

**NSAP****47th Annual Conference
(JOS 2022)****CONFERENCE
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**SECURING ANIMAL
AGRICULTURE AMIDST
GLOBAL CHALLENGES****HAEMATOLOGICAL INDICES OF MONGREL RABBITS (*Oryctolagus cuniculus*)
BUCKS ADMINISTERED CITRUS LIMON JUICE****Idang, E. J., Solomon, I. P. and Istifanus, E. F.**

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Abstract

The study was conducted to assess the effect of orally administered levels of Citrus limon juice on haematological indices of mongrel rabbit bucks. A total of 24 mongrel rabbit bucks were used for the study. The rabbits were randomly allocated into four treatments containing 0% (control), 25%, 50% and 75% fresh citrus limon juice respectively. The bucks were allotted to the four treatments (T1, T2, T3 and T4) with two rabbits per replicate and six rabbits per treatment. The trial lasted for 8 weeks. The result shows that C. limon juice administration at these levels had no negative effect on the haematological parameters of mongrel rabbit bucks examined in this study. All the parameters differed significantly ($P < 0.05$). In conclusion, Citrus lemon juice can be administered orally up to 75% concentration to mongrel rabbit bucks without adverse or deleterious effect on the blood parameters.

Keywords: Citrus limon, Haematological Indices, Rabbit, Vitamin C, Mongrel**Introduction**

The genus *Citrus* L., of the family Rutaceae, comprises various species of limes, lemons, oranges, grapefruits and mandarins. Species of the genus *Citrus* are widely cultivated and they are the most popular fruits in the world (Sadaf *et al.*, 2009). The presence of bioactive compounds, such as hydrocinnamic acid, ferulic acid, cyaniding glucoside, flavonoid, vitamin C, carotenoid, hesperidin and naringin content contribute to the value of lemon in terms of it being associated with promoting good health (Xu *et al.*, 2008).

Haematological parameter is an important and reliable medium used to monitor and elevate health and nutritional status of animals (Gupta *et al.*, 2007). According to Schalm *et al.* (1975) blood composition of animal might be influenced by certain factors, one of which is nutrition. Research studies have shown the usage of citrus pulp and peel meal as animal feedstuff without any side effect on the animals. Meanwhile, no significant studies have been carried out on the juice of citrus lemon to establish its beneficial effect and possible toxicity in rabbit models (Solomon *et al.*, 2015). Therefore, this study was carried out to determine the effect of citrus lemon

juice on the haematological indices of rabbit bucks.

Materials and Method**Experimental Animals and Management**

Twenty-four (24) clinically sound mongrel rabbits were purchased from a reputable farm in Uyo and used for this study. The rabbits were allowed for two weeks of acclimatization period before the administration of the treatment (*Citrus lemon* juice). The rabbits were randomly divided into four treatment groups. Each treatment was replicated three times with two (2) rabbits per replicate. They were raised in a three-tier rabbit hutch and fed commercial grower pellet. The experiment was carried out at the rabbitry unit of the Teaching and Research Farm of Animal Science Department, University of Uyo, Akwa Ibom State.

Experimental plan and Fresh Citrus limon Juice Administration

Rough *Citrus limon* fruits were bought from a reliable source at Itam Market, Itu, Akwa Ibom state, Nigeria and used for this study. The *Citrus limon* fruits were peeled and the juice squeezed out into a clean container manually. The extract was filtered using a clean sieve and the filtrate



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collected into clean bottles. After 14 days of acclimatization, all rabbits were administered fresh *Citrus limon* juice orally corresponding to their group as follows for eight (8) weeks:

Treatment 1 – distilled water

Treatment 2 – 25% *Citrus limon* juice + 75% water

Treatment 3 - 50% *Citrus limon* juice + 50% water

Treatment 4 - 75% *Citrus limon* juice + 25% water

Blood Sample Collection

At the end of the experimental period, 2ml of blood samples were collected from each replicate through the marginal ear vein using a sterilized disposable syringe and needle. The blood samples were collected into ethylenediamine tetraacetic acid (EDTA) impregnated sample bottles. White blood cells (WBC), red blood cells (RBC), haemoglobin (HB), packed cell volume (PCV), Mean Corpuscular volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin concentration (MCHC), Platelet, Lymphocyte and Neutrophils were determined in Haematology laboratory of the University of Uyo Teaching Hospital (UUTH), Uyo, using 5-part differential Haematology Auto-analyzer (Mindray BC 5300 model).

