# Growth Performance and Haematological Evaluation in Female Rabbit Fed Diets Containing Dried Date ~~s~~ (*Phoenix* *dactylifera*) Fruit ~~s~~ Meal

**ABSTRACT**

*This study was carried out to assess ~~the effect of dried dates fruits meal on~~ the growth performance and haematological profile ~~in~~ of female rabbits that were fed dried date ~~s~~ fruit ~~s~~ meal (DDFM) as supplement in their diets. Thirty-six (36) female rabbits (does) were used for the study. The rabbit does were randomly allotted to ~~four~~ 4 experimental diets in a completely randomized design with 9 does in each treatment group. The does in each treatment group were regrouped into 3 replications with 3 animals per replicate. ~~which had nine (9) does in each treatment and further replicated three times to have 3 rabbit does in each replicate.~~ The four experimental diets containing the dried date ~~s~~ fruit ~~s~~ meal at 0.00, 0.50, 1.00 and 1.50% inclusion levels respectively, were tagged T1, T2. T3, and T4 ~~respectively~~. ~~The study lasted for 168 days (24 weeks). The growth parameters that were assessed in the study were initial weight, final weight, total and daily weight gain, total and daily feed intake, and feed conversion ratio. Blood samples were collected at the end of the 24 weeks study from each replicate for haematological analysis to evaluated packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), hemoglobin (HB), mean corpuscular hemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV), Neutrophils, monocytes, eosinophils, basophils and lymphocytes.~~ The results revealed that there were significant differences (P=.05) in final body weight, total body weight gain, daily body weight gain, and feed conversion ratio of the does across the treatments. The results revealed significant effects (P=.05) of the DDFM on Packed Cell Volume (PCV), Platelet count, and Haemoglobin (Hb) concentration. The PCV value was ~~For PCV, the~~ highest for the does ~~value was recorded in~~ fed diet T3 (36.67%), which was significantly higher than the values recorded ~~observed~~ for the animals ~~in~~ fed on diets T1 (30.33%) and T2 (30.67~~%), indicating that increased levels of DDFM improved the PCV~~. Conclusion: Including DDFM ~~supplementation~~ in rabbit does diets at 1.00% can improve growth traits and haematological indices ~~leading~~ to enhance the ~~better~~ overall health status of rabbits. ~~in the does.~~*

# Keywords: Dates fruits, performance, haematology, female rabbits, does, performance

# INTRODUCTION

# Rabbits produce a nutritious white meat that is high in protein and low in fat and cholesterol than chicken, turkey, beef, and ~~or~~ pork (Flanders, 2012). Compared with the meat of other species, Flanders (2012), stated that, rabbit meat is richer in proteins and certain vitamins and minerals. According to Hassan *et al.* (2012), the rabbit's fast growth rate, high prolificacy, high genetic selection potential, high feed conversion efficiency and economic utilization of space make it ~~them~~ suitable for increased animal protein production. Taiwo *et al.* (2004), further added that, the ~~rabbit's~~ high fecundity, low cost of investment, and the short generation interval of rabbits, as well as their ability to utilize diverse forages are advantages for increased production.

# Date fruits ~~contain~~ have a very high nutritional value because of their ~~its~~ components. The fruits contain ~~s~~ a lot of carbohydrates, vitamins, and minerals (Ardekani *et al.,* 2010). Some ~~of the~~ benefits of the date fruit have been identified ~~studied~~ as ~~an~~ anti-inflammatory, anti-diabetic, nephroprotective, hepato-protective, anti-oxidation ~~s~~ and fertility enhancement (Hafez and El-Sohaimy, 2010). Al-Shwyeh (2019) also reported date fruit ~~s~~ as a rich source of phenolic antioxidants with antibacterial and anti-inflammatory property ~~activity~~; and so can serve as a resourceful ingredient in animal feed. But the effect of including the fruit in rabbit feed particularly ~~Since, nutrition affects~~ on their blood parameters is not commonly considered in scientific investigations, therefore, this study was ~~, therefore,~~ designed to investigate the effect of dried date ~~s~~ fruit ~~s~~ meal on the growth performance and haematological characteristics ~~in~~ of female rabbits.

# 2. MATERIALS AND METHODS

**2.1 Experimental Site**

The research was carried out at the ~~Rabbitry~~ Rabbit Unit of the Teaching and Research Farm, Department of Animal Science, University of Uyo, Akwa Ibom State, …. Uyo is situated ~~at a~~ on latitude ~~of~~ 4º 591 to 5º 041 N and ~~a~~ longitude ~~of~~ 7º 531 to 8º 001 E, with an elevation of approximately 60.96 meters above sea level. The region exhibits a bimodal rainfall pattern with an average annual rainfall of 2190 millimeters and a mean relative humidity of 81% (Solomon *et al.,* 2024).

