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PROBIOTICS AND SHADING AS MEANS FOR ALLEVIATING HEAT STRESS ON HASSANI GOATS

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ABSTRACT

This study was conducted in Hadraba Valley, Halaieb and Shalateen Research Station, Desert Research Center. The objective of this study is to investigate the effectiveness of providing shade and/ or feeding probiotics as means for alleviating heat stress on Hassani goats raised in the far south of the eastern desert of Egypt indicating by thermo- cardio- respiratory responses and changes in some hemato-biochemical parameters. Four groups of mature male Hassani goats (Five animals in each) were used; group one (G1); kept unshaded without probiotics, group two (G2); kept unshaded and fed probiotics. Group three (G3) shaded and had un-supplemented probiotics; while group four (G4); shaded and fed probiotics. Meteorological data in terms of radiant ambient temperature (RAT), ambient temperature (AT) and relative humidity (RH) and thermo-cardio- respiratory responses (rectal; RT, skin; ST and coat temperatures; CT and respiration; RR and heart rates; HR) were recorded twice daily at 08.00 and 14.00 hr. Hemoglobin (Hb), packed cell volume (PCV), mean of corpuscular hemoglobin concentration (MCHC), plasma total cholesterol (TC), glucose (GLU), total proteins (TP), albumin (A), globulin (G), A/G ratio, alanine amino transferase (ALT) and aspartate amino transferase (AST) were determined.

The results revealed that providing probiotics relieved the burden of heat stress as indicated by reducing ($P<0.01$) the thermo- cardio- respiratory responses and increasing ($P<0.05$) TP and G. Moreover, probiotics caused a non-significant elevation of mean values of PCV, HB, MCHC, A, GLU and reduction of A/G ratio, TC and AST and ALT. on the other hand, Shading resulted in significant ($P<0.01$) reductions in RT, CT and RR and non- significant reductions in ST, HR, TP, A, G, AST, ALT. Furthermore, shading caused significant ($P<0.05$) increases in PCV and MCHC and non-significant increases in Hb, TC and GLU. The improvement in thermo- cardio- respiratory responses and hemo-biochemical parameters due to probiotics were more pronounced than those of shading. However, the best benefits were obtained of the group provided the two treatments together.

It could be concluded that providing shade and/ or probiotics for heat stressed animals in such remote region would improve their heat tolerance to the severe hot conditions prevailing in this region.

Keywords: Heat stress, Hassani goats, Thermo- cardio- respiratory responses, Probiotics, Biochemical parameters, El- Shalateen- Halaieb- Abou Ramad triangle

INTRODUCTION

Goats raised in the far south of the eastern desert of Egypt particularly in El-Shalateen- Halaieb- Abou Ramad triangle are exposed to extreme climatic conditions either during summer or winter seasons.

The most permanent disaster in such desert is radiant heat stress which is caused primarily by intensive solar radiation. However, Heat stress effect can be intensified by other microclimatic factors such as high humidity, thermal radiation and low air movement. Improving heat tolerance and performance of animals raised under such hot conditions involves breeding, management, nutrition (Yu *et al.*, 1997) and modifying the thermal environment through provision of shelters (Hopkins *et al.*, 1978 and Shaker, 2003). The basic modification for protecting and promoting the heat tolerance and existence of the animals during summer days is a simple and inexpensive shade (Fuquay, 1981 and Yousef *et al.*, 1996 & 1997). Biologically, Williams *et al.* (1987) reported that supplementation with yeast culture improved acid/ base balance and performance of lambs subjected to heat stress. This suggests that any beneficial effects of yeast culture may be more pronounced when the animals is suffered heat stress, either via elevated ambient temperature or fever.

It is necessary to mention that the effect of probiotics on the animal thermal adaptation has been studied insufficiently. This investigation is an attempt to throw some lights on the role of probiotics combined with shading in improving heat tolerance of animals raised under such extreme arid conditions of El- Shalateen-Halaieb- Abou Ramad triangle in far south- east of Egypt.

MATERIALS AND METHODS

1- Studying area:

This study was carried out in Hederba Valley, Halaieb and Shalateen Research Station belonging to Desert Research Center (DRC), which lies 1400 km south east of Cairo (Latitude 22ºN, Longitude 36ºE).

2- The aim of the study:

This experiment aimed at studying the effect of providing shade and probiotics to Hassani goats raised in this area on their thermo- cardio- respiratory responses and some hemato-biochemical parameters.

3- Hassani goats:

Hassani goats are considered the second dominant goat breed in the El- Shalateen- Halaieb- Abou Ramad triangle. The goats in the triangle region look like the desert black goats. The Hassani goats are of medium size with long ears and a straight nose. The predominant color is black. Hassani goats observed were either horned or not. Most had straight horns.

