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INFLUENCE OF GRADED DOSE OF PROBIOTICS SUPPLEMENTS ON PACKED CELL VOLUME AND BODY WEIGHT DURING GESTATION PERIOD AND PREGNANCY PHASE OF NEW ZEALAND WHITE FEMALE RABBIT (DOES)

[1]Iliyasu, D., [2]Lawan, F. A., [3]Abdullahi, A. M., [1]Mustapha, AR., [1]Peter, I.D., [1]Yusuf, F. I., [3]Abba, A., [3]Bamanga, U. M., [4]Timta, M. H.,

[1]Department of Theriogenology,
University of Maiduguri, Nigeria
[2]Department of Veterinary Microbiology,
University of Maiduguri, Nigeria
[3]Veterinary Teaching Hospital, University of Maiduguri, Maiduguri, Nigeria
[4]Department of Veterinary Physiology and Biochemistry,
University of Maiduguri, Nigeria

*Corresponding author: drdisambo@gmail.com ; disambo@unimaid.edu.ng +2348063294756

ABSTRACT

Probiotics are live bacteria that, when administered in enough concentrations, provide health advantages to the host. This study was designed to determine the influence of graded dose of probiotics on packed cell volume (PCV) and live body weight of female rabbits during gestation and pregnancy phases. Twelve healthy adult female rabbits (does) were purchased and housed at the Laboratory Animal Research Unit of the Large Animal Clinic, Faculty of Veterinary Medicine, University of Maiduguri. The rabbits were randomly divided into four groups: A, B, C, and D. Groups A, B, and C received 300 g, 200 g, and 100 g of probiotic supplements, respectively. Group D, served as control and fed only a basal diet throughout the research period. Drinking water was provided *ad libitum* throughout the study period. Thereafter, blood samples were collected aseptically via the ear vein once every week for six weeks and the live body weight were measured once every w eek for six weeks. The results revealed that the PCV and the live body weight during gestation period were significant ($p < 0.05$) among the treated groups when compared to the control (group D). However, the weight during various pregnancy phases was also significant ($p < 0.05$) among the treated groups when compared to the control (group D). In conclusion, probiotics have influence on the PCV and the live body weight during gestation period and various pregnancy phases of the rabbits does.

Keywords: Probiotics, Supplements, Packed Cell Volume, body weight, gestation period, pregnancy phases of does

INTRODUCTION

Most developing countries favour the production of New Zealand white rabbits, and Nigeria is no exception (Niu *et al*., 2020). New Zealand white rabbits are noted for producing high-quality fabric for the woolen textile industry (Kamal *et al*., 2023). The New Zealand white rabbit is very easy to rear and has a rapid development and reproduction rate (Laker *et al*., 2013). Rabbit meat is extremely nutritious and can be advised for cardiac patients due to its high protein content and low cholesterol, fat, and sodium levels. Supplementing the diet of New Zealand white rabbits with growth hormones improved their growth rate and reproductive performance (Kamal *et al*., 2023). Probiotics is considered one of the promising supplements that optimized New Zealand white rabbit farming, through the higher level of production, which directly depends on reproductive efficiency which can used to determine the overall profitability of commercial rabbit enterprises (Tran *et al*., 2020).

Probiotics are live microorganisms that are advertised as providing health advantages when eaten, typically by rebuilding the gut microbiota (Kamal *et al*., 2023). Probiotics are generally regarded safe to eat, although in rare circumstances, bacteria-host interactions might result in undesired side effects, according to Refaie (2022) and Liang (2022). Probiotics boost rabbit health by speeding growth rates and restoring a balanced gut bacteria condition and intestinal immunity. When healthy female rabbits are fed probiotics, their body weight and development rate improve significantly due to the optimal utilization of digestive enzymes and the presence of beneficial bacteria

(Kamal *et al*., 2023). Feed supplemented with Probiotics is reported to improve nutrient digestibility, growth, reproductive performance, meat quality and antioxidative responses in rabbits (Crespo-Piazuelo *et al*., 2022).

Probiotics promote feed digestion and nutrient utilization by improving the physiology of the gastrointestinal track for optimum performance through adequate absorption of micro and macro nutrients by the host's digestive tract. When microorganisms obtain nutrients, the digestive enzymes secreted are beneficial to feed decomposition, promoting host nutrient utilization. Microorganisms in rabbits' caecum have been shown to ferment undigested cellulose, micronutrients, and other volatile fatty acid and vitamin components (Crespo-Piazuelo *et al*., 2022). Volatile fatty acids are quickly absorbed in the intestine and provide energy, whereas butyric and acetic acids also offer energy to the hindgut and produce cholesterol (Kamal *et al*., 2023). Furthermore, the microbes in the caecum create ammonia nitrogen through the synthesis of bacterial proteins, which are used twice by rabbits in the form of coprophagy or soft feces. (Niu *et al.,* 2022). Normal intestinal flora is beneficial to host's digestive system by promoting growth and development of physiological systems in rabbits.

