Original Research Article

Effects of a commercial probiotic product (Pro RojoTic®) on growth performance and carcass characteristics of broiler chicken

ABSTRACT

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| **Aims:** This study was conducted to assess the effects of a commercial probiotic product (Pro RojoTic®) on growth performance and carcass characteristics of broiler chicken**Study design:** Completely randomized design.**Place and Duration of Study:** The study was conducted at Tanzania Livestock Research Institute (TALIRI), Uyole Centre, in the Southern Highlands Zone of Tanzania. The centre lies between latitude 8°53’S and longitude 33°39’E and it lies on 1798 metres above sea level. The average temperature is 23°c and December being warmest month with temperature of 26°c and lowest temperature is in July with around 6°c. The annual precipitation is 1200 mm and it commence from November to May. The feeding trial lasted for 5 weeks.**Methodology:** 200 Ross-308 broiler chickens were raised under the intensive management system for 35 days. They were grouped into two groups; one group was fed and supplemented with Pro RojoTic® while other group was used as control which was fed without Pro Rojotic® supplementation. Each group was divided into four groups of 25 chicks each and kept in pens. **Results:** There was significant difference (P<0.05) on weight gain and feed conversion ratio between the control group and the group that was fed with probiotics. There were significantly differences on the carcass characteristics where the group with Pro Rojotic® showed higher values. In the group supplemented with Pro RojoTic® the proportions of drumstick to body weight were higher (P<0.05) while there was no significant difference on the proportions of breast weight and thigh weight to body weight. **Conclusion:** Based on these findings, it is concluded that supplementation of broiler chickens with Pro RojoTic® enhances growth performance and meat characteristics. |

*Keywords:* *Body Weight, FCR, Antibiotics, supplementation, weight gain*

1. INTRODUCTION

Antibiotics are used in animal production for boosting feed conversion and animal growth. Their use is also associated with reduced morbidity and mortality due to lower incidence of clinical and subclinical diseases. In poultry, it has been shown that antibiotics may enhance growth performance in the order of about 4 to 8% and feed utilization by 2 to 5% (Ajuwon, 2015). Mechanisms of antibiotics action in enhancing growth and protecting poultry against diseases is through protection of nutrients against bacterial destruction and improvement of nutrient absorption (Anderson et al. 1999 and Gaskins et al. 2002).

Due to increasing concern about development of antimicrobial resistance (AMR) by some strains of pathogenic microorganisms that may pose a threat to human health, the use of antibiotics as growth promoters has been under scrutiny (Patterson and Burkholder 2003). Antibiotics are strictly prohibited to be used as feed additives. They can be used only for treatment with precautions on withdraw periods. Therefore, there are considerable efforts in developing antibiotics alternatives that will have the benefits associated with antibiotics use without the associated threat to human health. The use of probiotics is one of the several approaches that have potential to reduce enteric diseases in poultry and subsequent contamination of poultry products (Dalloul et al. 2001, Patterson and Burkholder 2003 and Tierney et al. 2004). Probiotic products are products, which contain probiotics; these are live non-pathogenic microorganisms that provide health benefits to the host when administered in adequate amounts (Plaza-Diaz et al., 2019). Apart from that, probiotics enhance growth performance (weight gain) in livestock (Nawaz et al., 2016; Doto et al., 2017; Maake et al., 2021; Abdel Moati et al., 2022) and meat characteristics (Nawaz et al., 2016; Abdel Moati et al., 2022). As far as poultry are concerned, probiotics enhance immunity, health and growth in all ages and classes of poultry. They also improve the healthy balance of bacteria in the gastrointestinal tract, promoting the gut integrity and maturation, boosting the immune response and preventing inflammation, improve feed intake and digestion (Kabir et al 2004; Alagawany et al., 2018; Soomro et al., 2019). There are many species of probiotics which are used in livestock production. Some of them include Lactobacillus bulgaris, Lactobacillus plantarum, Streptococcus thermophils, Bifidobacterim bifidum, and Aspergillus oryzae. (Khaksefidi and Rahimi, 2005).