4- Animals and experimental design:

Twenty male Hassani goats aged 12- 18 months with average body weight of 19.44± 0.054 kg, were used in this study. Goats were randomly divided four groups (5 each). Two groups (1 and 2) were separately kept unsheltered just inside wire- fenced yard exposing to the climatic conditions. Group 1 was fed normally while group 2 supplemented with probiotics at rate of 10 gm/ head/ day Biovet- YC, Wockhardt Limited, Mumbai- 400 051, according to according to

Fayed, 2001). Groups 3 and 4 were kept in wire- fenced pens roofed with thatch. Group 3 was fed normally while group 4 supplemented with probiotics at the same rate of group 2. The experiment lasted for 34 days: the first 28 days were considered as a preliminary period, the next 4 days were for collection of samples and parameters and the last two days were as a recovery period during which all groups were separately kept under shade. Clean fresh water was offered for the four groups twice a day. The animals received their nutritional requirements according to Kearl (1982).

5- Measurements:

Meteorological data in terms of radiant ambient temperature (RAT, ºC), ambient temperature (AT, ºC) and relative humidity (RH, %) were recorded twice daily at 08.00 and 14.00 hrs. using digital thermo-hygrometer for AT and RH while RAT was recorded using a bulb made of copper (16 cm. diameter) painted in black and fixed with a thermometer. This black body was used for both shaded and unshaded pens to obtain the actual heat load on the animals.

Rectal temperature (RT, °C) by using a standard clinical thermometer, respiration rate (RR, breaths/ min) by countering flank movement, skin temperature (ST, °C), coat temperature (CT, °C) by using an electronic digital telethermometer as well as heart rate (HR, beats/ min) by using stethoscope and a stopwatch on the right heart side position were recorded twice daily.

Daily blood samples were withdrawn from all animals during the different experimental periods into clean heparinized tubes, in the early morning just before offering ration and water. Hemoglobin concentration (Hb) according to Drabkin and Austin (1932) as well as packed cell volume (PCV, %) were immediately determined in the fresh blood. The rest of the blood was centrifuged for 30 minutes at 3000 r.p.m. for plasma separation. The mean of corpuscular hemoglobin concentration (MCHC, %) was calculated as follows:

MCHC = (Hb X 100)/ PCV (%)

Plasma total cholesterol and glucose concentrations were determined according to Roeschlau *et al.* (1974) and Trinder (1969), respectively. Assay of total proteins (TP) and Albumin (A) were carried out according to Biuret method after Gornal *et al.* (1949) and Doumas *et al.* (1971), respectively. Values of Globulin (G) were calculated by subtracting the value of albumin from the total protein whereas A/G ratio was calculated according to results of albumin and globulin.

Concentrations of both alanine amino transferase (ALT) and aspartate amino transferase (AST) were analyzed according to Reitman and Frankel (1957).

6- Statistical analysis:

Data were analyzed using General Linear Model Procedure (SAS, 1998).

RESULTS AND DISCUSSION

1- Meteorological data:

Both of ambient (AT) and radiant ambient temperatures (RAT) tended to increase from the morning (08.00 hr.) to the afternoon (14.00 hr.) in both sites during the experiment or the recovery periods (Table 1). Similar diurnal changes in AT and RAT in the same location were reported by El- Rayes (2005).

On the other hand, the values of relative humidity showed a reverse diurnal trend to that of AT and RAT, being higher in the morning than in the afternoon in both experimental sites (Table 1).

The obtained results demonstrated that providing shade resulted in reducing both AT and RAT and increasing RH at 08.00 and 14.00 hr. These results were in accordance with those reported by Ahmed (1991), Azamel *et al.* (1994), Badawy *et al.* (1999) and Shaker (2003). Yet, thus a remarkable effect of shading was controlling the magnitude of diurnal variation in AT and RAT (between 08.00 and 14.00 hr.) in shaded pens being only 1.40 and 1.50; °C, respectively as compared to 9.00 and 5.50; °C recorded in unshaded ones.

2- Thermo- cardio- respiratory responses:

Providing probiotics to animals' diets reduced significantly the mean values of thermo- cardio- respiratory responses (Table 2). The present results were in consistence with those reported previously by many investigators e.g. Higginbotham *et al*. (1993), Marcus *et al*. (1986), Huber and Higginbotham (1985), Bertrand and Grimes (1997), Higginbotham *et al*. (1994), Gomes- Alarcon *et al*. (1990 and 1991) and Mertens (1979). Meyers (1974) and Huber *et al*. (1994) suggested that fungal metabolites influence temperature control centers in cows.

