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Full Length Research Paper

Effect of Probiotic Supplementation on Weight Gain, Blood Biochemical and Hematological Indices of Crossbred Dairy Goat Kids

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The study was conducted to evaluate the influence of probiotic supplementation on weight gain, blood biochemical and hematological indices of crossbred dairy goat kids. Sixteen (16) crossbred Anglo-Nubian x Saanen dairy goat kids, 3 to 4 months old, ranging from 19 to 23kg were randomly assigned into four treatments following a complete randomized design replicated 4 times. The dietary treatments were: control-w/o probiotics (T1), Lactic acid bacteria (T2), yeast (T3) and multi-strain probiotics (T4). Experimental animals were supplemented orally with 6ml of 5x10^9 cfu/ml probiotics for 8 weeks. Daily ration for individual animals was composed of 4kg fresh *Pennisetum purpureum* and *Gliciridia sepium* leaves (50:50), and 1kg mixed concentrate feed a combination of dried *Leucaena leucocephala* leaves and pollard. All the data collected were processed and analyzed using SPSS version 20. Results revealed that treatments fed with probiotics had significantly (P≥0.05) higher weight gain compared to the control. Significant effect on plasma urea nitrogen (PUN) and triglyceride were noted during 30th and 60th day of post-probiotic feeding. Concentrations of glucose and cholesterol remained unchanged throughout the experimental feeding trial. The finding suggests, under the environmental condition of the experiment, that probiotic supplements used in this study could enhance the performance of crossbred dairy goat kids through the improvement of body weight and metabolism.

Keywords: Probiotic supplements, weight gain, blood biochemical, hematological indices, crossbred dairy goat kids.

INTRODUCTION

GOAT is one of the most important animals raised by rural households in the Philippines. Its production in the country is considered as a sunrise industry that is slowly gaining favor with investors [23]. They are best sources of meat, milk, and fiber which if developed, can be a main source of income for the farmers.

Goats have faster reproductive rate, generation interval, are cheaper to buy and require fewer facilities for up keep and maintenance than cattle. Despite the potential of goat-raising as an enterprise, its total production and value have been one of the lowest in the livestock sector. From 2008 to 2012, the annual average volume of goat production was 77,600mt [2], representing only 3.24% of the annual average volume of livestock production. Various factors such

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as production environment, climatic conditions, breed, nutrition, poor reproduction techniques, and diseases have been pointed out to significantly cause mortality resulting to production losses in goat husbandry [9]. Hence, exploring ways and means to increase goats' productivity with the use of feed additive that can cause desired animal responses with minimum cost of inputs is recommended.

In recent years, feed additive containing bacterial and yeast culture has been widely used in manipulating ruminal fermentation to improved animal performance [7]. Probiotic is defined as "Live microbial feed supplement which beneficially affects the host animals by improving its intestinal microbial balance" [7].This definition encompasses single strain or a mixture of two or more species/strains of microbes, with or without growth medium [6].

The positive impacts of probiotic supplementation on nutrient intake, weight gain and feed conversion efficiency ratio have been pointed out by several authors [4], [1], [21]. A better performance in growth rate, average daily gain and total weight gain was also noted on lambs supplemented with 5g/kg of probiotics compared to the control group [10]. On calves, inclusion of 2% yeast caused a significant improvement on the average daily weight gain (15.6%) and dry matter intake [12]. However, limited studies were available on the effect of probiotics on the performance of crossbred dairy goat kids. Thus, the present study was undertaken to determine the influence of probiotics on the weight, blood biochemical, and selected hematological indices of crossbred dairy goat kids.

MATERIALS AND METHODS

The experiment was conducted at Naawan Agricultural Development Center (NADC) Goat Project, Naawan, Misamis Oriental. The experimental trial was conducted during the 12th day of September 2014 and lasted at the 16th day of November, 2014.

A. Animal distribution and Diet

Sixteen (16) female crossbred Anglo-Nubian x Saanen dairy goat kids, about 3 to 4 months, ranging from 19 to 23 kg were randomly assigned into four treatments fed daily with 6 ml 5 x 10 ^{9} cfu/ml probiotics: Treatment 1 – control; Treatment 2 – lactic acid bacteria *(L. plantarum BS and P. acidilactici 3G3*); treatment 3 – *S. cerevisiae 2030*; Treatment 4 – multi-strain probiotics (*L. plantarum BS, P. acidilactici 3G3, and S.cerevisiae 2030)*. Prior to the conduct of the study, the experimental animals were dewormed. Then, it was randomly placed into individual cages. Feed offered daily to each animals was composed of 4 kg fresh *Pennisetum purpureum* and *Gliciridia sepium* leaves, and1kg mixed dried *Leucaena leucocephala* leaves and pollard. Feeding of fresh leaves was done every 0900H, while concentrate mix was supplemented during 1300H. Fresh clean water was also available all the time. Proximate analyses of the used diet are presented in Table I.

