PHYSIOLOGICAL RESPONSES OF MANNOOLIGOSACCHARIDE ON LIPID PROFILE OF HEAT STRESSED RABBITS

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ABSTRACT

Heat stress in Egypt is one of the major constraints affecting growing rabbit productivity and impairs health. Every chance should be made to ameliorate the heat affects. The objective of this work was to determine the physiological effects of supplementing Mannooligosaccharide (MOS) on hematology, immunity, antioxidant and lipid profile of heat stressed growing V-line rabbits. A total number of 80 V-line rabbits at 4 weeks old with average initial live body weight of 765.46g were exposed to temperatures 29.3-35.3°C, humidity 55-70% and Temperature Humidity Index 27.22-33.53. Rabbits divided into four groups (n=20 rabbits/group), in a completely randomized design. The first group received basal diet free of MOS. The second, third and fourth groups were fed diets containing 0.5, 1.0 and 1.5% MOS/kg diet, respectively. The results reveal that final body weight and high-density lipoprotein (HDL) were improved by all MOS treatments; however, respiration rate and rectum temperature through two months were significantly decreased by MOS supplementation. MOS diets significantly lowers the level of serum cholesterol and total lipids, however, it had numerically increasing effect on serum total antioxidant capacity (TAC) with a significant decreasing on serum malonaldehyde (MAD) as compared with control group. Sheep RBCs titer at 7^{th} day was better by MOS treatments. The study could help to improved heat tolerance, lipid profile and immune status of growing heat stressed V-line rabbits by providing MOS.

Key words: rabbit, MOS, immunity, heat stress, lipid profile

INTRODUCTION

Climate change is one of the major threats to the animal industry in Egypt, where the temperature in different seasons varies. High ambient temperature has negatively effects on physiological and hematological parameters; enzymatic reactions and antioxidant status, in addition to immunity responses of rabbit (Okab *et al.,* 2008) especially growing one. Also, the ban of antibiotic growth promoters was strategy steps to dealing with antibiotic resistance. At same time, high performing rabbit production challenge the health of the rabbits. The rabbit is susceptible to enteric diseases, mostly after weaning especially under heat stress. For this reason, several studies have been accomplished to find alternatives to replace dietary antibiotics (Eiben *et al.,* 2008). Oligosaccharides as prebiotics are a class of carbohydrates that are not absorbed or digested in the small intestine of animals, but readily fermented by the intestinal microflora. This may result in changes in this flora, thereby increasing the number of beneficial micro-organisms, while repressing the harmful bacteria (Quigley, 2004). Also, MOS enhances immunizing function, promotes animal growth, protects intestinal tract health and improves animal products quality and security. Therefore, the aim of the present study was to determine the effect of MOS as natural growth promoters on physiological and hematological parameters, lipid profile and antioxidant status of growing V-line rabbits under heat stress.

MATERIALS AND METHODS

A total number of 80 V-line rabbits at 4 weeks old with an average initial live body weight of 765.46g were divided into four groups (n=20 rabbits/group). Each group was subdivided into ten replicates with two rabbits each in a completely randomized design. Rabbits fed a basal diet containing 17.0 % crude protein and 2650 kcal digestible energy / kg diet, Ingredients of experimental diets are shown in Table 1. The first group received basal diet free of MOS. The second, third and fourth groups were fed diets containing 0.5, 1.0 and 1.5% MOS/kg diet, respectively. The experiment lasted for eight weeks. All cages were provided with a manual feeder, and clean fresh water was available continuously through an automatic system of nipple drinkers. Rabbits were exposed to temperature 29.3- 35.3°C, humidity 55-70% and Temperature Humidity Index 27.22-33.53 units as moderate to severe heat stress.