Table (1): Mean values of meteorological data recorded at both shaded and unshaded sites during the experiment

Variable	Experimental pens			Recovery
	Unshaded site	Shaded site	Change[1]	
Ambient temperature (AT); °C				
08.00 hr.	36.00	35.60	**- 0.40**	34.00
14.00 hr.	45.00	37.00	**- 8.00**	37.00
Change[2]	**+ 9.00**	**+ 1.40**		**+ 3.00**
Radiant ambient temperature (RAT); °C				
08.00 hr.	41.50	40.00	**- 1.50**	39.00
14.00 hr.	46.00	41.00	**- 4.50**	43.00
Change[2]	**+ 5.50**	**+ 1.50**		**+ 4.00**
Relative humidity (RH); %				
08.00 hr.	39.00	34.00	**- 5.00**	36.00
14.00 hr.	24.00	30.00	**+ 6.00**	28.00
Change[2]	**- 15.00**	**- 4.00**		**- 8.00**

Change[1] due to shade. **Change[2] due to day- time.**

Irrespective of the effect of probiotics, all the mean vales of thermo- cardio- respiratory responses were reduced as a result of providing shading. These reductions were significant for RT, CT and RR while they were not significant for ST and HR (Table 2). Similar trends were reported by Azamel *et al.* (1987), Ahmed (1991), Badawy *et al.* (1999), Gawish *et al*, (1999) and Shaker (2003) reporting that shading resulted in reducing thermo respiratory responses temperature.

The mean values of thermo- cardio- respiratory responses were elevated significantly from morning to afternoon (Table 2). These changed in thermo- cardio- respiratory responses due to the day time were reported by Badawy *et al.* (1999), Gawish *et al*. (1999), Shaker (2003) and El- Rayes (2005).

Providing probiotics to the shaded and sun-exposed goats resulted in reducing the mean values of thermo- cardio- respiratory responses either in both experimental sites and times. However, the advantage of providing probiotics is so clear in the afternoon where the mean values of RT, ST, CT, RR and HR in goats fed probiotics were lower even under sun as under shade (Table 2). Heat-stressed animals in several studies fed extract of A. oryzae had lower RT and RR or both than their controls (Higginbotham et al., 1993; Marcus et al., 1986; Huber and Higginbotham, 1985; Bertrand and Grimes, 1997; Higginbotham et al., 1994; Gomes- Alarcon et al., 1990 & 1991 and Mertens, 1979).

On the other hand, the mean values of diurnal change in RT, ST, CT, RR and HR for non probiotics goats were higher than those of their counterparts fed probiotics even under shaded or sun exposed groups.
These results demonstrated that providing probiotics for goats improved their heat tolerance (Table 2).

Generally, after the end of the experiment and during the recovery period, the mean values of thermo- cardio- respiratory responses of all groups were nearly similar with no significant differences among the four experimental groups.

3- Body- environmental temperature gradients:

In the morning, the mean values of the inner temperature gradient between RT- ST for probiotics group was higher than fore the non- probiotics one in sun pens. While under shade the probiotics treated goats had almost the same value of their counterparts of non probiotics ones. Consistently, in the afternoon the probiotics treated groups showed the same trend of the morning where it had higher RT-ST values in sun and lower RT-ST in shade (Table 3). This might be due to the effect of probiotics in reduction the RT values of probiotics treated goats which in turn facilitate the heat flow from RT to ST especially under sun exposure.

Table (2): Least square means ±SE of the thermo- cardio- respiratory responses and their changes for the four experimental groups as affected by probiotics and sheltering