TABLE I: PROXIMATE ANALYSIS OF DAIRY GOAT DIET

CONTENTS %	NAPIER GRASS	MADRE DE CACAO LEAVES	MIXED IPIL-IPIL LEAVES & POLLARD
Moisture	3.90	4.31	11.06
Dry matter	96.10	95.69	88.94
Ash	14.44	8.19	6.30
Crude Protein	11.26	20.08	15.35
Crude Fiber	31.68	20.06	2.57
Crude Fat	1.85	6.59	49.28
Nitrogen Free Extract	36.87	40.77	1.14
Calcium	0.02	1.45	1.14
Phosphorus	0.62	0.33	0.62

Analyzed at Lipa Quality Control Center, Lipa, Batangas City

B. Composition and Production of Probiotics

Probiotic feed supplements were produced in a large scale using coconut paring meal extract and coconut water as base substrate and nutrient source. The optimized specific parameters for *Lb. plantarum BS* and *P. acidilactici 3G3* and *S.cerevisiae 2030* is shown in Table II.

TABLE II: OPTIMIZED SPECIFIC PARAMETERS FOR PROBIOTIC SUPPLEMENTS

Parameters	*L. plantarum BS*	*P. acidilactici 3G3*	*S. cerevisiae 2030*
Coco paring meal extract	8.38%	40%	-
Coconut water	83.85%	50%	25%
Molasses	2%	0.50%	20%
$(NH_4)_2 SO_4$	-	-	0.52%
Yeast Extract	0.50%	0.50%	-
K_2HPO_4	0.20%	2.%	0.15%

Four (4) ml of each medium for a specific culture was produced and sterilized at15 psi (121ºC) for 15 minutes and stored at room temperature prior to

inoculation. About 3 to 5% of the cultures *Lb. plantarum BS, P. acidilactici 3G3* and *S. cerevisiae 2030* were inoculated into the specified medium and incubated at 37ºC for 24 hours and 30°C for 20 to 24 hours, respectively. Afterwards, the produced probiotic feed supplements were dispensed into sterile plastic containers according to treatments: T_2 –50% *Lb. plantarum BS* and 50% *P. acidilactici 3G3*; T_3 – 100% *S. cerevisiae 2030*; T_4 – 33% *Lb. plantarum BS*, 33% *P. acidilactici 3G3*, and 33% *S. cerevisiae 2030*.

C. Probiotic Feeding

Daily supplementation of probiotics to dairy goat kids was done orally using a 10ml syringe at a dosage of 6 ml of 5 x 10^9 per head. Oral feeding was done every 0800H for 8 weeks.

D. Weighing and Blood Sampling

Experimental animals were weighed once a week using a calibrated weighing scale at around 0700H before morning feeding.

Blood samples were collected thrice during; pre-trial, 30th day, and 60th day post-feeding trial. Collection of 5ml blood samples from each of the experimental animals was done 2 hours after morning feeding via jugular vein. The drawn blood samples were immediately placed in 6 ml serum vacutainer tubes, while blood samples subjected for hematological analyses were placed in vacutainer tubes conatining ethylenediamine tetra-acetic acid (EDTA). Tubes containing EDTA were inverted several times to ensure adequate mixing of the blood.

E. Blood Biochemical Analyses

Blood samples collected were instantly centrifuged (Sorval LYNX 6000) at 3500rpm for 15 min at Micron Laboratory Center, Iligan City. The plasma or serum was carefully harvested and stored at -200C until analysis. Biochemical parameters such as total cholesterol, urea nitrogen, triglycerides and glucose concentrations were determined using automatic multi-parameter analyzer for chemistry system (Dimension Xpand Plus) using specialized reagents (Siemens).

F. Body Weights

Total weight gain (TWG, kg) was calculated as the difference between final and initial weights. Growth performance indices were calculated as follows:

Growth rate (%) = (Final weight – initial weight) / (initial weight)*100

G. Statistical Analyses

Analysis of Variance of Randomized Complete Block design (RCBD) was used to determine the significant result from the different factors while the Least Significant Difference (LSD) was used to test the significant differences between treatment means. All the data gathered were processed and analyzed using SPSS version 20 with homogeneity of variance tested using Levene's Test.