Table 1: Ingredients of experimental diets

	Control	MOS 0.5%	MOS 1%	MOS 1.5 %
Ingredients (%):				
Yellow corn	19	19	19	19
Wheat bran	11	10.5	10	9.5
Barley	17.2	17.2	17.2	17.2
Clover hay	33	33	33	33
Soy bean meal (44%CP)	15	15	15	15
Molasses	3	3	3	3
DI-calcium phosphate	1	1	1	1
L-lysine	0.1	0.1	0.1	0.1
DI- Methionine	0.1	0.1	0.1	0.1
Premix[1]	0.3	0.3	0.3	0.3
Salt	0.3	0.3	0.3	0.3
MOS	-	0.5	1	1.5

[1]Premix contained: Vit A.2000.000 IU; E 10mg; B1 400 mg; B2* 1200mg; B6 400mg; B12 10 mg; D3 180000 IU; Colin chloride 240 mg; Pantothenic acid 400 mg; Niacin 1000mg; Folic acid 1000 mg; Biotin 40 mg; Manganese 1700 mg; Zinc 1400 mg; Iron 15 mg; Copper 600 mg; Selenium 20 mg; Iodine 40 mg and Magnesium 8000 mg.

Rabbits kept under the same hygienic during the experimental period, they provided with 14 h of light daily. Ten rabbits of each treatment used to measure each of rectum temperature and respiration rate (monthly), cell blood count (RBCs, WBCs, PCV, Hb) at the end of experiment. All biochemical traits of blood serum were determined using commercial kits (Diamond Diagnostics, Halliston, MA, USA). Ten rabbits of each treatment were immunized with 0.1 ml of 2.5% sheep red blood cells (SRBCs) via the marginal ear vein at 15 days after starting the dietary treatment supplementation, to measure antibody titer to SRBCs (Nelson *et al.*, 1995). Data were analyzed using one-way ANOVA of GLM procedure of SAS® (SAS, 2000). Significant differences between means were detected using mew Duncan multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Results presented in Table 2 indicated that final body weight were increased as affected by MOS treatments, although decrease the total feed intake of two highest MOS doses treatments (1&1.5%); however, thermoregulatory parameters (Fig. 1) such as respiration rate and rectum temperature were significantly ($P<0.05$) decreased by MOS supplementation as compared with the control group, which suggests that it mitigates the adverse effects of thermal stress on heat stressed rabbits. Providing Bio-Mos® improved final body weight compared to control (Fonseca *et al.*, 2004). This may be attributed to that Bio-Mos® induced longer villi and increased absorption area compared to the control (Pinheiro *et al.*, 2004). Serum TAC and Sheep RBCs titers at 14^{th} d. (Fig. 2) were numerically increased by treatments. While, serum MAD was significantly decreased by MOS treatments. Sheep RBCs titers at

Table 2: Effect of different levels of MOS on body weight (BW), hematology and lipid profile of heat stressed growing rabbits.

Parameters	Control	MOS 0.5%	MOS 1%	MOS 1.5%	SEM	P value
Initial BW (g)	761.85	776.00	754.00	770.00	9.32	0.856
Final BW (g)	1505.00^{B}	1595.20^{A}	1609.50^{A}	1605.00^{A}	14.10	0.023
TotaL Feed intake (g)	2934.70^{A}	2848.90^{A}	2637.90^{B}	2723.80^{B}	22.23	0.001
Hb (mg/dl)	10.30	10.64	10.46	10.44	0.08	0.606
WBCS (103/mm3)	5.36^{B}	6.62^{A}	6.58^{A}	5.80^{B}	0.15	0.003
RBC (106/mm3)	3.58	3.56	3.50	3.51	0.05	0.925
PCV %	31.42	33.28	33.04	33.05	0.43	0.397
Chol. (mg/dL)	94.60^{A}	77.30^{B}	81.76^{B}	61.78^{C}	2.42	<0.001
TG. (mg/dL)	72.96	68.11	69.28	69.20	0.90	0.253
HDL (mg/dL)	19.00^{B}	20.20^{A}	20.60^{A}	20.80^{A}	0.20	0.005
LDL (mg/dL)	26.40^{A}	25.92^{A}	22.80^{B}	23.00^{B}	0.47	0.004
HDL/LDL	1.06^{B}	1.10^{B}	1.18^{A}	1.19^{A}	0.01	<0.001
T. Lipid (mg/dL)	317.40^{A}	241.60^{B}	252.40^{B}	231.00^{B}	6.47	<0.001

a- c Means in the same row having different letters are significantly different (P≤0.05). Hb= hemoglobin; WBCs=White blood cell; RBCs= red blood cell; PCV= packed cell volume; Chol..= cholesterol; TG= triglyceride; HDL=High density lipoprotein; LDL= low density lipoprotein; T. lipid= total lipid.