Probiotics promote the complete absorption of nutrients and energy by the healthy intestinal ecology, which is the primary component determining the rabbit's intestinal microbial balance. According to Iliyasu *et al*. (2024), probiotics alter physiochemical characteristics of the gastrointestinal tract such as intestinal pH and metabolite concentration, which significantly boost foetal growth and development in rabbits (does). Rabbits' gut physiology is critical to their survival and pregnancy progression. Pregnancy is typically supported by the presence of beneficial bacteria that have been balanced by probiotics supplements through optimal absorption of micro and macronutrients essential for optimum foetal growth and development during the animal's gestation period.

MATERIALS AND METHODS

Study Area

This study was designed and carried out at the Department of Theriogenology, Faculty of Veterinary Medicine University of Maiduguri, Nigeria. Maiduguri is Cosmopolitan in nature, located at an elevation of 354 meters above sea level located between latitudes 11^0 and 14^0N and longitudes 10^0 and 14^0E, within the Sahel region and has a total land mass of 50,778 square kilometers (BMLS, 2007). It has a population density of 1,738 people per square kilometers, and a total population of 521,492 (NPC, 2006). The temperature ranges from 35-40 ^{0}C for most parts of the year with two distinct seasons, a rainy season with mean annual rainfall of 647mm from July to October and a prolonged dry season for the rest of the year (LCRI, 2007). The state due to its geographical features favors the production of livestock and agricultural produce at colossal economy (NPC, 2006).

Experimental Animals

New Zealand white is one of the breed used globally for meat production. It is all white or White or black in colour and usually weighs 3-5kg when mature. Twelve, healthy New Zealand white female rabbits (does), aged 4-5 months with an average body weight of 4.0 ± 1.3 kg were purchased from the market. The does were examined to ensure that they were apparently healthy. Thereafter, the does were acclimatized for two weeks before commencement of the research. The does were kept under intensive management and fed on grasses, beans husks, groundnut and salad leaves water was provided *ad libitum* throughout the research period.

Source of Probiotics

Five kilogram (Kg) of Probiotics was purchased from FroVet Veterinary diagnostic centre, Ibrahim Taiwo Estate, Maiduguri Metropolis, Borno State.

Housing of the Experimental Animals

The does were kept in the laboratory research cages of the Large Animal Clinic Unit, Veterinary Teaching Hospital University of Maiduguri. The rabbits were kept for 6 weeks period of the research.

Experimental Design

The does were randomly selected into four groups (A, B, C and D) of three rabbits per group. Groups A, B and C were supplemented with probiotics at a different dose 300, 200 and 100 g respectively. Group D served as untreated control and was fed normal ratio. The probiotics was supplemented in the treated group diet for 6 weeks. Thereafter, body weight before bred and PCV were recorded once every week, while weight during gestation period and various stages of pregnancy were monitored and recorded immediately after mating to the point of kindling were determined according to the method described by (Iliyasu *et al*., 2024).

Statistical Analyses

Data were analyzed using GraphPad Prism (Instat) ® GraphPad. (2000), the data were subjected to one-way ANOVA and Dunnett Posthoc test. Values were summarized and expressed as mean (±SE) and the results were considered significant at $p < 0.05$.

Results

Effects of graded treatments doses of probiotics on female rabbit (does) on packed cell volume (PCV) and physiological performance of the does during gestation period were presented in Table 1. Live body weights during gestation period were not affected significantly ($p < 0.05$) by various doses treatments. Probiotics as supplement improves health status of pregnant does by elevating the level of the packed cell volume (PCV) among the treated groups of does, when compared to the control group as presented in (Table 1).

Table 1: Effects of graded dose of Probiotics supplements on percentage of Parked Cell Volume PCV of Rabbit Does

Weeks	Doses of Probiotics			
	Group A (300 g)	**Group B (200 g)**	**Group C (100 g)**	**Group D (normal ratio)**
1	37.28±0.00	35.38±0.01	37.35±0.10	37.18±0.00
2	37.38±0.10	36.58±0.02	37.42±0.20	37.38±0.00
3	38.30±0.01	37.88±0.23	38.28±0.10	37.38±0.00
4	39.38±0.00[a]	39.48±0.00	39.08±0.00	37.78±0.0
5	39.55±0.58[a]	39.88±0.50[a]	39.78±0.50[a]	37.90±0.00[a]
6	40.29±0.58[b]	39.98±0.58[b]	40.18±0.00[b]	48.58±0.58[b]

[a, b] Values with different superscripts within the columns are significantly different ($p < 0.05$).

The influence of probiotics on live body weight is independent to the dosage among the treatment groups of does, but there was significant ($p < 0.05$) increase in the live body weight of does across the entire treatment group especially at week 5 when compared to the control group as shown in Table 2. The treatment groups showed a progressive increase in live body weight at second and third trimester of the pregnancy period when compared to the control group as presented in Table 3.