**2.2 Sourcing and Processing of Test Materials**

Dried date palm fruits were procured from a local market in the Itu Local Government Area, Akwa Ibom State. The fruits were subjected to air drying and subsequently milled using an electric grinding machine to obtain the dried date palm fruit meal (DDFM).

# 2.3 Proximate analysis of dried date palm fruits meal and experimental diets

The dried date palm fruit ~~s~~ meal (DDFM) and the four experimental diets were analyzed according to the method of AOAC (2010) to determine their dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract (NFE) contents.

**2.4 Experimental Animals and Management**

Thirty-six female growing rabbits that aged between ~~eight~~ 8 and ~~ten~~ 10 weeks were used ~~utilized~~ for the study. A two-week acclimatization period was implemented, during which all the rabbits ~~received~~ fed a formulated ration. Subsequently, the rabbits were randomly assigned to four treatment diets ~~groups, each receiving a diet containing varying levels of DDFM: 0.00% (control), 0.00%, 0.50%, 1.00 and 1.50%, respectively.~~ Prior to the commencement of the experiment, prophylactic measures were taken to control ~~address~~ internal and external parasites through subcutaneous administration of ivermectin injection (0.1 ml/rabbit). Additionally, a broad-spectrum antibiotic, [Oxytetracycline L.A (0.2 ml/rabbit)], was administered to minimize bacterial load. The rabbits were managed under intensive conditions and housed in wired wooden rabbit hutches within an open-ended rabbit house to ensure adequate ventilation. Throughout the 168-day (24-week) experimental period, the rabbits were provided with feed, water, and forages ad libitum. Weekly weights were taken to monitor growth progress.

**2.5 Ethical Statement**

The ~~All~~ authors hereby declare that “Principles of laboratory animal care” (NIH Publication No. 85-23, revised 1985) ~~were followed as well as~~ and specific national laws of … were followed. ~~applicable~~. All experiments have been examined and approved by the Ethics Committee of the Animal Science Department, University of Uyo, Nigeria.

# 2.6 Experimental Diets

The four experimental diets were formulated to contain varying levels of DDFM: 0.00% (control), 0.50%, 1.00%, and 1.50%, and designated as T1, T2, T3, and T4, respectively. ~~The control diet (T1) served as a baseline, containing no DDFM.~~ All the diets were fortified with bone meal, vitamin premix, and salt.

**Table 1: Composition of the Experimental Diets**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ingredients | T1  (0.00% DDFM) | T2  (0.50% DDFM) | T3  (1.00% DDFM) | T4  (1.50% DDFM) |
| Maize | 45.00 | 45.00 | 45.00 | 45.00 |
| Soybean cake | 21.00 | 21.00 | 21.00 | 21.00 |
| Wheat Offal | 17.10 | 17.10 | 17.10 | 17.10 |
| Rice offal | 5.00 | 5:00 | 5:00 | 5:00 |
| Palm Kernel Cake | 8.00 | 8.00 | 8.00 | 8.00 |
| Bone meal | 3.00 | 3.00 | 3.00 | 3.00 |
| Common salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Vit-Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.20 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.20 | 0.25 | 0.25 | 0.25 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 |
| Calculated Composition | |  |  |  |
| Metabolizable Energy (Kcal/Kg) | 2806.30 | 2806.30 | 2806.30 | 2806.30 |
| Crude Protein (%) | 17.15 | 17.15 | 17.15 | 17.15 |
| Crude fibre (%) | 5.56 | 5.56 | 5.56 | 5.56 |
| Ether Extract (%) | 6.87 | 6.87 | 6.87 | 6.87 |

**2.7 Experimental Design**

A completely randomized design (CRD) was employed to allocate 36 rabbit does to 4 ~~four treatment groups to~~ ~~the respective~~ experimental diets that contained varying levels of DDFM at 0.00% (control), 0.50%, 1.00% and 1.50% and designated as T1, T2, T3, and T4 accordingly. Each treatment group consisted of ~~three~~ 3 replicates, with each replicate comprising ~~three~~ 3 rabbits; making ~~This resulted in a total of~~ ~~nine~~ 9 rabbits per treatment and a total of 36 rabbits. The experimental feeding period for each replicate was twenty-four weeks (168 – days).