			RT	ST	CT	RR	HR
Probiotics (P):			**(±0.047)****	**(±0.085)****	**(±0.091)****	**(±0.878)****	**(±0.803)****
Untreated			39.68b	39.02b	39.21b	56.70b	80.50b
Probiotics			39.22a	38.61a	38.67a	51.40a	73.90a
Change[1]			**- 0.46**	**- 0.41**	**- 0.54**	**- 14.30**	**- 6.60**
Shading (S):			**(±0.047)****	**(±0.085)[ns]**	**(±0.091)****	**(±0.878)****	**(±0.803)[ns]**
Un-shaded			39.57a	38.82	39.11a	56.00a	78.00
Shaded			39.34b	38.81	38.77b	52.10b	76.40
Change2			**- 0.23**	**- 0.01**	**- 0.34**	**- 3.90**	**- 1.60**
Time of day (T):			**(±0.047)****	**(±0.085)****	**(±0.091)****	**(±0.878)****	**(±0.803)****
08.00 hr.			39.19a	38.16a	38.47a	40.60a	75.70a
14.00 hr.			39.70b	39.46b	39.40b	67.50b	78.70b
Change3			**+ 0.51**	**+ 1.30**	**+ 0.93**	**+ 26.90**	**+ 3.00**
P X S X T			**(±0.096)[ns]**	**(±0.169)[ns]**	**(±0.183)[ns]**	**(±1.758)[ns]**	**(±1.606)[ns]**
Sun	**08.00**	**Untreated**	39.36	38.24	38.62	41.20	76.80
		Probiotics	39.04	37.89	37.98	38.40	73.60
		Change[1]	**- 0.32**	**- 0.35**	**- 0.64**	**- 2.80**	**- 3.20**
	14.00	**Untreated**	40.16	39.84	40.12	74.40	83.20
		Probiotics	39.70	39.29	39.72	70.00	78.40
		Change[1]	**- 0.46**	**- 0.55**	**- 0.40**	**- 4.40**	**- 4.80**
Shade	**08.00**	**Untreated**	39.40	38.47	38.95	45.60	82.40
		Probiotics	38.97	38.05	38.35	37.20	70.00
		Change[1]	**- 0.43**	**- 0.42**	**- 0.60**	**- 8.60**	**- 12.40**
	14.00	**Untreated**	39.79	39.53	39.13	65.60	79.60
		Probiotics	39.18	39.19	38.63	60.00	73.60
		Change[1]	**- 0.61**	**- 0.34**	**- 0.50**	**- 5.60**	**- 6.00**
Recovery			**(±0.101)[ns]**	**(±0.224)[ns]**	**(±0.190)[ns]**	**(±2.071)[ns]**	**(±2.446)[ns]**
Sun	**08.00**	**Untreated**	39.17	38.40	39.00	44.00	81.00
		Probiotics	39.36	38.66	38.84	43.20	80.80
		Change[1]	**+ 0.19**	**+ 0.26**	**- 0.16**	**- 0.80**	**+0.20**
	14.00	**Untreated**	39.60	39.52	39.24	61.00	76.00
		Probiotics	39.46	39.52	38.98	60.00	72.80
		Change[1]	**- 0.14**	**0.00**	**- 0.26**	**- 1.00**	**- 3.20**
Shade	**08.00**	**Untreated**	39.30	38.70	38.96	45.20	84.80
		Probiotics	39.40	38.74	39.02	44.00	78.40
		Change[1]	**+ 0.10**	**+ 0.04**	**+ 0.06**	**- 1.20**	**- 6.40**
	14.00	**Untreated**	39.44	39.56	38.72	66.00	76.80
		Probiotics	39.44	39.94	38.90	64.00	76.80
		Change[1]	**0.00**	**+ 0.38**	**+ 0.18**	**- 2.00**	**0.00**

[1], due to probiotics [2], due to shading [3], due to day time NS, non-significant
****, $P < 0.01$**
RT, rectal temperature; °C. ST, skin temperature; °C. CT, coat temperature; °C.
RR, respiration rate; breaths/minute. HR, heart rate; beats/ minute.
In the same column, means in a certain item having the same letter do not differ significantly.

Concerning the medium temperature gradient between ST-CT, the results revealed that all experimental animals at sun- exposure pens at both day- times and at the shade pens in the morning had negative ST- CT values, which indicated to the role of coat in thermoregulation. The results also showed that the heat transfer was easier in shaded goats than un-shaded ones especially in the afternoon (Table 3). The high AT in the un-shaded sites (45°C, Table 1) caused increases of the coat surface temperature of the un-shaded animals. Also, the obtained results showed that the least gradient values were for skin- coat temperature, which might reflect an efficient role of the coat in thermoregulation in climatic conditions (El- Ganaieny and Abdou, 1999).

On the other hand, the means of outer gradient (CT- AT) showed that the heat flow from the animals body to the environment was easier in non- probiotics goats than the probiotics ones which might be due to the lower values of coats temperature of probiotics groups. The present results also demonstrated that the heat transfer in shaded goats was more readily as compared with their counterparts left un-shaded (Table 3).

Table (3): Mean values of environmental- body temperature gradients (°C) for the four experimental groups as affected by probiotics and sheltering

			RT-ST	ST- CT	CT- AT	RT- AT
Sun	**08.00**	**Untreated**	+ 1.12	- 0.38	+ 2.62	+ 3.36
		Probiotics	+ 1.15	- 0.09	+ 1.98	+ 3.04
	14.00	**Untreated**	+ 0.32	- 0.28	- 4.88	- 4.84
		Probiotics	+ 0.41	- 0.43	- 5.28	- 5.30
Shade	**08.00**	**Untreated**	+ 0.93	- 0.48	+ 3.35	+ 3.80
		Probiotics	+ 0.92	- 0.30	+ 2.75	+ 3.37
	14.00	**Untreated**	+ 0.26	+ 0.40	+ 2.13	+ 2.79
		Probiotics	- 0.01	+ 0.56	+ 1.63	+ 2.18
Recovery						
Sun	**08.00**	**Untreated**	+ 0.78	- 0.60	+ 5.00	+ 5.18
		Probiotics	+ 0.70	- 0.18	+ 4.84	+ 5.36
	14.00	**Untreated**	+ 0.08	+ 0.28	+ 2.24	+ 2.60
		Probiotics	- 0.06	+ 0.54	+ 1.98	+ 2.46
Shade	**08.00**	**Untreated**	+ 0.60	- 0.26	+ 3.96	+ 5.30
		Probiotics	+ 0.66	- 0.28	+ 5.02	+ 5.40
	14.00	**Untreated**	- 0.12	+ 0.84	+ 1.72	+ 2.44
		Probiotics	- 0.50	+ 1.04	+ 1.90	+ 2.44

RT, rectal temperature ST, skin temperature CT, coat temperature
AT, ambient temperature
In the same column, means in a certain item having the same letter do not differ significantly.