Despite the popularity and promise of probiotic products as antibiotic alternatives, a major limitation against their widespread adoption has been the apparent inconsistencies in their expected effects on the performance and health of livestock. Pro RojoTic® is one of the probiotic products, which have been introduced in Tanzania in recent years. However, there is limited information on its effects in poultry production. The objective of this study was to evaluate the effects of Pro RojoTic® on growth performance and carcass characteristics of broiler chicken.

2. material and methods

2.1. Examination location

The study was conducted at Tanzania Livestock Research Institute (TALIRI), Uyole Centre, in the Southern Highlands Zone of Tanzania. The centre lies between latitude 8°53’S and longitude 33°39’E and it lies on 1798 metres above sea level. The average temperature is 23°c and December being warmest month with temperature of 26°c and lowest temperature is in July with around 6°c. The annual precipitation is 1200 mm and it commence from November to May.

**2.2. Animals and their Management**

Two hundred (200) Ross-308 broiler chickens raised under the intensive deep litter management system using rice husks as litter material. The house was open – sided built using concrete blocks and roofed with corrugated iron sheet. They were grouped into two groups; one group was fed and supplemented with Pro RojoTic®, and other group was used as control, which was fed without Pro RojoTics® supplementation. Each group was divided into four groups of 25 chicks each and kept in pens, making 8 pens. Pens were cleaned and disinfected by using V-RID and left for one week before arrival of chicks. The brooding of chicks was done in individual pens in which brooding facilities (brooder rings, source of light and heat, and bedding materials) were prepared before the arrival of chicks. On arrival, chicks were unloaded from boxes immediately, counted and weighed using a digital balance. The source of heat and light in the brooder rings were infrared bulbs hanging from the house’s roof. Due to unstable power supply, sometimes charcoal was used as source of heat and solar bulbs used as source of light. Each pen was equipped with enough feeders and drinkers; kept under the same management conditions like space, light, temperature, ventilation and relative humidity.

**2.3. Chicken Feeding**

The birds were offered commercial feed from Silverlands Tanzania company throughout the experimental period. During the brooding, birds were provided with a starter diet in form of crumbles containing 2941 Kcal ME/kg and 21.2% CP from 0 to14th days. A grower ration in form of pellets containing 15.5% CP and 3015 Kcal ME/kg was provided from the 15th to 28th day and finisher diet in form of pellets with 3110 Kcal ME/Kg from day 29th to 35th day. Chickens were fed twice daily at 7:00 and 13:00 h and feed offered were weekly adjusted according to the actual feed intake and water was provided daily ad libitum. The chemical compositions for starter, grower, and finisher rations are summarized in Table 1.

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| **Table 1. Chemical composition of chicken feeds** |
| **Constituents** | **Starter****Crumble** | **Grower Pellets** | **Finisher Pellets** |
| Crude Protein (%) | 21.2 | 15.5 | 18.5 |
| Metabolizable Energy (Kcal/KgDM) | 2941 | 3015 | 3110 |
| Crude Fat (%) | 3.92 | 3.74 | 3.89 |
| Crude Fiber (%) | 7.41 | 8.22 | 9.76 |
| Ash (%) | 5.61 | 3.76 | 4.61 |
| Dry Matter (%) | 89.7 | 89.5 | 89.8 |
| Starch (%) | 41.9 | 41.8 | 41.7 |
| Total Sugar (%) | 3.7 | 4.2 | 4.4 |

Apart from being provided with the feed described above, the chicken were supplemented with Pro RojoTic®. One bolus of Pro RojoTic® was mixed in 20 litres of clean water and given as drinking water to treatment group throughout the experimental period. The control group was given clean water (not supplemented Pro RojoTic®) ad libitum throughout the experimental period. Pro RojoTic® contains four species of probiotics namely *Bacillus subtilis*, *B. licheniformus*, *B. pumilus* and *B. megatrium*.

**2.4. Measurement of feed intake, growth rate, and feed conversion ratio (FCR)**

Feed intake was measured daily as the difference between the weight of feed offered and that which remained uneaten (refusals). The birds were weighed at the end of every week using a digital weighing scale in the morning before feeding, and the difference between initial and final body weight was measured as total gain. FCR was calculated as the ratio of feed offered to weight gain.