The statistical model adopted was:

Yіј = μ+Tі +eіј

Where:

Yіј = single observation μ = overall mean

Tі = Treatment effect

eіј = Random error associated with the jth observation in the

ith treatment

# 2.8 Data Collection

**2.8.1 Measurement of Growth Parameters ~~Live Weight Change~~**

**Live body weight**: the weekly live body weight of each doe in each group was measured ~~for each doe in each group~~ using an electronic weighing scale () with a sensitivity of 1g ~~weekly during the feeding period and changes in weights were recorded and presented in a table~~.

**Feed intake:** Feed intake was evaluated by subtracting the quantity of leftover feed from the quantity ~~of feed~~ offered the previous day in a 24-hour ~~s’~~ cycle.

**Total weight gain:** Total weight gain was calculated as the difference between the final ~~weight~~ and the initial body weights of each doe.

Total weight gain (g) = final body weight – Initial body weight ~~Daily weight gain.~~

**Daily weight** **gain** was obtained by dividing the total body weight gain by ~~168~~ total number of experimental days as follows:

Daily weight gain (g) =

**Total feed intake**: Total feed intake was calculated by summing the total amount of feed consumed by the animals during the ~~for~~ 168-day ~~s~~ ~~of the~~ experimental period.

**Daily feed intake**: This was computed by dividing the total feed consumed ~~by the~~ per each bucks ~~during~~ by the total number of experimental days ~~experimental period by 168 days~~ as follows:

Daily feed intake (g) =

**Feed conversion ratio (FCR)**: Feed conversion ratio was computed by dividing the total feed intake by the total body weight gain during the study period as follows:

Feed Conversion Ratio =

**2.8.2 Haematological Parameters**

At the conclusion of the 24-week experimental period, blood samples were collected from one randomly selected doe within each replicate in each treatment group. Blood collection was performed via ~~the~~ an external ear vein between 7:00 and 8:30 AM using a sterile disposable syringe and needle. Prior to collection, sterile universal bottles containing Ethylenediaminetetraacetic acid (EDTA) ~~as an~~ anticoagulant were labeled for sample identification. Before ~~Following~~ the blood collection, the puncture site of each animal was disinfected with a cotton swab, soaked in methylated spirit to prevent infection.

The following hematological parameters: ~~were assessed:~~ packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), hemoglobin (Hb), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular volume (MCV), neutrophils, and lymphocytes were assessed ~~Blood samples were subjected to laboratory analysis~~ using an automated analyzer (). ~~, and the results were tabulated.~~

# 2.9 Statistical Analysis

# ~~The experimental~~ Data collected were subjected to the analysis of variance (ANOVA) procedure in a completely randomized design, using IBM Statistical Package for Social Science (SPSS) version 21. Differences between treatment means were separated using the Duncan ~~m~~ Multiple Range Test at …% significance level. ~~of the software.~~ The statistical model adopted was:

# Yіј = μ+Tі +eіј

# Where Yіј = a single observation, μ = overall mean, Tі = Treatment effect, eіј = Random error

# associated with the jth observation in the ith treatment.

**3. RESULTS**

**3.1 Growth Performance of Rabbit Does Fed Diets Containing Varying Dietary Levels of Dried Date Fruit ~~s~~ Meal**

~~The~~ Growth performance of the rabbit does fed diets containing varying levels of the dried date fruit ~~s~~ meal (DDFM) is presented in Table 2. The results revealed significant differences *(P=.05)* in the final body weight, total body weight gain, daily body weight gain, and feed conversion ratio of the does across the treatments. The highest final body weight was ~~observed~~ recorded in the does fed diet T3 (1887.39 g), which was significantly greater than the final body weight of the does fed diets ~~in~~ T1 (1629.39 g) ~~,~~ and T2 (1741.00 g), but similar for those fed diet ~~and~~ T4 (1847.33 g). The lowest final body weight was recorded for the does on the control diet ~~in~~ (T1). Similarly, total body weight gain was significantly highest ~~higher~~ for the animals fed diet ~~in~~ T3 (1138.28 g), followed by those fed diets T4 (1099.11 g), T2 (993.78 g) ~~, and~~ with the lowest for ~~in~~ the rabbits fed the control diet (T1) (886.39 g). Daily body weight gain followed a similar trend, with the does fed diet ~~in~~ T3 showing the highest value ~~daily weight gain~~ (8.13 g), followed by those fed diets T4 (7.85 g), T2 (7.10 g), and T1 (6.33 g). ~~, respectively.~~

