

DIETARY SUPPLEMENTATION OF SPIRULINA (*Arthrospira platensis*) AND THYME (*Thymus vulgaris L.*) PART 1: EFFECT ON PRODUCTIVE PERFORMANCE OF GROWING RABBITS

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ABSTRACT

The objective of this study was to evaluate the effect of a dietary supplementation between the ages of 5-11 or between only 8 to 11 weeks, with Spirulina or/and Thyme on the growing rabbits' performances. At weaning (5 weeks) the rabbits were randomly allotted to 7 groups (42 rabbits/group, 3 rabbits/cage). Rabbits of the control group (C) received a control pelleted feed throughout the experiment (5-11 weeks of age) without any supplementation. In the other groups, the diet was completed by 5% Spirulina (S), or 3% Thyme (T) or by both (ST) for the whole (5-11 wk; groups: S-S, T-T, ST-ST), or for part of the growing period (8-11 wk; groups: C-S, C-T, C-ST). Supplementing the diet with Spirulina or/and Thyme had no effect on the rabbits' weight gain, body weight, feed consumption, morbidity and mortality. Significant differences were only found for feed conversion ratio that was lower for the C-T group (3.39) than for the C-C groups (3.54, $P < 0.05$). Based on the results, the feed supplements applied separately or jointly had no substantial effect on the growing rabbits' production and health status.

Key words: Spirulina, thyme, growing rabbits, productive performance

INTRODUCTION

Spirulina (*Arthrospira platensis*) is generally regarded as a rich source of protein, vitamins, essential amino acids, minerals, essential fatty acids and antioxidant pigments like carotenoids (Belay *et al.*, 1996). Because of these characteristics Spirulina may favourably affects the immune system. According to Qureshi *et al.* (1996) and Qureshi and Ali (1996) even small amount of Spirulina builds up both the humoral and cellular mechanisms of the immune system in chickens and cats. So far few authors analyzed the effects of Spirulina on the productive performance. Based on the experiment of Ross and Dominy (1990), Spirulina supplementation (1.5, 3.0, 6.0 and 12.0%) had no effect on the production of broiler chickens. On the contrary, Grinstead *et al.* (2000) found slightly increased growth in pigs after completing their diet by 0.2%, 0.5% and 2% Spirulina. Using different degree of supplementation (5, 10 and 15%), effects of adding Spirulina to the diet on 9-13 week old rabbits on production and meat quality were investigated by Peiretti and Meineri (2008, 2011). According to their findings, the supplementation had no effect on production; however the lipid content and fatty acid profile of the meat was favourably changed. As no health problems or mortality were observed in the experiment of Peiretti and Meineri (2008), the possible effect of Spirulina on health status could not be observed.

Thyme (*Thymus vulgaris L.*) is rich in essential oils, which are known to have antioxidant properties and antimicrobial activity (Rota *et al.*, 2008). Özkan *et al.* (2010) examined the effect of *Thymus*

serpyllum on coccidiosis. Based on their findings, the treatment decreased the faecal oocyst counts, and the treated rabbits had higher body weight gain over the day 24 post treatment period.

The objective of this study was to evaluate the effect of supplementation and the length of the supplementation (between the ages of 5-11 or 8-11 weeks) of the growing rabbits' diet by Spirulina (5%) or/and Thyme (3%) on the growing rabbits' production. Other parameters have been measured and are presented in several other communication (parts 2 to 6).

MATERIALS AND METHODS

Animals and experimental design

The experiment was conducted at the experimental rabbit farm of Kaposvár University using maternal line rabbits. All rabbits received the control pellet (C) from 3 weeks of age. After weaning (at 5 weeks of age) the rabbits were housed in wire net cages (0.61 x 0.32m, 3 rabbits/cage). The temperature and daily lighting in the house were 15-18°C and 16 hours (6:00-22:00), respectively.

The weaned rabbits were randomly sorted to 7 groups (42 rabbits/group no full-sibs were allowed within the groups). Rabbits of the control group (C-C) received a pelleted diet without any supplementation throughout the experiment (5-11 weeks of age). In the other groups the diet was completed by 5% Spirulina powder (S), or 3% Thyme meal (T) or by both (ST) before pelleting for the whole (5-11 wk; groups: S-S, T-T, ST-ST, respectively), or at the end of the growing period (8-11 wk; groups: C-S, C-T, C-ST, respectively, Figure 1). Water and feed were available *ad libitum*. The chemical composition of the pellets (contained no medication) are shown in Table 1.