**2.5. Carcass Traits Measurements**

At the age of 35 days a sample of 16 birds, i.e. 8 birds/group were randomly selected and slaughtered to determine carcass weight as well as parts yield. Sampled birds were starved for 12 hours but had free access to drinking water until slaughter. The birds were slaughtered by cutting the jugular vein, bled for 120 seconds and then scalded at about 55 - 60℃ for 60 seconds and manually de-feathered. The carcass weight was taken after de-feathering and removal of feet, head and the viscera (gizzard, heart, spleen, liver and intestine). The eviscerated carcass, breast, thighs, drumsticks, wings, back and neck were weighed using digital balance. Carcass weight data were used to calculate the dressing percent and carcass composition (%) by taking the weight of the individual parts as the percentage of the body weight at slaughter (BWs) of the chicken.

**2.6. Statistical analysis**

Analysis on the collected data was carried out using GLM procedure of SAS (2009) software package, and Duncan’s Multiple Range Test of the same software was used to separate the means.

The statistical model used was:

Yij = µ+ Gi +eij

Where; Yij= observation (body weight, FCR, carcass weight) from the ith group.

µ = General Mean

Gi = Effect of the ith group

eij= Residual Effect

3. results and discussion

3.1. Effects of Pro Rojotic® on Growth Performance

Table 2 shows the effects of Pro RojoTic® on feed intake, weight gain and feed conversion ratio (FCR). There was significant difference (P<.05) on the weight gain and FCR between the control group and the group that was fed with Pro RojoTic®.

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| **Table 2: Least square mean values for the effects of Pro RojoTic® on feed intake, weight gain and feed conversion ratio (FCR) on broiler chickens.** |
| **Parameters** | **Group without Pro RojoTic® (Control)** | **Group with Pro RojoTic®** | **P-value** | **SEM** |
| Feed intake (g/chick/day) | 116.8 | 123.4 | 0.13 | 2.57 |
| Weight gain (g/chick/day) | 62.2a | 71.6b | 0.001 | 1.12 |
| FCR (intake/weight gain) | 1.82a | 1.68b | 0.004 | 0.024 |
| *Means within each row with different superscripts differ significantly at P<.05; SEM = Standard error of the mean* |

Similar results have been obtained in other studies conducted to investigate the performance of broiler chicken when probiotics are used (Abudabos et al. 2015; Li et al. 2014). A study by Rostagno et al (2006) showed that broiler chicken supplemented with probiotics performed better as those supplemented with antibiotics growth promoters. The mode of action of probiotics in improving weight gain and FCR is through modification of the intestinal microbiota, which in turn improve the efficiency of feed utilization and hence improve productive performance (Patterson and Burkholder, 2003). In addition, probiotic stimulate the immune system hence protecting chicken against diseases (Ajuwon, 2015). Therefore, supplementation of Pro RojoTic® to broiler chicken improve the FCR by maintaining normal microbiota and better ideal digestibility (Rahman et al., 2009).

There was no significant difference on feed intake. This is in agreement with some studies, which have shown that there is limited, or no benefit in terms of feed intake of probiotics (Tayeri et al. 2018). Similar results were obtained also in the study by Ghasemi et al (2014) using Ross 308 broiler chickens in which feed intake was not affected by probiotics. In other studies feed intake decreased by the supplementation of probiotics (Mokhtari et al. 2010; Falaki et al. 2011; Amerah et al. 2013; Chen et al. 2015). The difference in results might be related to several factors such as birds and type of prebiotics and probiotics, sex and dose rate.

**3.2. Effects of Pro RojoTic® on carcass characteristics**

Table 3 shows the effects of Pro RojoTic® on the carcass characteristics of broiler chicken. There were significantly differences on the carcass characteristics in which the group with Pro RojoTic® showed higher values.