No significant differences () were observed in total feed intake and ~~or~~ daily feed intake of the does across all the treatments. However, while total feed intake varied slightly at ~~, with~~ ~~values of~~ 13392.90 g, 13548.00 g, 13530.67 g, and 13530.67 g for the rabbits fed diets T1, T2, T3, and T4, respectively, ~~and~~ daily feed intake increased marginally in the does fed diets T1, T2, T3 but slightly decreased in those fed diet T4. ~~values ranging from 95.66 g to 96.86 g.~~ Feed conversion ratio (FCR) was significantly the best ~~better~~ (lowest) in the does fed diet T4 (12.85), followed by those fed diets T3 (13.01), T2 (14.30), and T1 (18.30). ~~, indicating that rabbit does fed diets with higher levels of dried date fruits meal had more efficient feed utilization.~~

**Table 2: Growth performance of rabbit does fed diets containing varying dietary levels of dried date fruit ~~s~~ meal**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameters | T1  () | T2  () | T3  () | T4  () | SEM | p-value |
| Initial body weight (g) | 743.00 | 747.22 | 749.11 | 748.22 | 81.24 |  |
| Final body weight (g) | 1629.39b | 1741.00ab | 1887.39a | 1847.33a | 51.90 |  |
| Total weight gain (g) | 886.39b | 993.78ab | 1138.28a | 1099.11a | 94.71 |  |
| Daily weight gain (g) | 6.33b | 7.10ab | 8.133a | 7.85a | 7.35 |  |
| Total Feed Intake (g) | 13392.90 | 13548.00 | 13530.67 | 13530.67 | 48.02 |  |
| Daily Feed Intake (g) | 95.66 | 96.77 | 96.86 | 96.65 | 0.34 |  |
| Feed Conversion Ratio | 18.30a | 14.30b | 13.01b | 12.85b | 1.53 |  |

Means without letters were not significant (p>0.05); **SEM** – Standard Error of Means,**T1:T2:T3:** **T4:** **p-value:**

**3.2 Haematological Indices of Rabbit Does Fed Diets Containing Varying Dietary Levels Dried Date Fruit ~~s~~ Meal**

The haematological indices of rabbit does fed diets containing varying levels of dried date fruit ~~s~~ meal (DDFM) are presented in Table 3. The results reveal ~~ed~~ significant effects *(P=.05)* of DDFM on Packed Cell Volume (PCV), Platelet count, and Haemoglobin (Hb) concentration. For PCV, the highest value was recorded in the does fed diet T3 (36.67%), which was significantly higher than the values recorded ~~observed~~ for the does fed diets ~~in~~ T1 (30.33%) and T2 (30.67%). ~~, indicating that increasing levels of DDFM improved the PCV.~~ The PCV value recorded for the does fed diet ~~in~~ T4 ~~was~~ (36.33%), ~~which~~ was similar to the value noted for those fed diet T3 but significantly higher than the PCV value noted for the does fed both diet T1 and T2. Platelet count was ~~s were~~ significantly but intermittently different in does fed the various diets with ~~higher~~ the highest in the animals fed diet T3 (197.67). ~~compared to T1 (123.33), with T2 (154.00) and T4 (139.67) having intermediate values.~~ The concentration of ~~H~~ haemoglobin ~~concentration~~ was significantly but intermittently different in does fed the various diets with the highest value in those fed diet ~~higher in~~ T4 (11.70 g/dL). ~~compared to T1 (9.33 g/dL), with T2 (10.13 g/dL) and T3 (11.57 g/dL) showing intermediate values.~~

In contrast, no significant differences (p>0.05) were recorded ~~observed in~~ for ~~the~~ White Blood Cell (WBC) ~~count,~~ and Red Blood Cell (RBC) counts, as well as the Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), and the Mean Corpuscular Haemoglobin Concentration (MCHC) across the treatments. ~~The WBC count ranged from 4.80 × 10⁹/dL in T4 to 5.67 × 10⁹/dL in T2, with T1 (5.27 × 10⁹/dL) and T3 (5.47 × 10⁹/dL) showing intermediate values. The similarity in WBC counts across the groups indicates that the DDFM supplementation did not significantly affect the WBCs. The RBC counts were 4.37 × 10¹²/L in T1, 4.33 × 10¹²/L in T2, 4.90 × 10¹²/L in T3, and 5.17 × 10¹²/L in T4. While there was a trend towards higher RBC counts in T3 and T4, the differences were not significant. Similarly, MCV values were 69.33 fl in T1, 71.00 fl in T2, 75.67 fl in T3, and 69.67 fl in T4, showing no significant effect of DDFM on the average volume of red blood cells. MCH values, which reflect the amount of haemoglobin per red blood cell, were 21.33 pg in T1, 23.33 pg in T2, 23.67 pg in T3, and 22.67 pg in T4. The MCHC values, which indicate the concentration of haemoglobin in a given volume of packed red blood cells, were 31.33% in T1, 33.33% in T2, 31.33% in T3, and 33.00% in T4, with no significant differences observed across the treatments.~~ ~~These parameters suggest that the DDFM supplementation did not significantly alter the general characteristics of red blood cells or their haemoglobin content.~~