The mean values of total gradient between body core and environmental temperature (RT- AT) were lower for probiotics goats than those for non-probiotics ones. This results might be attributed to the lower values of the thermal responses of probiotics groups as compared with those of non- probiotics ones (Tables 2 and 3). Meanwhile, the present results also demonstrated that total temperature gradients was higher in shaded goats than un-shaded ones at both day- times which might be owing to the reduction in ambient temperature or load falling on goats and in turn increases total temperature gradient which enhanced the heat flow to the hot environment (Shaker, 2003).

4- The hemato- biochemical parameters:

4- 1- The hematological parameters:

Providing probiotics resulted in increasing the mean values of packed cell volume (PCV, %) hemoglobin (Hb, g/dl) and mean corpuscular hemoglobin (MCHC) concentrations for probiotics groups as compared with those of the non-probiotics ones (Table 4). These findings in agreement with those of Miller *et al.* (1982) and Kander (2004) where piglets fed probiotics had higher hemoglobin levels which might be due to that probiotics bacteria reduce the contraction of the alimentary tract, resulting in better iron salt absorption from the small intestine. They also produce vitamins B, affecting positively blood- forming processes. Kander (2004) reported that the hematocrit value of animals fed probiotic were slightly higher than control ones. Bomba *et al.* (1998) also noted an increase in the erythrocyte count, hemoglobin level in piglets receiving *Lactobacillus sp.*

Concerning shading effects, shaded goats recorded higher values of PCV, Hb and MCHC concentrations than those of their counterparts left unshaded (Table 4). These results were in accordance with the results obtained by El-Shafie (1997) on Baladi and Damascus goats, Shaker (2003) on Baladi goats and Abdel- Fattah (1994) on sheep. Consistently, El- Shafie (1997) and Barghout *et al.* (1995) found that PCV and Hb values were negatively correlated with environmental temperature. The decrease in hemoglobin concentration at high ambient temperature might be due to the reduction in the concentration of RBC's in the blood as an attempt to reduce O_2 carrying capacity to depress the metabolic rate under heat stress condition. This reduction in RBC's is a result of blood dilution and/ or adjusted by increasing storage in spleen (Reece, 1991). Moreover, Sergant *et al.* (1985) reported that solar radiation caused a decrease in PCV values. Also, Hassanin *et al.* (1996) and Shaker (2003) reported that shading resulted in decreasing AT and increasing the PCV percentages. Heat stress was found to increase water turnover and total body water in farm animals as an adaptive mechanism which enable them to increase their body capacity to store heat and to dissipate excessive energy by evaporation (Yousef and Johnson, 1985 and El- Sherif *et al.*, 1995).

4- 2- The biochemical parameters:

4- 2- 1- Total proteins:

The results in Table (4) revealed that goats fed probiotics had higher concentrations of total protein (TP, g/dl) (P<0.05), albumin (A, g/dl), globulin (G, g/dl) (P<0.01) and lower A/ G ratio than those of non probiotics ones at both experimental sites.

Table (4): Least square means ±SE of some hematological parameters for the four experimental groups as affected by probiotics and sheltering