Table 2: Effects of graded dose of Probiotics supplements on body weight during gestation period of Rabbit Does

Weight at gestation period	Doses of Probiotics			
	Group A (300 g)	**Group B (200 g)**	**Group C (100 g)**	**Group D (normal ratio)**
Week 1	3.2±0.00	3.3±1.00	3.5±0.21	3.1±0.10
Week 2	3.2±0.10	3.3±0.00	3.4±0.10	3.2±0.10
Week 3	3.3±0.01	3.4±0.31	3.6±1.10	3.5±0.21
Week 4	3.8±0.00[a]	3.9±1.30[a]	3.9±0.20[a]	3.7±1.10[a]
Week 5	4.5±0.51[b]	4.4±0.46[b]	4.3±0.31[b]	4.2±0.13[b]

[a, b] Values with different superscripts within the columns are significantly different ($p < 0.05$).

Table 3: Effects of graded dose of Probiotics supplement on weight during various stages of pregnancy of Rabbit Does

Does weight during gestation period	Doses of Probiotics			
	Group A (300 g)	**Group B (200 g)**	**Group C (100 g)**	**Group D (normal ratio)**
Before pregnancy	2.8±0.0	2.5±0.0	2.5±0.1	2.4±0.0
First trimester	3.3±0.1	3.5±0.3[a]	3.4±0.0	3.3±0.0
Second trimester	3.8±0.0[a]	3.9±0.0[a]	3.8±0.0[a]	3.6±0.0[a]
Third trimester	4.5±0.2[b]	4.4±0.5[b]	4.4±0.3[b]	4.3±0.0[b]

[a, b] Values with different superscripts within the columns are significantly different ($p < 0.05$).

DISCUSSION

The aspiration of the present study is to elucidate the effects of graded doses of probiotics on female rabbit (Does) packed cell volume (PCV), body weight during gestation period and various stages of pregnancy, however the probiotics at various dosage have influenced the PCV and the stages of pregnancy in does this agreed with the findings of Abou-Hashim *et al.* (2024) who reported beneficial effects of probiotics supplementation to broiler diet that resulted to increased in body weight and elevation of some hematological parameters this also disagreed with the findings of (Saidi *et al*., 2021) and (Refaie *et al*., 2022) who reported disparity in PCV profiles of bovine with mastitis but concur with the current studies on elevation of PCV level of rabbit administered with graded doses of Probiotics and the increased PCV was in dose depended manner this concurred with findings reported by Abou-Hashim *et al.* (2024) on rabbits.

The increase in the PCV levels agreed with the findings reported by (Szenc *et al*., 2018) who reported on dairy cow feds with supplements, similar observation was recorded by (El Bachir *et al*., 2022) and Abdallah *et al* (2023) on rabbits. The increase in the level of PCV can be accredited to the action of probiotics on feed conversion through restoration of physiological way of improving the digestion process by balancing the occupant gut microflora as they preserve and improve the integrity of the intestinal mucosal of the digestive tract, which influenced the process of absorption and assimilation of micronutrient required to improve the integrity of the hematopoietic organs (Tran *et al*., 2020). Improvement in digestion and absorption of nutrients facilitate the elevation of the PVC and the PCV status is one of the indicators that signal the health of the rabbit, similar findings were reported (Laker *et al*. (2013) among offspring that were supplemented with additives with interest to boots physiological performance that will ensure optimum productivity in the future (Crespo-Piazuelo *et al*., 2022).

The outcome of the current findings shows that, the increase in the body weight gain has been prejudiced in a dose dependant manner at various phase of the pregnancy this agreed with findings reported by Céline *et al*. (2022) and Ebeid *et al*. (2023) who reported increased in body weight of rats and rabbit respectively when fed mix diet of prebiotics and Probiotics and Probiotics along. Similar findings were also reported by Iliyasu *et al*. (2024). The increased in the weight recorded in rats and rabbits might be attributed to influence of supplements in improving gut healthy for proper absorption of nutrient that enhance conception and growth of the fetus during various stages of gestation period of the does (El Bachi., *et al*., 2022). This disagreed with the findings of Bhatt *et al*, (2017) who reported body condition scores of goats treated with Probiotics was not significantly affected and this might be attributed to the no effect of probiotics on the deposition of fat in the sternal and lumbar regions of the goats and there was no difference with the weight during gestation period among the treated animals (Liang *et al*., 2022). However, during third trimester of the gestation period of the goat a decreased in body condition scores were observed among the treated groups this can be linked to the increase in pregnancy stress usually noticed at the third trimester which is also associated with decreased in feed intake until parturition occurred. This also agreed with the findings reported by He and Shi, (2017) and Kamal *et al*., (2023).

Similar observation on the beneficial effects of these feed additives on gestation period (Kijmanawat *et al*., 2019) weight gain and feed conversion ratio were reported by some researchers in farm animals like poultry, pigs and mice (Fathi *et al*., 2017; Angelakis, 2017 and Hu *et al*., 2022) and El-Speiy, *et al*. (2023) in rabbit. Research investigation have shown that dietary supplement of probiotics improved body weight compared with the control to a similar

extend other animal species which is in agreement with the results obtained in this research study (Alkhalf *et al.*, 2010).

CONCLUSION

Probiotics at the dose rate of (300, 200 and 100) g can effectively used in pregnant rabbits does. It is safe and easy to administer to the rabbit it enhanced live body weight and packed cell volume, during gestation period.

CONFLICT OF INTEREST

The authors declared no divergence of interest in respect to the document.

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