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Research Article

EFFECT OF AMLA AND SPIRULINA SUPPLEMENTATION ON BODY MEASUREMENTS OF RABBITS

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ABSTRACT

One hundred and eight, weaned New Zealand White rabbits of either sex and six weeks of age were randomly allocated to three different feeding treatments viz., I, Control; II, EO (supplemented with 2% *Emblica officinalis*) and III, SP (supplemented with 5% *Spirulina platensis*) in addition to ad lib barseem fodder. The concentrate diets formulated were iso-nitrogenous and iso-caloric. Body measurements were taken at the beginning of the experiment and thereafter fortnightly and the experiment continued for 45 days. Supplementation of diets with *Emblica officinalis* and *Spirulina platensis* had no significant effect on the body length, body height, hearth girth, abdominal girth, fore canon length and thigh length of rabbits.

Key words: Amla, body measurements, rabbit, spirulina

Probiotics are biological products, which stimulate the immune system and increase the defensive activity against pathogenic bacteria (Shanmuga Priya and Saravana Babu, 2012). Spirulina, a probiotic, has been commercially cultivated due to its high nutritional contents e.g. proteins, amino acids, vitamin, minerals, essential fatty acid and b-carotene (Vonshak, 1997). Another additive, amla, a deciduous tree found throughout tropical and subtropical India, is known for its high content of ascorbic acid. Studies conducted on amla fruit suggest that it has anti-viral properties (Koul *et al.,* 2010) and it also functions as an anti-bacterial and anti-fungal agent (Treadway and Linda, 1994). Amla has been particularly indicated for anemia, asthma, bleeding gums, diabetes, chronic lung disease, hyperlipidaemia, yeast infections, scurvy and cancer (Dwivedi *et al.,* 2003; Akhtar *et al.,* 2011; Eevuri and Putturu, 2013). Therefore, the present study was undertaken to elucidate the effect of dried amla powder and spirulina supplementation on body measurements of rabbits.

MATERIALS AND METHODS

One hundred and eight, weaned New Zealand White rabbits of either sex of six weeks of age were randomly allocated to three different feeding treatments: I. Control, II. EO (added 2% *Emblica officinalis* of diet) and III. SP (added 5% *Spirulina platensis* of diet). The rabbits were housed in a closed room and provided with separate facilities for feeding and watering. Feed and water were offered *ad libitum* throughout the 45 day trial in a closed room where the temperature was maintained 20±5^{0}C and humidity 60±15% during the trial. The room had an exhaust fitting for ventilation and glass fitted windows and 2 CFLs to maintain a light/dark cycle (approx. 12/12 h). In control, the concentrate mixture was formulated using maize, soybean meal, ground nut cake, gram, mineral mixture and common salt; in EO basal diet was supplemented with 2% amla. The diet for SP had 5% Spirulina supplemented in standard concentrate mixture (Table 1). The concentrate diets formulated were iso-nitrogenous and iso-caloric. In addition to the concentrate mixture, all the treatment groups were offered *ad lib* barseem fodder. The chemical composition of concentrate mixture prepared at the Department of Animal Nutrition by mixing half crushed ingredients and barseem fodder is mentioned in Table 2. The rabbits under different treatments were fed concentrate mixture and green fodder as per ICAR (2008) requirements.The feed and water containers were hanged tightly at neck level of rabbits to avoid any spilling and wastage. Water containers were located near feeders and they were regularly cleaned to prevent the chance of any contamination. The study was carried out for a period of 45 days on selected rabbits. Body length, body height, hearth girth, abdominal girth, fore canon length and thigh length were taken at the beginning of the experiment and thereafter fortnightly during the experiment.

All experiments were approved by the Institutional Animal Ethics Committee of the University. Statistical analyses were performed with SPSS version 21.0 (SPSS,

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Table 1
Ingredient composition of concentrate mixtures of different dietary treatments (g/kg)

Ingredients	Treatments		
	Control	EO (2% *Emblica officinalis*)	SP (5% *Spirulina platensis*)
Maize	481	451	500
Soyabean meal	186	187	150
Groundnut cake	161	160	126
Gram	160	170	162
Spirulina	-	-	50
Amla	-	20	-
Iodized salt	5	5	5
Mineral mixture*	5	5	5
Spectromix powder premix**	1	1	1
Spectro BE powder premix***	1	1	1

*Mineral mixture (Salt free)- Ca (32%), Cu (100 ppm), Zn (0.26%), Iodine (0.01%), P (6%), Mn (0.27%), Fe (1000 ppm) and Co (50 ppm).
**Spectromix: Powder (Ranbaxy Animal Health, New Delhi). Each gm contained Vitamin A (82,500 IU), Vit. D3 (12,000 IU), Vit. B2 (50 mg) and Vit. K (10mg). Mixing rate: 100 g/MT of feed.
***Spectro BE: Powder. Each gm contained Vit. B1 (8 mg), Vit. B6 (16 mg), Vit. B12 (80 mg), niacin (120 mg), calcium petothenate (80 mg), Vit. E (160 mg), lysine hydrochloride (10 mg), DL-methionine (10 mg) and calcium (260mg). Mixing rate:100 g/MT of feed.

2012). All the values were grouped and the means and standard errors were calculated. One-way ANOVA was applied to the all parameters to examine the difference between groups. Differences were considered significant at P<0.05. If the difference between groups was provided to be significant (P<0.05), differences evaluated by Duncan test.