		PCV	Hb	MCHC	TP	AL	GL	AG ratio
Probiotics (P):		**(±0.358)^{ns}**	**(± 0.273)^{ns}**	**(± 1.235)^{ns}**	**(± 0.426)***	**(± 0.226)^{ns}**	**(± 0.317)***	**(± 0.105)^{ns}**
	Probiotics	28.30	8.12	28.65	8.55a	3.85	4.70	0.90
	Untreated	27.50	7.59	27.53	7.19b	3.66	3.52	1.15
	Change[1]	**+ 0.80**	**+ 0.53**	**+ 1.12**	**+ 1.36**	**+ 0.19**	**+ 1.18**	**- 0.25**
Shading (S):		**(± 0.358)***	**(± 0.273)^{ns}**	**(± 1.235)***	**(± 0.426)^{ns}**	**(± 0.226)^{ns}**	**(± 0.317)^{ns}**	**(± 0.105)^{ns}**
	Unshaded	27.10	7.18	26.37a	8.29	3.79	4.50	1.00
	Shaded	28.70	8.65	29.81b	7.45	3.73	3.72	1.10
	Change[2]	**+ 1.60**	**+ 1.47**	**+ 3.44**	**- 0.84**	**- 0.06**	**- 0.78**	**+ 0.10**
P X S		**(± 0.506)^{ns}**	**(± 0.387)^{ns}**	**(± 1.747)***	**(± 0.603)^{ns}**	**(± 0.320)^{ns}**	**(± 0.448)^{ns}**	**(± 0.148)^{ns}**
Sun	Untreated	26.40	6.77	25.64b	7.47	3.82	3.65	1.19
	Probiotics	27.80	7.53	27.09ab	9.11	3.77	5.35	0.72
	Change[1]	**+ 1.40**	**+ 0.76**	**+ 1.45**	**+ 1.64**	**- 0.05**	**+ 1.70**	**- 0.47**
Shade	Untreated	28.60	8.41	29.41a	6.90	3.51	3.40	1.11
	Probiotics	28.80	8.70	30.21a	7.99	3.94	4.05	1.09
	Change[1]	**+ 0.20**	**+ 0.29**	**+ 0.80**	**+ 1.09**	**+ 0.43**	**+ 0.65**	**- 0.02**
Recovery		**(± 0.500)^{ns}**	**(± 0.604)***	**(± 2.358)***	**(± 0.773)^{ns}**	**(± 0.347)^{ns}**	**(± 0.570)^{ns}**	**(± 0.173)^{ns}**
Sun	Untreated	28.80	6.85b	23.78b	6.36	3.45	2.90	1.20
	Probiotics	29.60	7.74a	26.15a	7.08	3.39	3.69	1.06
	Change[1]	**+ 0.80**	**+ 0.89**	**+ 2.37**	**+ 0.72**	**- 0.06**	**+ 0.79**	**- 0.14**
Shade	Untreated	29.60	9.99c	33.75c	6.97	3.42	3.55	1.02
	Probiotics	28.80	8.31a	28.85a	7.97	3.98	3.91	1.09
	Change[1]	**- 0.80**	**- 1.68**	**- 4.90**	**+ 1.00**	**+ 0.56**	**+ 0.36**	**+ 0.07**

[1], due to probiotics [2], due to shading ns, non-significant *, P< 0.05, P< 0.01**

PCV, packed cell volume (%) Hb, hemoglobin (g/dl) MCHC, mean corpuscular hemoglobin concentration (%)

TP, total protein (g/dl) AL, albumin (g/dl) GL, globulin (g/dl) AG, Albumin/ globulin ratio

In each column any two means having the same letter do not differ significantly.

These results are in agreement with those reported by Kander (2004) where animals fed probiotics had higher total protein levels. Results on sheep and goats, Fayed (2001) and on sheep Fayed *et al*. (2005) reported that total protein and albumin were increased non significantly as a result of feeding yeast culture.

Zomborszky *et al.* (1998) reported that ewes and lambs fed thermolysed brewer's yeast of high nucleotide content had higher but within the physiological limits of plasma total protein, albumin and globulin concentration than control ones.

Regardless the probiotics effect, keeping goats under shade resulted in a decrease in TP and A and G concentrations and an increase in A/ G ratio (Table 4). Similar trends of decreasing globulin values of sun- exposed ewes and goats while albumin showed little increase as compared to the shaded ones were found by El- Sherif *et al.* (1996) and Shaker (2003). This increase in A would ensure high plasma colloid osmotic pressure which shifts fluid from extracellular compartment to plasma. Such mechanism is considered an adaptive means to cope with the increasing sweating rate under hot climate so as to maintain homeothermy (Saxena and Joshi, 1980).

4- 2- 2- Total cholesterol concentration:

The probiotics goats had lower values of total cholesterol than their counterpart of non probiotics ones (Table 5). Consistently, Fayed (2001) reported that sheep and goats fed yeast culture had insignificant lower total cholesterol level than control group. This is might be due to the anticholesterol activity of one type of probiotics in the yeast culture. The serum levels of cholesterol decrease as probiotics bacteria are able to degrade and assimilate this compound. Probably some metabolites of probiotics bacteria inhibit the estrification of cholesterol in intestinal mucosa, thus reducing its level in the organism (Kander, 2004). Some cultures of intestine bacteria reduce cholesterol to caprosterol which is excreted with the bile acid salts and their derivatives (Siuta, 1994). However, the mean values of total cholesterol concentration did not differ significantly among the experimental groups. These results agreed with those reported by Metwally *et al.* (2001) and Mehrez *et al.* (2004) on lambs, Ibrahim *et al. (*2002) on goats and Chiofalo *et al.* (2004) on goat kids.

Regardless the probiotics effects, the present results demonstrated that sun exposed goats had lower total cholesterol concentrations either in probiotics or non probiotics groups (Table 5). These results agree those reported by Shaffer *et al.*, 1981; Abdel Samee, 1987; Aboul Naga, 1987, El- Masry, 1987) which might be attributed to the increase in total body water or the decrease in acetate concentration which is the primary precursor for the synthesis of cholesterol.