RESULTS AND DISCUSSION

A. Total Weight Gain of Crossbred Dairy Goat Kid after Probiotic Feeding

The total weight gain of dairy goat kids fed with probiotics is shown in Table III. Results revealed that there were significant differences between the weight gains of crossbred dairy goat kids among the treatment groups (P≤0.018). Highest weight gain was observed in Treatment 3 with 10.12kg, followed by Treatments 2, 4, and 1 with 9.62kg, 8.0 kg and 3.5 kg, respectively. The control group had significantly (P≤0.05) lower weight gain compared to probiotic-treated groups. No significant differences on weight gain, however, were noted among probiotic-treated treatment groups.

TABLE III: MEAN WEIGHT GAIN OF CROSSBRED DAIRY GOAT KIDS SUPPLEMENTED WITH PROBIOTICS

Treatments	Weight In kilograms			
	Initial	Final	Total weight gain	Percent Growth Rate
T_1 – Control	18.75	22.25	3.50±0.54[b]	18.67%
T_2- LAB	18.25	27.88	9.62±2.15[a]	52.74%
T_3 -*S. cerevisiae 2030*	18.75	28.87	10.12±1.34[a]	54.0%
T_4-Multi-strain (combined T_2 & T_3)	18.25	26.25	8.00±0.79[a]	43.83%

Values on the same vertical columns followed with different letters are significantly different according to LSD at P≥0.05.

This result is in harmony with the findings of [15] and [4] who observed a significant (P≥0.05) increase on final body weight gain and average daily body weight gain of goats fed with probiotics compared to

the control. Similar type of result was also reported on weaned lambs supplemented with both 5g/kg and 10g/kg probiotics [10]. Conversely, a non- significant effect on growth of lambs was reported upon supplementation of lactobacilli and yeast cultures [5], [19], [20].

In this study, the relative increase in the body weight gain observed from the microbial- treated groups cannot be assumed as an excess in dry mat ter intake as each of the experimental animals were given the same kind and amount of feed. Increased in body weight is rather linked to the efficiency of nutrient digestion from the ration stimulated by probiotics with the interactions of microbial flora. Yeast cells in the rumen had the ability to use available oxygen on the surface of freshly ingested feed to maintain metabolic activity. It competes with other starch-utilizing bacteria for the fermentation of starch [13] which leads to the prevention of lactate accumulation in the rumen. This action then allows the maintenance of the cellulolytic micro flora which enhances fiber digestion of plant fiber, and therefore, digestibility of the diet [16].

B. Levels of Biochemical Parameters among Crossbred Dairy Goat Kids after Probiotic Feedings

Evaluations of results of the effect of probiotic feeding on the selected biochemical indices of dairy goat kids are shown on Table IV.

TABLE IV: SELECTED BIOCHEMICAL PARAMETERS OF CROSSBRED DAIRY GOAT KIDS SUPPLEMENTED WITH PROBIOTICS

Parameter	Treatments	Sampling Period 1ST (Pre-trial wk)	2ND (30th d trial)	3RD (60th d trial)
BUN	1	5.49 ±0.56	19.66 ±1.84	19.78±1.11^{ab}
	2	5.64±0.08	19.14±0.67	17.28±0.33^{c}
	3	5.05±0.31	17.96±0.54	18.34±0.50^{bc}
	4	5.97±0.32	20.04 ±0.70	21.24±0.35^{a}
Cholesterol	1	203.31±28.93	156.61±21.36	218.57±24.41
	2	184.02±0.24	124.78±15.11	183.39±14.84
	3	185.36±4.53	134.74±9.88	191.91±5.88
	4	159.39±12.19	125.68±10.91	169.75±4.72
Triglyceride	1	57.37±6.53	9.32±3.85^{c}	8.45±1.73
	2	47.51±9.66	40.90±5.41^{a}	11.26±2.92
	3	45.22±3.55	22.33±2.56a^{b}	26.24±21.41
	4	30.38±9.43	11.10±1.08^{c}	7.47±3.85
Glucose	1	44.25±3.50	71.25±13.50	49.50±1.19
	2	42.50±2.53	63.25±2.46	60.75±1.37
	3	48.25±8.05	69.25±1.43	56.00±4.08
	4	48.75±3.35	65.00±2.80	55.50±3.01

Table IV: continue

Mean, standard error of mean (±SEM) of Blood Urea Nitrogen (BUN), Cholesterol, triglyceride, and glucose from the different treatments during the three (3) sampling periods. Value followed by the different letters in the same vertical column is significantly different according to Less Significant Difference (LSD) at P≥0.05.