**Table 3: Haematological indices of rabbit does fed diets containing varying dietary levels of dried date fruit ~~s~~ meal**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameters | T1  () | T2  () | T3  () | T4  () | SEM | p-value |
| Packed Cell Volume (%) | 30.33b | 30.67b | 36.67a | 36.33a | 1.01 |  |
| White Blood Cells (×109/dL) | 5.27 | 5.67 | 5.47 | 4.80 | 0.39 |  |
| Platelet | 123.33c | 154.00b | 197.67a | 139.67bc | 21.91 |  |
| Red Blood Cells (×1012/L) | 4.37 | 4.33 | 4.90 | 5.17 | 0.14 |  |
| MCV (fl) | 69.33 | 71.00 | 75.67 | 69.67 | 1.21 |  |
| MCH (pg) | 21.333 | 23.33 | 23.67 | 22.67 | 0.52 |  |
| MCHC (%) | 31.33 | 33.33 | 31.33 | 33.00 | 0.64 |  |
| Haemoglobin (g/dL) | 9.33b | 10.13ab | 11.57a | 11.70a | 10.68 |  |
| Lymphocytes (%) | 60.00 | 70.00 | 62.33 | 63.33 | 1.80 |  |
| Eosinophil (%) | 4.67 | 4.67 | 4.00 | 4.00 | 0.19 |  |
| Monocytes (%) | 3.67 | 3.00 | 3.00 | 2.67 | 0.19 |  |
| Neutrophils (%) | 31.33 | 22.00 | 30.33 | 29.67 | 1.71 |  |
| Basophil (%) | 0.33 | 0.33 | 0.33 | 0.33 | 0.14 |  |

**MCV -** mean corpuscular volume, **MCH –** mean corpuscular haemoglobin, **MCHC –** Mean corpuscular haemoglobin concentration, **SEM –** Standard error of means; **p-value –** ; Means with different superscripts are significant *(P=.05)*

For the differential white blood cell counts, there was no significant difference (p>0.05) in the percentage of ~~M~~ monocytes; ~~, with~~ however, rabbits fed diet T2 (33.00%) had the ~~showing a non-significantly higher~~ highest percentage count compared to the other treatments. ~~Rabbit does fed T1 (3.67%), T3 (3.00%), and T4 (2.67%) diets respectively, had much lower monocyte percentages.~~ Similarly, ~~In contrast,~~ no significant differences () were ~~observed~~ recorded in the percentage ~~s~~ concentration of Lymphocytes, Eosinophils, Neutrophils, and Basophils of rabbits fed the various treatment diets. ~~The percentage of Lymphocytes ranged from 60.00% in T1 to 70.00% in T2, with T3 and T4 showing 62.33% and 63.33%, respectively. Eosinophil percentages were 4.67% in T1 and T2, and 4.00% in T3 and T4, indicating that the DDFM had little effect on this parameter in the does. Neutrophil percentages ranged from 22.00% in T2 to 31.33% in T1, with T3 and T4 showing values of 30.33% and 29.67%, respectively. Basophil percentages remained consistent across all treatments at 0.33%.~~

Overall, while significant differences were observed in PCV, Platelet count, and Haemoglobin concentration, ~~the~~ majority of the haematological indices, including WBC and ~~count,~~ RBC counts, MCV, MCH, MCHC, and the differential white blood cell counts, showed no significant differences in the rabbits across the treatments. ~~This indicates that the addition of dried date fruits meal influenced specific aspects of the rabbits' blood profile, particularly related to red blood cell function, platelet production, and haemoglobin concentration, but did not significantly affect other haematological parameters.~~