RESULTS AND DISCUSSION

The chemical composition of concentrate mixture offered to different treatment groups indicates that proximate constituents were similar in all the dietary treatments. The crude protein content was 21.34, 21.42 and 21.68 % in concentrate mixture of control, EO and SP groups, respectively (Table 2).

The body measurements (length, height, heart girth, abdominal girth, fore canon length and thigh length) were almost similar at the start and at the end of the experiment among all the groups and the difference was statistically non-significnat at all intervals (Table 3). Grenscer *et al.* (2014) reported that dietary inclusion of spirulina and thyme did not improve growth rate of the rabbits. Similar to our results, other studies did not observe better rabbit growth performance when diets were supplemented with spirulina at 0.5% (Colla *et al.*, 2008), 1% (Peiretti and Meineri, 2009), 3% (Dalle Zotte *et al.,* 2013) or 5, 10 and 15% (Peiretti and Meineri, 2008) levels. Aayat *et al.* (1995) found body length, heart girth, pelvic girth, fore canon length and thigh length at 90 days of age to be 32.70, 28.10, 32.00, 9.50 and 14.50, respectively which were higher than the final measurements of our treatments. The overall low growth of rabbits in the present study may be due to rearing of slow growing strain of New Zealand White rabbits. Further, feeding of diets half crushed rather than pelleted form also reduce performance. Kumari *et al.* (2012) also reported that there was no significant difference in linear increase in length, height, heart girth, abdominal girth, fore

Table 2
Chemical composition of concentrate mixture and fodder used for different treatments (% DM basis)

Attributes	Treatments			Barseem
	Control	EO (2% *Emblica officinalis*)	SP (5% *Spirulina platensis*)	
Dry matter	91.46	91.44	90.87	14.33
Crude protein	21.34	21.42	21.68	15.12
Ether extract	4.13	4.40	4.06	3.26
Crude fibre	12.62	12.13	12.11	19.62
Nitrogen free extract	53.55	54.13	54.27	45.39
Ash	8.36	7.92	7.88	16.61

Table 3
Body measurements of rabbits under different dietary treatments

Attributes		Treatments		
		Control	EO (2% *Emblica officinalis*)	SP (5% *Spirulina platensis*)
Body length	0	16.56±0.17	16.57±0.18	16.68±0.17
	15	21.77±0.25	21.39±0.26	21.60±0.25
	30	25.64±0.35	25.67±0.36	25.77±0.34
	45	29.19±0.43	29.21±0.46	29.34±0.42
	Av. gain	12.63±0.26	12.64±0.28	12.72±0.25
Body height	0	11.63±0.12	11.64±0.13	11.72±0.12
	15	13.81±0.18	13.60±0.18	13.75±0.17
	30	17.15±0.24	17.17±0.25	17.24±0.24
	45	18.56±0.30	18.57±0.32	18.67±0.29
	Av. gain	6.92±0.18	6.93±0.19	6.99±0.18
Heart girth	0	14.33±0.14	14.34±0.15	14.43±0.14
	15	18.16±0.22	18.34±0.21	18.54±0.21
	30	21.43±0.30	21.45±0.31	21.54±0.29
	45	23.56±0.37	23.58±0.40	23.69±0.36
	Av. gain	9.23±0.22	9.24±0.24	9.31±0.22
Abdominal girth	0	17.23±0.17	17.24±0.19	17.35±0.17
	15	21.96±0.25	21.46±0.29	21.56±0.25
	30	28.03±0.46	28.01±0.50	28.22±0.47
	45	29.19±0.43	29.21±0.46	29.34±0.42
	Av. gain	10.80±0.30	10.77±0.32	10.93±0.31
Thigh length	0 day	8.62±0.09	8.62±0.09	8.68±0.09
	15	10.26±0.13	10.37±0.13	10.15±0.13
	30	12.11±0.18	12.12±0.19	12.17±0.18
	45	13.59±0.22	13.60±0.24	13.67±0.22
	Av. gain	4.98±0.13	4.98±0.14	5.02±0.13
Fore canon length	0	5.80±0.06	5.80±0.06	5.84±0.06
	15	7.37±0.09	7.44±0.09	7.52±0.08
	30	9.53±0.12	9.53±0.13	9.57±0.12
	45	10.22±0.15	10.22±0.16	10.27±0.15
	Av. gain	4.42±0.09	4.43±0.10	4.45±0.09

All values are Mean±S.E.; n=36; Av.=Average

canon length and thigh length with the increase in level of addition of amla in commercial broilers. The similarity in length, height, heart girth, abdominal girth, fore canon length and thigh length despite the antioxidant (Zhang *et al*., 2001), antimicrobial (Saeed and Tariq, 2007) and anti-inflammatory (Rao *et al*., 2005) effects of amla, besides providing added minerals and vitamins could be attributed to effect of genetics on many of these parameters. However, Yokozawa *et al*. (2007) reported improvement in growth performance of the experimental chicks attributed to the vitamin C present in amla pomace. Lambertini *et al.* (2004) reported that live weight of rabbits at slaughter increased from 2603 g to 2636 g and daily weight gain increased from 32.30 g to 32.70 g.

Therefore, from the results it can be concluded that supplementation of diets with Amla and Spirulina at 2% and 5% levels, respectively had no significant effect on the body measurements of rabbits.

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