Collection of data and data management

Body weight and feed consumption was measured at 5, 8 and 11 wk of age, weight gains and feed conversion values were calculated. Body weight and weight gain were calculated based on individually data (n=42 rabbits/group), and feed consumption and feed conversion ratio based on the unit of cage (n=14 cages/group). When calculating feed consumption, it was supposed that the rabbits did not consume any pellet during 2 days prior to the death. The morbidity was recorded weekly and the mortality was recorded every day. Rabbits suffering from diarrhoea were considered as morbid. When the same individual was registered with diarrhoea at several subsequent examinations morbidity was registered only once within the same period.

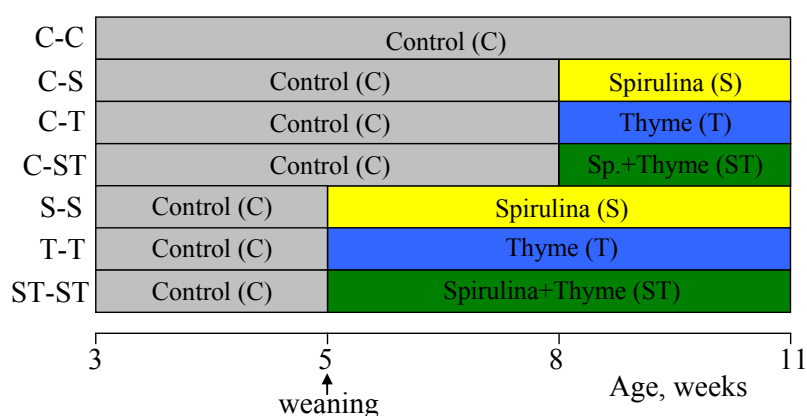


Figure 1: Experimental design

Statistical analysis

The productive traits were compared by one-factor ANOVA, morbidity and mortality by chi-square test using SPSS 10.0 software package.

Table 1: Supplementation and chemical composition of the experimental diets

	Control (C)	Spirulina (S)	Thyme (T)	Spirulina+Thyme (ST)
Ingredients (%of raw materials)				
Spirulina	-	5.0	-	5.0
Thyme	-	-	3.0	3.0
Soybean meal 46%	13.0	5.5	14.0	6.0
Dehydrated alfalfa	40.0	39.7	37.0	39.7
Barley	24.7	26.2	23.7	26.2
Wheat straw (Faser-mix)	12.0	11.0	12.0	9.0
Fat powder	3.5	3.5	3.5	3.5
MCP	0.3	0.3	0.3	0.3
Salt (NaCl)	0.50	0.50	0.50	0.50
Methionine - DL	0.1	0.1	0.1	0.1
L-Lysine HCL	0.4	0.6	0.4	0.6
Vitamin-Mineral premix	0.5	0.5	0.5	0.5
Dried apple pomace	4.0	4.0	4.0	4.0
Zeolit press	1.0	3.0	1.0	1.5
Chemical composition*				
Dry matter (%)	88.6	88.8	88.7	88.9
Crude protein (%)	16.8	17.0	17.0	17.1
Ether extract (%)	2.6	2.6	2.7	2.7
Crude fibre (%)	18.5	18.9	18.4	18.7
Starch (%)	13.7	14.6	13.3	14.0
DE (MJ/kg)	10.1	9.3	9.9	9.0

* Chemical composition of whole diets (including supplementation) was calculated

RESULTS AND DISCUSSION

Supplementing the diet with Spirulina or/and Thyme had no effect on the rabbits' weight gain and body weight at any age (Table 2). Similarly to our results, applying Spirulina supplementation, Peiretti and Meineri (2008) observed no significant differences for final weight and for weight gain. Contrary to these findings, Grinstead *et al.* (2000) showed minimal improvement in growth performance of piglets consuming Spirulina supplemented diet.

Feed consumption showed no differences among the groups. Significant differences were only found for feed conversion ratio between weeks of 8-11, and 5-11 of the C-T and C-C groups to the advantage of the C-T rabbits ($P < 0.05$). Contrary to our results, after supplementing the diet by 5% and 10% Spirulina, Peiretti and Meineri (2008) recorded an increased feed consumption (183 g/d vs. 210 and 227 g/d, respectively), however, no differences were observed for feed conversion ratio which was explained by the lower digestibility of the supplemented diets. This result did not agree with the changes observed in this study.