**4. DISCUSSION**

**4.1 Growth performance of rabbit does fed diets containing varying levels of dried date fruit ~~s~~ meal**

~~The~~ Results on the growth performance of rabbit does fed diets containing varying levels of dried date fruit ~~s~~ meal (DDFM) reveal ~~ed~~ significant improvements in the final body weight, total body weight gain, daily body weight gain, and feed conversion ratio (FCR), aligning with findings in existing literature on the effects of plant-based feed additives *on what?*. The significantly higher final body weights recorded for the animals ~~in~~ fed diets T3 (~~1887.39 g~~) and T4 (~~1847.33 g~~) compared to those fed on T1 (~~1629.39 g~~) are consistent with the observations of Reece *et al.* (2015), and Malik *et al.* (2022), who reported improved body weight in animals supplemented with nutrient-rich plant-based feeds. DDFM ~~,~~ ~~which~~ contains ~~a~~ high nitrogen-free extract (78.81%) and minerals such as calcium and iron and would ~~,~~ likely enhance ~~d~~ energy availability and skeletal development which might result to the increases in the growth traits ~~,~~ as was noted by Etim *et al.* (2014) ~~,~~ who emphasized the role of dietary minerals in growth performance.

The significantly higher total body weight gain and daily body weight gain noted ~~observed~~ in the rabbits fed on diets ~~In~~ T3 and T4 ~~were significantly higher~~ than those fed on the control diet T1 ~~,~~ suggests ing that DDFM improved nutrient assimilation and feed utilization in the animals. This finding supports the report of Omoikhoje *et al.* (2024) ~~,~~ who noted increased weight gain in animals fed diets supplemented with Jatropha leaf meal. Similarly, Essien *et al.* (2023) attributed improved growth to ~~the~~ phytochemical and energy composition of plant-based supplements, which enhance protein synthesis and metabolic activity.

Total feed intake and daily feed intake did not vary significantly in the rabbits does across the treatments. However, the similarity of their values ~~, with values ranging from (13392.90 g to 13548.00 g and 95.66 g to 96.86 g, respectively. This stability~~ aligns with the findings of Malik *et al.* (2022) ~~,~~ who reported no significant differences in feed intake among broilers fed plant-based diets. This suggests that the DDFM ~~does~~ did not influence feed palatability for increased consumption but enhanced ~~s~~ growth of the rabbits by improving their nutrient conversion efficiency ~~,~~ as evidenced by the significantly better FCR detected for the animals fed on diet ~~in~~ T4 (12.85) and T3 (13.01) compared to those fed on the control diet T1 (18.30). The improved FCR detected ~~observed~~ in this study indicates more efficient feed utilization with higher DDFM inclusion. This is consistent with the findings of Ameer *et al.* (2022) ~~,~~ who have reported enhanced FCR in rabbits fed diets containing bioactive-rich plant extracts. The rich phytochemical composition of DDFM ~~’s,~~ which includes ~~ing~~ flavonoids and saponins, may have contributed to better nutrient absorption and gut health, as was reported by Soetan *et al.* (2013). …

**4.2 Haematological indices of rabbit does fed diets containing varying dietary levels of dried date fruits meal**

Hematological indices according to Okorie *et al.* (2011), are ~~offer a~~ means of conducting clinical investigations on the existence of various metabolites and other components in an animal, and they can also be used as crucial tools for determining the health status of an individual as well as in the diagnosis of various pathological and metabolic problems (Afolabi *et al.,* 2011). The haematological findings in this study align with established literature, showcasing the potential of dried date fruit ~~s~~ meal (DDFM) to ~~in~~ improve ~~ing~~ certain blood parameters while maintaining the overall blood health of rabbits. ~~The~~ Packed cell volume (PCV), an important marker of oxygen-carrying capacity, was significantly elevated in the rabbits fed diets T3 and T4 ~~,~~ which is consistent with the reports of Reece *et al.* (2015) and the Merck Veterinary Manual (2012), which identified ~~y~~ PCV values of 30–50% as optimal for health ~~y~~ of rabbits. This suggests that DDFM supplementation could support ~~s~~ efficient oxygen transport, a critical condition that is needed for growth and metabolism.

