 and 5 respectively. The values recorded for Albumin are 30.02, 32.10, 32.11, 32.0 and 32.13 for treatments 1, 2, 3, 4 and 5 respectively. The values for Total Protein are 60.02, 66.10, 65.24, 65.06 and 65.80 for treatment 1, 2, 3, 4 and 5 respectively. The values recorded for direct bilirubin (µmol/L) are 0.73, 0.70, 0.72, 0.70 and 0.81, Total Bilirubin (µmol/L) 3.41, 3.09, 3.00, 3.47 and 3.40 for treatments 1, 2, 3, 4 and 5 respectively.

4. DISCUSSION

Phytochemicals are secondary metabolites or bioactive chemicals found in plants. Secondary metabolites of plants play a vital role as a defense mechanism against attack by microorganisms (Cowen, 1999; Dreosti, 2000; Alagbe et al., 2020). Phytochemical results (Alkaloids (1.88%), Flavonoids (10.47%), Phenols (16.08%), Tannins (1.09%) and Saponins (3.88%) of DWMP in this current study were consistent with the permissible range reported by Alagbe et al. (2020). According to Bako et al. (2005); Omokore and Alagbe (2019); Oluwafemi et al. (2020), phytochemicals vary in distribution within the plant parts as well as in their occurrence within the plant species and have also been reported to reduce the risk of some diseases due to their protective and therapeutic roles (Adesanya and Sofowora, 1983).

Phenols are found in many plants and they function as antioxidants, free radicals scavengers (Cespedes et al., 2008; Chanda and Dave, 2009), anti-inflammatory, anti-ageing and anti-carcinogen (Han et al, 2007). Phenol is an erythrocyte membrane modifier (Adesanya and Sofowora, 1983). Saponin performs antimicrobial and anti-inflammatory roles (Hassan et al., 2012). Saponin plays a significant role in maintaining blood cholesterol levels (Cheeke, 2000). According to Adisa et al. (2010) and Chinwe et al. (2015), tannins are known to possess anti-bacterial, anti-inflammatory, anti-parasitic, anti-cancer, anti-viral and antioxidant activity, and Flavonoids have protective effects including anti-inflammatory, antioxidant, antiviral, anti-diabetic and anti-carcinogenic properties (Bashir et al. 2020; Alagbe, 2019). Alkaloids are heterogeneous group of naturally occurring compounds found in the leaves, roots and barks of some plants, they are found to have antimicrobial properties and have also been reported to reduce the risk of some diseases due to their protective and therapeutic roles (Adesanya and Sofowora, 1983).

Haematological studies represent a useful process in the diagnosis of many diseases as well as investigation of the extent of damage to the blood (Onyeyili et al., 1991), they are good indicators of the physiological status of animals (Khan and Zafar, 2005). Haematological variables and protein levels of the blood of livestock are known to be positively correlated with protein quality (Adeyeni et al., 2000; Alagbe et al., 2019). Results on the blood haematological parameters of weaner rabbits fed different graded levels of DWMOP meal presented in Table 3 showed PCV of between 29.78% - 45.72%, haemoglobin values of 9.09 – 13.88 (g/dl) while RBC values are 3.00 – 6.55. The PCV values fall within the normal ranges of 30-60% previously reported by (Flecknell 2000). All the haematological parameters obtained in this study showed that they were significantly (P<0.05) influenced by the dietary inclusion of DWMOP meal. The PCV, Hb, RBC, MCV and WBC values obtained slightly increased from diet 1 to 5, though not at a significant level. The parameters observed in this study were within the normal ranges for rabbits reported by (Mituka and Rawnsley, 1997). According to Olabanji et al. (2007) the values for all the parameters fall within the normal range established by Mitruka and Rawnsley (1977) for rabbits. Post Graduate Committee on Veterinary Sciences (PGCVS) (1990) reported a standard WBC range of 2.5 – 12.5 (x10⁹ /mm³). Reilly (1993) opined that normal range of values for WBC indicated that the animals were healthy because decrease
in number of WBC below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism. The WBC and its differentials increased from diet 1 to 5, a higher WBC value implies an increase in antibody level and high resistance to diseases (Soetan et al., 2013; Oluwafemi and Alagbe, 2019).

Togun and Oseni (2005) reported that haematological analysis is useful in disease diagnosis and nutritional stress. It also provides the opportunity to clinically investigate the presence of several metabolites and other constituents in the body (Doyle 2006; Alagbe and Oluwafemi, 2019). Nutrition and dietary contents affect the blood profile of healthy animals (Yeong 1999, Abass et al., 2012). Esou et al., (2012) reported that haematological parameters like haemoglobin concentration, white blood cell counts, red blood cell counts are dictating the level of oxygen in the blood. Blood parameters are excellent medium for measurement of potential biomarkers, because its collection is relatively non-invasive, and it shows an enormous range of physiological process in the body at any given time. Changes in blood profile can be due to disease and nutritional stress Afolabi et al., (2001), age and sex (Cheeke and Nobert 2000) and breed.

Table 4 shows the serum biochemistry of weaner rabbits fed graded levels of DWMOP meal. The results revealed that the values obtained for total protein in this study were not significantly (P >0.05) among the treatments. The total protein values obtained is 6.2-6.58 (g/dl) which fall within the normal ranges of 5.40-7.50 (g/dl) previously reported by (Medirabbit, 2011), this shows that the protein quality in the diet is able to support the growth in tissue and cell rebuild after stress (Alagbe, 2017). Glucose and activities Aspartate aminotransferase (AST) values and alkaline phosphate (ALP) were significantly (P <0.05) affected by DWMOP. However, all values fall within the normal ranges reported by Ozkan et al. (2012) on the normal biochemical parameters of New Zealand white rabbits. This therefore implies that DWMOP meal has no toxic chemicals that could compromise the activity of the liver of the animals. Creatinine and bilirubin were not significantly (P >0.05) influenced by DWMOP, this is an indication that the kidney is functioning properly.

5. CONCLUSION

It was concluded that DWMOP contains several bioactive chemicals and other nutrient necessary for the proper development of the body. Therefore, dried water melon peel and sweet orange peel meal mixtures could be included in the diet of weaner rabbits up to 20% without any deleterious effect on the health and general performance of rabbits without causing any pathological abnormalities in their blood profile.

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