7th d. significantly improved with MOS groups. All MOS diets (Tab. 1) significantly ($P \leq 0.05$) lowers the level of serum total lipids and cholesterol and significantly increased HDL, however, 1 and 1.5% MOS treatments had a significant decreasing effect on LDL with significantly increased on HDL/LDL as compared with the control group. WBCs significantly ($P \leq 0.01$) increased by 0.5 and1% MOS supplementation compared to control group.

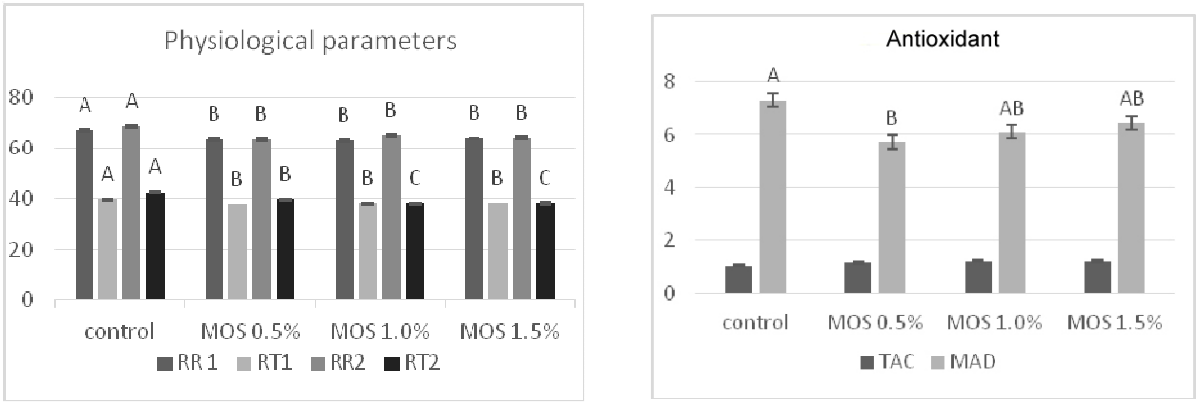

Figure 1. Effect of different levels of MOS on (*on the left*)) Respiration rate (RR) and Rectum temperature (RT) during 1st & 2nd month, and (*on he right*) antioxidant: Total antioxidant (TAC) mm/L and Malonaldehyde (MAD) nmol/ml of heat stressed rabbits. The same color of bar having different letters are significantly different (P≤0.05).

Mannooligosaccharide at levels 0.1, 0.2 and 0.3% in broiler diet stimulating the humoral immunity against AIV vaccine and increased antibody titers (Tohid *et al.*, 2010). The primary antibody response against sheep red blood cell was significantly ($P < 0.05$) increased by supplemental MOS (Jahanian et a., 2015). Also, MOS significantly decreased both plasma total lipids and cholesterol ($P \leq 0.05$) (Radwan and Abdel-Khalek, 2007).

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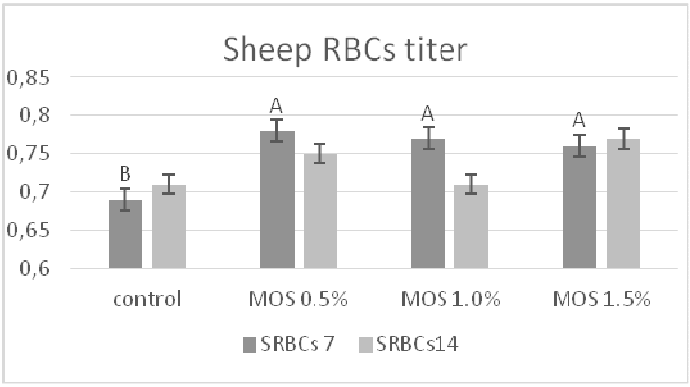

Figure 2. Effect of different levels of MOS on sheep RBCs titers at 7th and 14th day of heat stressed rabbits. A-B Means in the same color of bar having different letters are significantly different ($P \leq 0.05$).

CONCLUSIONS

It is well demonstrated in the present study that the consumption of MOS has positive effects on rabbits' performance, had a beneficial effect on blood lipid regulation which was demonstrated to be ascribed to their thermoregulatory parameters.

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