Statistical Analysis

The experimental data was subjected to analysis of variance (ANOVA) procedure in a completely randomized design, using IBM Statistical Package for Social Science (SPSS) version 21. Differences between treatments means were separated using Duncan multiple Range Test (Duncan, 1955).

Results and Discussion

Haematological Indices as Affected by *Citrus limon* Juice in Rabbits



Table 1: Haematological Indices as Affected by *Citrus limon* Juice in Rabbits

PARAMETER	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	SEM*
White Blood Cell ($\times 10^3/\mu\text{L}$)	4.50 ^c	4.60 ^c	5.20 ^b	8.00 ^a	0.43
Red Blood Cell ($\times 10^6/\mu\text{L}$)	4.34 ^c	5.82 ^a	4.89 ^b	5.66 ^a	0.18
Haemoglobin (g/dL)	9.40 ^d	13.20 ^a	11.40 ^c	13.00 ^b	0.46
Haematocrit (%)	26.10 ^d	40.00 ^b	32.80 ^c	40.40 ^a	1.77
Mean Corpuscular volume (fL)	60.10 ^d	68.70 ^b	67.10 ^c	71.40 ^a	1.26
Mean Corpuscular Hemoglobin (pg)	21.70 ^d	22.70 ^c	23.30 ^a	23.00 ^b	0.18
MCHC** (g/dL)	36.00 ^a	33.00 ^c	34.80 ^b	32.20 ^d	0.45
Platelet ($\times 10^3/\mu\text{L}$)	82.00 ^d	109.00 ^c	164.00 ^b	378.00 ^a	35.05
Lymphocyte (%)	30.90 ^c	41.80 ^a	38.00 ^b	30.10 ^d	1.48
Neutrophils (%)	65.80 ^b	56.80 ^d	60.00 ^c	68.10 ^a	1.36

a,b,c,d : means in the same row with different superscripts differ significantly ($P < 0.05$); *SEM: standard error of mean; **MCHC: Mean corpuscular haemoglobin concentration

The haematological indices of rabbit bucks administered 0%, 25%, 50% and 75% of *Citrus limon* juice are shown on table 1. The results showed that *Citrus limon* juice significantly ($P < 0.05$) influenced the haematological parameters mongrel rabbit bucks. The result revealed that there was significant difference ($P < 0.05$) in WBC value of bucks administered levels of *Citrus limon* juice orally. It was observed that T₄ ($8.00 \times 10^3/\mu\text{L}$) had the highest value while T₁ ($4.50 \times 10^3/\mu\text{L}$) had the lowest value of WBC. Blood is an important index of physiological, pathological and nutritional status of an organism (Olorode *et al.*, 2007). The WBC

values of mongrel rabbit bucks were within the range of 4.5 to $11 \times 10^3 \text{ mm}^3$ reported by Research Animal Resources [RAR] (2009) for rabbits. This shows 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, while elevated values (leukocytosis) indicate the existence of a recent infection, usually with bacteria (Ahamefule *et al.*, 2008). Thus, animals with low white blood cells are exposed to high risk of disease infection, while those with high counts are capable of generating antibodies in the process of phagocytosis and have high degree of resistance to diseases (Soetan *et al.*, 2013). Increased WBC by treatment with increased levels of *Citrus limon* juice is due to its content of natural antioxidants such as citrate, Vit. C, Vit. E and flavonoid (Manthou *et al.*, 2017).