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| **Table 3: Least square means for the effect of Pro RojoTic® on carcass yield of broiler chicken.** |
| **Parameter** | **Group without Pro RojoTic® (Control)** | **Group with Pro RojoTic®** | **P-value** | **SEM** |
| BW at slaughter (g) | 1861.9a | 2247.3b | 0.0001 | 53.2 |
| Carcass weight (g) | 1208.4a | 1523.7b | 0.03 | 35.8 |
| Dressing % | 64.9a | 67.8b | 0.0233 | 0.49 |
| Breast weight (g) | 446.9a | 561.8b | <.0001 | 16.6 |
| Thigh weight (g) | 412.6a | 497.5b | 0.0288 | 12.2 |
| Drumstick weight (g) | 652.5a | 787.6b | 0.0018 | 20.5 |
| *a, bMeans within each row with different superscripts differ significantly at P<0.05; SEM = Standard Error of the Mean; BW = Body weight at slaughter* |

Results of carcass weight, dressing percentage, breast weight, thigh weight and drumstick weight were in line with other studies which showed the increase with supplementation of probiotics (Abdel-Raheem and Abd-Allah, 2011; Saiyed et al., 2015 and Rehman et al., 2020). Dressing percentage were similar as those reported for broilers that are in range of 63.67% to 66.67% (Abdel-Raheem and Abd-Allah, 2011). Results of dressing percentage were in line with other researchers who reported that the dressing percentage was increased by the addition of prebiotics and probiotics on the diets of broilers (Abdel-Raheem and Abd-Allah, 2011; Saiyed et al., 2015). The present findings were different from those reported by Sahin et al (2008) and Chumpawadee et al (2008) who reported that probiotics had no significantly positive effects on carcass yields of broilers.

The data for carcass parts expressed as percentage of the BW are presented in table 4. The group receiving Pro RojoTic® had a higher drumstick proportion (35.0%) compared to 33.6% in the control group. This suggests that Pro RojoTic® might influence muscle growth and development in the lower limb region of broilers. The increase in drumstick weight in the Pro RojoTic® group suggests a possible targeted effect of this supplement on the muscle groups associated with this part. It could be promoting muscle hypertrophy or enhancing nutrient utilization in a way that favors growth in the drumstick. No significant difference (P > 0.05) was observed in the breast weight and thigh weight between the two groups. The breast weight was slightly higher in the Pro RojoTic® group (25.0%) compared to the control group (24.0%), but the difference was not statistically meaningful (P = 0.62). Similarly, the thigh weight showed a negligible difference (22.1% vs. 22.2%; P = 0.0562). The lack of significant differences in breast and thigh weight indicates that Pro RojoTic® does not universally affect muscle development across all carcass parts. Instead, its effects may be selective, possibly influenced by physiological factors such as muscle metabolism, nutrient absorption, or skeletal development. This data also suggests that while Pro RojoTic® can enhance certain aspects of carcass composition, it does not drastically alter overall muscle distribution in broilers.

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| **Table 4: Least square means for the effects of Pro RojoTic® on carcass parts of broilers at 35 days of age (Carcass parts expressed as a percentage of the BWs)** |
| Parameters | Group without Pro RojoTic® (Control) | Group with Pro RojoTic® | P-value | SEM |
| Breast weight | 24.0 | 25.0 | 0.62 | 2.33 |
| Thigh Weight | 22.2 | 22.1 | 0.0562 | 0.13 |
| Drumstick weight | 33.6a | 35.0b | 0.002 | 0.77 |
| *a, bMeans within each row with different superscripts differ significantly at P<.05; SEM = Standard Error of the Mean* |

From the findings of this study, Pro RojoTic® has been found to promote a healthy balance of gut microflora, which enhances nutrient absorption and digestion. This leads to better overall growth and development of the chicken hence good carcass quality (Nawaz et al 2016). Pro RojoTic® has been also found to improve the efficiency of feed utilization, allowing broilers to convert feed into body mass more effectively. This leads to better growth rates and improved carcass characteristics (Elsagheer et al 2022). As it has been found in other studies that probiotics can enhance muscle development in broilers, leading to higher breast and thigh weights (Malik et al 2016). This is beneficial for meat production and overall carcass quality.

4. Conclusion

The experiment conducted show significant increase in feed intake, body weight gain, FCR and percentage of carcass yield by the dietary inclusion of prebiotic and probiotic compared with unsupplemented control in Ross 308 broiler chicken. Therefore, the products Pro RojoTic® might be promising alternatives for antibiotic growth promoters, as pressure to eliminate antibiotic growth promoters in animal feed increases. However further studies could be done to investigate the mechanisms behind the selective increase in drumstick weight. Additionally, exploring other carcass parameters, such as fat deposition and feed conversion ratio, would provide a more comprehensive understanding of the supplement’s role in broiler growth.

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