The morbidity (diarrhoea syndrome) for the whole growth period (5-11 wk) was relatively low, and between 4.8% and 14.3%, and without any significant difference among the 7 groups. Similarly, the mortality rate was here very low, and no differences were observed among the groups. No mortality was recorded in the study of Peiretti and Meineri (2008). In both studies the favourable environmental circumstances and the excellent health status of the examined rabbits were responsible for the low morbidity and mortality. In our study the proportion of rabbits with diarrhoea and the mortality rate were low, even in the control group, thus the favourable effects of Spirulina and Thyme against digestive disorders and for health status may not be justified. On the contrary, examining chickens (Qureshi *et al.*, 1996) and cats (Qureshi and Ali, 1996), authors reported a favourable effect of Spirulina supplementation on the immune system. According to Özkan *et al.* (2010) the *Thymus serpyllum* treatment decreased the faecal oocyst counts, which is a possible indicator of the rabbits' health status.

Table 2: Effect of Spirulina or Thyme dietary incorporation on the growing rabbits' performances.

Traits	Experimental groups						SEM	Prob.	
	C-C	C-S	C-T	C-ST	S-S	T-T			ST-ST
n (at beginning)	42	42	42	42	42	42	42		
Body weight, g									
at 5 wk	951	951	951	951	951	951	954	4.73	1.00
at 8 wk	1836	1837	1799	1857	1835	1873	1830	9.64	0.55
at 11 wk	2542	2539	2551	2582	2569	2594	2555	11.6	0.84
Body weight gain, g/d									
5-8 wk	41.9	42.2	40.5	43.2	42.2	43.9	41.7	0.36	0.25
8-11 wk	33.6	33.0	35.9	34.5	34.9	34.3	34.5	0.33	0.33
5-11 wk	37.8	37.8	38.2	38.8	38.6	39.1	38.1	0.23	0.65
Feed intake, g/d									
5-8 wk	115	114	109	119	113	118	115	0.96	0.137
8-11 wk	152	148	151	154	152	151	154	1.02	0.75
5-11 wk	134	131	130	137	133	135	134	0.80	0.35
Feed conversion ratio									
5-8 wk	2.75	2.72	2.69	2.76	2.69	2.68	2.76	0.01	0.62
8-11 wk	4.57 ^b	4.51 ^{ab}	4.21 ^a	4.50 ^{ab}	4.37 ^{ab}	4.42 ^{ab}	4.49 ^{ab}	0.03	0.033
5-11 wk	3.54 ^b	3.48 ^{ab}	3.39 ^a	3.52 ^{ab}	3.44 ^{ab}	3.44 ^{ab}	3.53 ^{ab}	0.01	0.032
Morbidity, %									
5-8 wk	7.1	11.9	14.3	4.8	9.5	4.8	14.3		0.55
8-11 wk	0	0	0	0	0	2.4	0		0.42
5-11 wk	7.1	11.9	14.3	4.8	9.5	7.1	14.3		0.68
Mortality, %									
5-8 wk	2.4	0	2.4	0	2.4	0	0		0.67
8-11 wk	0	4.8	0	0	0	0	0		0.063
5-11 wk	2.4	4.8	2.4	0	2.4	0	0		0.56

C-C: the rabbits received control pellet throughout the whole growing period;

C-S: the rabbits received control pellet during the first 3 weeks of the growing period (5-8 wk) then a pellet supplemented by Spirulina (5%) (8-11 wk);

C-T: the rabbits received control pellet during the first 3 weeks of the growing period (5-8 wk) then a pellet supplemented by Thyme (3%) (8-11 wk);

C-ST: the rabbits received control pellet during the first 3 weeks of the growing period (5-8 wk) then a pellet supplemented by Spirulina+Thyme (8-11 wk);

S-S: the rabbits received a pellet supplemented by Spirulina (5%) throughout the whole growing period;

T-T: the rabbits received a pellet supplemented by Thyme (3%) throughout the whole growing period;

ST-ST the rabbits received a pellet supplemented by Spirulina (5%) and Thyme (3%) throughout the whole growing period.

SEM: Standard error of the mean

CONCLUSIONS

Supplementing the diet by Spirulina and/or Thyme for a shorter or longer period had no substantial effect on the growing rabbits' production and health status. This result does not indicate that these supplements have any positive effects, but it shows that in a favourable environment where the rabbits have high health status no further increase of production can be achieved.

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