Result showed significant differences between the triglyceride levels of the treatment groups on the 30th day of probiotic-treatment. Highest level of triglycerides was observed in LAB supplemented group (T2) among other treatments. The results obtained conform to the findings of [14] on goats and [18] on calves who reported significantly (P≥0.05) higher triglyceride values upon supplementation of yeast culture. On the contrary, a significant (P<0.001) lower triglycerides concentration was reported on goats upon supplemented with *lactobacilli* [11]. The mechanisms involved for this varied response on triglyceride concentrations is not yet fully understood. Hence, nutritional factors, animal condition, age, and probiotic concentrations are considered as factors that modify triglyceride concentration in the blood.

On the 60th day of experimentation, significant differences (P≥0.05) were observed between the BUN concentrations of the different treatment groups. Significant higher value of BUN concentration was observed in multi-strain probiotic treated-group (T4) compared LAB, *S. cerevisae* 2030, and the control group. Variations in the concentration of BUN observed from the probiotic treated groups could be correlated to the specific mode of actions of a particular probiotic strain inside the rumen. Moreover, lower values of BUN obtained from both Lactic acid bacteria and *S. cerevisiae 2030* is an indicative of improved utility of nitrogen in the rumen [3]. This result correlates to the previous findings of [5] and [1] who observed significant (P<0.05) decrease in PUN values on lambs supplemented with probiotic. Whereas, higher BUN concentration on growing lambs fed with a combination of yeast culture*, lactobacillus, streptococcus* and *aspergillus* compared to the control group was also observed by [22].

Moreover, under the present study's experimental conditions, plasma cholesterol and glucose concentrations from probiotic-fed groups operate in the same way with the control group throughout the duration of the experiment. The result found was in accordance with the results findings obtained from

weaned lambs [10], goats [17], and on feedlot cattle [8]. On the other hand, higher values of CHO after yeast supplementation was also reported on weaned lambs [10], goats [17], and on ewes [14] compared to the control group.

C. Levels of Selected Hematological Parameters of Crossbred Dairy GoatKids Supplemented with Probiotics

The effects of probiotic feeding on white blood cell (WBC), red blood cells (RBC) and hemoglobin concentration of crossbred dairy goat kids are presented in Table V. The findings revealed significant differences between WBC count levels for the different treatment groups on the pre-trial and 60th day of post-supplementation.

TABLE V. SELECTED HEMATOLOGICAL INDICES OF CRSOSSBRED DAIRY GOAT KIDS SUPPLEMENTED WITH PROBIOTICS

Parameters	Treatments	Sampling Periods		
		Pre-trial	30th day post-feeding	60th day post-feeding
WHITE BLOOD CELLS	1	5.61±0.66^{bc}	8.65±1.11	10.75±1.11^{ab}
	2	9.96±0.55^{a}	8.07±0.73	11.65±0.73^{a}
	3	7.10±0.75^{b}	7.37±0.69	8.10±0.77^{c}
	4	5.97±0.32^{c}	20.04±0.70	21.24±0.35^{a}
RED BLOOD CELLS	1	2.49±0.50	3.28±0.30	3.44±0.22
	2	2.43±0.20	2.35±0.31	2.73±0.17
	3	3.28±0.27	3.18±0.21	3.29±0.16
	4	3.33±0.42	3.24±0.25	3.67±0.32
HEMOGLOBIN	1	11.22±1.01	10.65±0.63	11.77±0.63
	2	7.82±0.24	10.82±0.29	11.50±0.37
	3	9.92±0.86	9.85±0.45	10.25±1.00
	4	11.22±1.01	10.65±0.63	11.77±0.63

Value followed by the different letters in the same vertical column is significantly different according to Less Significant Difference (LSD) at P≤0.05.

This result conforms to the previous findings of [12], and [18] on weaned lambs fed with probiotics. Treatment comparison during the 60th day of post-probiotic feeding showed that supplementation of Lactobacillus strains (T2) had significantly higher WBC levels than S.cerevisiae 2030, muti-strain probiotics, and the control.

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