4-2- 3- Glucose concentration:

The mean concentration values of glucose in goats fed probiotics were higher than those of non- probiotics ones (Table 5), might be attributed to that probiotics could positively affect glucose absorption from the alimentary tract since animals fed probiotics had higher significant glucose levels (Kander, 2004). Consistently, Nocker *et al.* (2003) reported that supplementing cattle with direct-fed microbials at pre- and postpartum increased ($P<0.05$) blood glucose concentration compared with control cattle. Contrarily, Nursoy and Baytor (2003) reported that the serum glucose didn't differ significantly as a result of supplementing *Saccharomyces cerevisiae* to dairy cow diets. Working on different animals, Metwally *et al.* (2001) and Mehrez *et al.* (2004) on lambs, Ibrahim *et al.* (2002) on goats and Piva *et al.* (1993) on cows reported that the mean concentration of glucose did not differ significantly between control and yeast culture groups.

Table (5): Least square means ±SE of some biochemical parameters for the four experimental groups as affected by probiotics and sheltering

		TC	GLU	AST	ALT
Probiotics (P):		**(± 1.576)^{ns}**	**(± 16.71)^{ns}**	**(± 0.874)^{ns}**	**(± 0.214)^{ns}**
Untreated		29.10	85.83	49.15	13.48
Probiotics		27.80	99.94	47.10	12.07
Change[1]		**- 1.30**	**+ 14.11**	**- 2.05**	**- 1.41**
Shading (S):		**(± 1.576)^{ns}**	**(± 16.71)^{ns}**	**(± 0.874)^{ns}**	**(± 0.214)^{ns}**
Unshaded		27.79	73.74	48.65	12.81
Shaded		29.11	112.03	47.60	12.74
Change[2]		**+ 1.32**	**+ 38.29**	**- 1.05**	**- 0.07**
P X S		**(± 2.229)^{ns}**	**(± 23.631)^{ns}**	**(± 1.235)^{ns}**	**(± 0.302)^{ns}**
Sun	Untreated	29.03	55.03	49.30	13.40
	Probiotics	26.55	92.45	48.00	12.22
	Change[1]	**- 2.48**	**+ 37.42**	**- 1.30**	**- 1.34**
Shade	Untreated	29.17	116.63	49.00	13.56
	Probiotics	29.05	107.42	46.20	11.92
	Change[1]	**- 0.12**	**- 9.21**	**- 2.80**	**- 1.64**
Recovery		**(± 2.382)^{ns}**	**(± 20.831)^{ns}**	**(± 2.013)^{ns}**	**(± 0.442)^{ns}**
Sun	Untreated	23.17	82.07	40.10	13.16
	Probiotics	20.80	98.71	43.50	12.48
	Change[1]	**- 2.37**	**+ 16.64**	**+ 3.40**	**- 0.68**
Shade	Untreated	24.06	65.03	37.40	13.08
	Probiotics	19.23	124.65	42.30	12.90
	Change[1]	**- 4.83**	**+ 59.62**	**+ 4.90**	**- 0.18**

[1], due to probiotics [2], due to shading ns, non-significant GL, glucose
TC, total cholesterol ALT, alanine amino tranferase AST, aspertate amino tranferase
In the same column, means in a certain item having the same letter do not differ significantly

On the other hand, the sun exposed goats had lower blood glucose levels than those of goats kept under shade (Table 5). Some studies showed that blood glucose decrease significantly in animals exposed to heat stress (Abdel Samee, 1987; El- Masry, 1987; Habeeb, 1987 and Yousef, 1990). The decrease in glucose level during heat exposure relates in part to the decrease in blood plasma thyroxin (El- Masry, 1987) or marked dilution of blood and body fluids as a whole in the heat stressed animals (Habeeb, 1987).

4-2- 4- AST and ALT concentrations:

The present results of alanine amino transferase (ALT) and aspartate amino transferase (AST), for the experimental animals showed no significant differences among the four groups (Table 5), indicating that there were no adverse effects of supplementing probiotics on liver function. These results were in agreement with those reported by Metwally *et al*. (2001) and Mehrez *et al*. (2004) on lambs, Ibrahim *et al*. (2002) on goats and Piva *et al.* (1993) on cows. Consistently, Nursoy and Baytor (2003) reported that the serum aspartate aminotransferase didn't differ significantly as a result of supplementing *Saccharomyces cerevisiae* to dairy cow diets. In addition, Chiofalo *et al.* (2004) reported that there were no significant difference observed for AST and ALT in goat kids fed *Lactobacilli*. Zomborszky *et al.* (1998) reported that ewes and lambs fed thermolysed brewer's yeast of high nucleotide content had higher but within the physiological limits of plasma ALT activity than controls.

The results showed that shaded goats had lower mean values of both hepatic enzymes (ALT and AST) even fed probiotics or not. This reduction in ALT and AST might be attributed to the effect of shading in reducing the ambient and radiant ambient temperatures falling on the animals (Table 1). In agreement, Khalil *et al*. (1985), Ashmawy (2000), Gawish *et al*. (2003) and El- Rayes (2005) observed an increment in hepatic enzymes activity in different animal species due to the high ambient temperature.