White blood cell (WBC) count ~~s showed no~~ was not significantly different ~~ces~~ in the does across the treatment diets, ~~maintaining~~ but the values were maintained within the normal range (6.00–12.00 × 10⁹/dL) recommended by the Merck Veterinary Manual (2012). This indicates that the DDFM did not compromise the rabbits’ immunity. Similar findings were reported by Istifanus *et al.* (2022) ~~,~~ who have highlighted the importance of WBC in combating infections and maintaining immunity. Moreover, Soetan *et al.* (2013) ~~,~~ emphasized that, WBC plays a crucial role in antibody production and phagocytosis, and ~~the current findings~~ confirmed by the current findings, ~~that~~ the DDFM supplementation has shown to support ~~s~~ these immune functions without any negative impacts. The WBC aids to protect the body from pathogen (Odunitan-Wayas *et al.,* 2018). White blood cell (WBC) count s typically increases in response to pathogens, enhancing the body’s defense mechanisms (Onyema *et al.,* 2024); ~~,~~ thus the WBC counts recorded in the animals fed the various diets in the current work imply ~~ing~~ that the rabbit does were not exposed to pathogenic infections nor were their immune system compromised. The WBC differentials, including granulocytes (neutrophils, basophils, eosinophils) and non-granulocytes (lymphocytes, monocytes), provide specific insights into immune system activity (Onyema *et al.,* 2024). Lymphocytes, according to Afolabi *et al.* (2011), are the most common form of white blood cell, followed by heterophils, eosinophils, and monocytes. Since lymphocytes are reactive cells in inflammation and delayed hypersensitivity, they are involved in the manufacture of antibodies (Banks, 2014).

Red blood cell (RBC) counts, haemoglobin (Hb) levels, and other red cell indices (MCV, MCH, and MCHC) remained unaffected in the rabbits fed the experimental diets, with the values falling within the normal reference ranges for healthy rabbits reported by the Merck Veterinary Manual (2012) ~~(Merck Veterinary Manual, 2012).~~ These ~~This~~ align ~~s~~ with the observations made by Ameer *et al.* (2022) and Istifanus *et al.* (2022) ~~, who noted~~ which indicate that stable RBC parameters reflect the absence of anemia and ~~the~~ adequate oxygen-carrying capacity of the blood. The function of RBC as noted by (Onyema *et al.* (2024) ~~,~~ is to transport oxygen from the lungs to tissues and remove carbon dioxide from the tissues to the lung in the body via haemoglobin. Therefore, ~~T~~ the unaffected levels of RBC and Hb of the rabbis in all the treatment groups ~~levels~~ suggests that the DDFM supplementation ~~does~~ did not impair erythropoiesis ~~,~~ but ~~further~~ affirms ~~ing~~ its safety and suitability in rabbit diets. The MCV is used to calculate the average erythrocyte size, the MCH ~~to~~ measures the amount of haemoglobin ~~amount~~ per blood cell and the MCHC ~~to know~~ measures the amount of haemoglobin relative to the size of the cell per red blood cell (Odunitan-Wayas *et al.,* 2018). Results on MCV ~~,~~ and MCH in the current study indicate ~~d a~~ lack of macrocytic or hypochromic anemia in the rabbit does as supported by onyema *et al.* (2024).

The study also recorded significant ~~I~~ increases in platelet counts, particularly in the does fed diets T3 and T4; ~~. Elevated platelets~~ suggesting enhanced blood clotting potential of the animals, ~~which~~ ~~is vital for~~ to prevent ~~ing~~ excessive blood loss during injuries according to Etim *et al.* (2014). ~~This observation aligns with Etim~~ *~~et al.~~* ~~(2014) , who noted that higher platelet counts enhance clot formation, ensuring rapid wound healing.~~

**5. CONCLUSION**

~~The~~ Findings of the ~~this~~ study ~~,~~ indicate ~~d~~ that, DDFM at 1.00% can be supplemented in female rabbits’ diets to improve growth parameters without exhibiting any deleterious effect on the animals’ health.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

The ~~A~~ authors hereby declare that no ~~NO~~ generative AI technologies such as Large Lnaguage Models (ChatGPT, COPILOT, etc) and text – to – image generators have been used during the writing or editing of this manuscript.

**References**

Afolabi, K. D., Akinsoyinu, A. O., Abdullah, A. R. O., Olajide, R., & Akinleye, S. B. (2011). Haematological parameters of the Nigerian local grower chickens fed varying dietary levels of palm kernel cake. *Poljoprivreda*, 17(1): 74-78.

 Al-Shwyeh, H. A. (2019). Date palm (Phoenix dactylifera L.) fruit as potential antioxidant and antimicrobial agents. Journal of Pharmacy and Bioallied Sciences; 11:1-11.

Ameer et al., 2022

AOAC. (2010). Association of Official Analytical Chemists. Official Methods of Analysis, 16th edition. *Washington DC,* USA.

Ardekani, M. (2010). Comparison of Antioxidant Activity and Total Phenol Contents of some Date Seed Varieties from Iran. *Iranian Journal of Pharmaceutical Research*, 9(2): 141–146.