The RBC values were significantly influenced ($P < 0.05$) by oral administration of *Citrus limon* juice. It was observed that T₂ ($5.82 \times 10^6/\mu\text{L}$) had the highest value while T₁ ($4.34 \times 10^6/\mu\text{L}$) had the lowest value of RBC. The significant increase in RBC levels of rabbit bucks with increased levels of administered *Citrus limon* juice may be attributed to the high content of natural antioxidant in *Citrus limon* juice such as Vit. C, flavonoids and alkaloid which scavenge free radicals and reduce their harmful effect on the body (Koomson *et al.*, 2018).

The mean values of haemoglobin and Pack Cell Volume (PCV) were statistically different across the treatment groups. The PCV values obtained in this study were 26.10%, 40.00%, 32.80% and 40.40% for T₁, T₂, T₃, and T₄ respectively. Haemoglobin (Hb) values of rabbit bucks were within the range of 9.0 – 17.4 g/dl reported by Njidda *et al.*, (2006) except for rabbit bucks in the control group (9.40 g/dl) which was not too far from the normal range of 10 – 15 g/dl reported by Research Animal Resources [RAR] (2009). Haemoglobin is the iron-containing oxygen-transport metalloprotein in the red blood cells of all vertebrates (Maton *et al.*, 1993). Haemoglobin has the physiological function of transporting oxygen to tissues of the animal for oxidation of ingested food so as to release energy for the other body functions as well as transport carbon dioxide out of the body of animals (Omiyale *et al.*, 2012).

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The PCV values were within the range of 30% - 50% as reported by Research Animal Resources [RAR] (2009) except for T₁ (26.10%) which was not too far from the reported range. The PCV values obtained in this study indicates that the rabbit bucks had good health status throughout the trial period. According to Rastogi (2009), low PCV indicates such condition as anemia or overhydration while high value of PCV denote such condition as polycythemia or dehydration. Furthermore, Chineke *et al.* (2006) posited that high Packed Cell Volume (PCV) reading indicated either an increase in number of Red Blood Cells (RBCs) or reduction in circulating plasma volume.

Mean Corpuscular Volume (MCV) were significantly ($P < 0.05$) increased by oral administration of *Citrus limon* juice. Highest value MCV was observed in rabbit bucks of T₄ (71.40 fL) and the lowest mean value of MCV were observed in rabbit bucks of T₁ (60.10 fL). Mean Corpuscular Haemoglobin (MCH) mean value was highest (23.30 pg) in the rabbit bucks administered 50% (T₃) *Citrus limon* juice and lowest (21.70 pg) in rabbit bucks administered 0% (T₁) *Citrus limon* juice. MCV values were within the range of 50.00 – 75.00 fl/mm³ reported by Burke (1994). The mean corpuscular haemoglobin (MCH) value were also within the range of 14 – 24 reported by Burke (1994).

The Mean Corpuscular Haemoglobin Concentration (MCHC) were significantly ($P < 0.05$) influenced by oral administration of *Citrus limon* juice with the highest value (36.00 g/dL) been observed in the control (T₁) and the lowest (32.20 g/dL) in rabbit bucks administered 75% *Citrus limon* juices. MCHC values were within the range of 27-37g/dL reported by Research Animal Resources [RAR] (2009). Mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration indicate blood level conditions. A low level is an indication of anaemia (Aster, 2004).

Platelets, lymphocytes and neutrophils values were significantly different ($P < 0.05$) among the treatment groups. The significant high value in the Platelets count with increasing *Citrus limon* juice administration may be attributed to the fact that *Citrus limon* juice caused enhancement in the count and activity of platelets which contradicts Adepoju and Adeyemi (2010) who reported that *Citrus limon* juice inhibits clotting and reduces activity of platelets.

Conclusion and Recommendation

The results obtained in this study suggests that oral administration of *Citrus limon* juice up to 75% concentration did not have negative effect on haematological indices of rabbit bucks.

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