CONCLUSION

In light of the above, providing shade or probiotics (Biovet- YC) enhanced the metabolic rate and improve of different hematological parameters with goats indicated alleviation of heat stress burden. The results also revealed that the combination of shade and probiotics exhibited the best benefits for the desert animals so as to cope with such harsh conditions in the far south of the eastern desert of Egypt.

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البروبيوتك والتظليل كوسائل لتخفيف الاجهاد الحرارى للماعز الحسانى المرباه

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أجريت هذه الدراسة في محطة بحوث حدربة بمثلث حلايب- شلاتين – ابو رماد على الحدود المصرية السودانية ا لتابعة لمركز بحوث الصحراء لدراسة كفاءة أستخدام كلا من البروبيوتك **(بيوفيت - YC)** أو التظليل او كلاهما معاً كوسائل لتخفيف الاجهاد الحرارى للماعز الحسانى. استخدم فى هذه التجربة عشرون ذكر ماعز حسانى بمتوسط عمر من ١٢- ١٨ شهر ومتوسط وزن ١٩,٤٤±٠,٠٥٤ كليوجرام قسمت الحيوانات الى اربعة مجاميع: المجموعة الاولى وضعت بدون تظليل معرضة للعوامل الجوية المختلفة ولم يتم إضافة البروبيوتك. أما المجموعة الثانية فقد وضعت إيضا بدون تظليل معرضة

للعوامل الجوية المختلفة مع إضافة البروبيوتك إلى العلائق بمعدل ١٠جم/ راس/ يوم. المجموعة الثالثة وضعت تحت الظل مع عدم إضافة البيروبيوتك. أما المجموعة الرابعة فقد وضعت إيضا تحت الظل مع إضافة البروبيوتك إلى العلائق بنفس المعدل. تم تسيجل البيانات الارصاردية (درجة حرارة البيئة، درجة حرارة الاشعاع الشمسى، الرطوبة النسبية) مرتين يوميا كما تم أخذ القراءات الفسيولوجية (درجة حرارة كل من المستقيم- الجلد- غطاءالجسم بالاضافة الى معدل التنفس ومعدل ضربات القلب) مرتين يوميا (٨ ص ، ٢ ظهرا). كما تم جمع عينات الدم وتقدير كل من نسبة الهيماتوكريت، تركيز الهيموجلوبين، تركيز الهيموجلوبين داخل كريات الدم الحمراء، البروتينات الكلية، الجلوبيولين، الألبيومين، النسبة بين الألبيومين: الجلوبيولين، تركيز اللبيدات الكلية، الجلوكوز بالاضافة الى انزيمات الكبد.

أظهرت النتائج أن إضافة البروبيوتك الى علائق الماعز الحسانى أدى إلى تخفيف العبء الحرارى متمثلا فى إنخفاض كلا من الاستجابات الفسيولوجية ($P<0.01$) وزيادة تركيز البروتينات الكلية والجلوبيولين ($P<0.05$) معنويا. علاوة على ذلك، فان إضافة البوربيوتك أدت الى زيادة غير معنويا فى كلا من نسبة الهيماتوكريت، تركيز الهيموجلوبين، تركيز الهيموجلوبين داخل كريات الدم الحمراء، الألبيومين بالاضافة الى الجلوكوز، و إنخفاض كلا من النسبة بين الألبيومين: الجلوبيولين، تركيز اللبيدات الكلية، وإنزيمات الكبد. ومن جهة اخرى فان استخدام التظليل أدى إلى إنخفاض معنوى ($P<0.01$) فى كلا من درجة حرارة كل من المستقيم وغطاءالجسم بالاضافة الى معدل التنفس كما أدى إلى إنخفاض غير معنوى فى كلا من درجة حرارة الجلد، معدل ضربات القلب، البروتينات الكلية، الجلوبيولين، الألبيومين، و إنزيمات الكبد. كما أدى التظليل إلى زيادة معنوية ($P<0.05$) فى كلا من نسبة الهيماتوكريت وتركيز الهيموجلوبين داخل كريات الدم الحمراء وزيادة غير معنوية فى كلا من تركيز الهيموجلوبين، تركيز اللبيدات الكلية والجلوكوز.

أوضحت النتائج المتحصل عليها أن إضافة البروبيوتك أدى الى تحسن أفضل فى الإستجابات الفسيولوجية والهيمو كيميائية من تلك التحسن الناتج عن توفير التظليل. كانت أفضل النتائج المنتحصل عليها من تلك المجموعة الرابعة التى تجمع ما بين إضافة البروبيوتك واستخدام التظليل.

الخلاصة: خلصت التجربة الى ان أستخدام كلا من البروبيوتك أو التظليل اوكلاهما معا أدى الى تحسين قدرة الحيوانات على مواجهة العبء الحرارى الذى تتميز به منطقة جنوب الصحراء الشرقية لمصر.