Banks W.S, (2014). Effect of probiotic supplementation on the performance of broilers. *Journal of Animal Science*, 5, 277-284

Essien, C. A., Sam, I. M., & Okon, U. M. (2024). Effect of date palm waste on growth performance, and nutrient digestibility of weaner rabbits. *Proceedings of 49th Annual Conference of Nigerian Society for Animal Production, 24 – 27 March, 2024, University of Ibadan, Nigeria.*

Essien et al., 2023

Etim, N. N., Enyenihi, G. E., Akpabio, U. & Offiong E. E. A (2014) Effects of nutrition on haematology of rabbits: a review. *European Scientific Journal*; 10(3): 413 424.

Flanders, F.B. (2012). Exploring Animal Science. *Delmar Cengage Learning 5 Maxwell Drive Clifton Park*, NY 12065-2919 USA

Hafez, E.E. & El-Sohaimy, S.A., (2010). Biochemical and Nutritional Characterizations of Date Palm Fruits (*Phoenix* *dactylifera* L). *Journal of Applied Sciences Research*, 6(8): 1060–1067.

Hassan, H.E., Elamin, K.M., Yousif, I.A., Musa, A.M. & Elkhairey, M.A. (2012). Evaluation of body weight and some morphometric traits at various ages in local rabbits of Sudan. *Journal of Animal Science Advances*, 2(4): 407-415.

Istifanus, E. F., Solomon, I. P. & Idang, E. J. (2022). Growth performance and haematological indices of mongrel rabbit bucks fed diets supplemented with Roselle (*Hibiscus* *sabdariffa*) calyx meal. *Nigerian Society for Animal Production*. 49(4):194-205

Lebas, F., Coudert P. & de Rochambeau H. (1997). The rabbit - Husbandry, health and production FAO Animal Production and Health Series No. 21 (new revised version) *FAO - Food and agriculture organization of the united nations Rome*.

Malik, A. A., Busari, L. B., Idundun, S. O., Adebowale, Z. A. & Okoye, A. O. (2022). Effect of feeding *Jatropha tanjorensis* leaf meal as a growth promoter on the performance, carcass characteristics and sensory properties of broiler chicken. *Nigerian Society for Animal Production;* 49(2): 140-149.https://doi.org/10.51791/njap.v49i2.3477

Merck Manual (2012). Haematologic reference ranges. Mareck Veterinary Manual. Retrieved from *http://www.merckmanuals.com.*

Odunitan-Wayas, F. I., Kolanisi, U. I. & Chimonyo, M. I. (2018). Haematological and Serum Biochemical Responses of Ovambo Chickens Fed Provitamin A Biofortified Maize. *Brazilian Journal of Poultry Science;* 20(3): 425-434

Okorie, K. C., Nkwocha, G. A. & Ndubuisi, E. C. (2011). Implications of feeding varying dietary levels of cassava leaf meal on finisher broilers: Performance, carcass haematology and serological profiles. *Global research journal of science*, 1, 58-66

Omoikhoje, S.O., Eguaoje, A.S., Iyiorobhe, P., Akangbe, E. & Aidelomon, E.O. (2024). Growth performance of broiler chickens on cold aqueous *Jatropha tanjorensis* leaf extracts. *Proceedings of 49th Conference of Nigerian Society for Animal Production: 24 – 27 March, 2024, Univ. of Ibadan, Nigeria*; 1298-1302

Onyema, C. R., Ene, A. C., Nwaoguikpe, R. N. & Igwe, C. U. (2024). Haematological and biochemical studies on Justicia secunda infusion used in treatment of anaemia. *GSC Advanced Research and Reviews*, 20(02), 057–068

Reece, W. O., Erickson, H. H., Goff, J. P. & Uemura, E. E, (2015). Dukes' Physiology of Domestic Animals Thirteenth Edition. *Wiley Blackwell, John Wiley & Sons, Inc., Publication*

Soetan, K. O., Akinrinde, A. S. & Ajibade, T. O. 2013. Preliminary studies on the haematological parameters of cockerels fed raw and processed guinea corn (Sorghum bicolor) *Proceedings of 38th Annual Conference of Nigerian Society for Animal Production*. 49-52

Solomon, I. P., Atata, E., Istifanus, E. F. & Tom, E. E. (2024). Haematological and serum biochemical responses of rabbit bucks to quantitative feed restriction and feeding time. *Journal of Experimental and Molecular Biology*; 25(1):11-20

Taiwo, B.B.A., Ogundipe. I.I. and Ogunsiji O. (2004). Reproductive and growth performance of rabbits raised on forage crops. *Proceedings of the 4th Annual Conference of the Animal Association of Nigeria held in Ibadan, Nigeria*, 108-109.