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EFFECT OF SUPPLEMENTATION WITH NIACIN AND *Nigella sativa* SEEDS ON FRIESIAN CALVES UNDER HEAT STRESS CONDITIONS

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ABSTRACT

Nine Friesian calves, averaged 140 kg live body weight aged 5 months, were randomly allocated into three equal groups. The first group was supplemented with 12 g Niacin (NA) /day per calve for 60 days, the second group was supplemented with 100 mg/kg body weight *Nigella sativa seeds* (NS) while the last group served as a control with no supplemented niacin or *Nigella sativa seeds*. Animals were housed indoors (semi-open shed) during the period of the experiment. Mean maximum air temperatures and relative humidity were 39.9 °C and 67.4%, respectively for the experimental period. Rectal temperature, skin temperature and respiration rate were recorded at different intervals 0800 h, 1200 h, 1600 h and 2000 h. Although, the thermal responses were taken at 1000 h pre exposure and at 1300 h (after 3 h exposure). The thermal responses were affected by treatments. Comparison of rectal temperature for control calves and calves fed NS and NA showed higher temperature (39.3 vs 39.1 and 38.9 °C at 0800 h; 40.0 vs 39.5 and 39.0 °C at 1400 h) and skin temperature (38.1 vs 38.0 and 37.8 °C at 0800 h; 39.3 VS 38.6 and 38.0 °C at 1400 h, respectively) and respiration rate (35 vs 33 and 26 respiration per minute (rpm) at 0800; 49 vs 38 and 31 rpm at 1400 h). Meanwhile, exposure to heat stress for 3 h caused a significant increase of thermal responses in calves fed control diet in comparison with calves fed NS and NA. Calves fed Niacin (NA) showed a decrease of respiration rate, rectal and skin temperatures in comparison to other groups which indicated a possible positive effect of NA supplementation on calves exposed to hot summer conditions.

Calves fed diets supplemented with NA tended to gain less body weight than did calves fed NS or the control diet.

Niacin treatment resulted in metabolic changes that was reflected by an insignificant increase in total protein and total globulin and significant increase in glucose in comparison with calves fed NS or control group.

The results indicated a positive effect of niacin supplementation on Friesian calves exposed to hot summer conditions especially under Upper Egypt conditions with severe heat stress.

Keywords: Niacin, *Nigella sativa* seeds, thermal response, some blood parameters, heat stress and Friesian calves

INTRODUCTION

Summer temperature and humidity conditions can decrease body weight, and reproduction (Younas *et al.*, 1993) in cows. This depression may be mediated by a reduction in feed intake, which is reported to occur as ambient temperature rises above 27 °C (Schwab, 1983). An increase in body temperature usually accompanies this rise in ambient temperature and may be a primary stimulus for reduction in both feed intake and body weight.

Whole body heat content and body temperature are dependent on rates of heat gain and loss (Schearer and Beede, 1990). These rates, in turn, are affected by thermal gradients among core, skin, and ambient sites. Any shift in peripheral or internal vasomotor activity may alter the heat loss process and affect body temperature. Therefore, a treatment that has the potential to increase body heat transfer could possibly ameliorate the effects of reduced feed intake and body weight that occur during summer.

Niacin (NA), a B vitamin, elicits vasodialtory reaction that may be beneficial for cows under heat stress. Peripheral and internal vasodilation, caused by therapeutic concentrations of NA (Altschul, 1994), may enhance heat transfer from core to skin sites and generate a temperature gradient favoring heat loss from skin to environment.

Di costanzo *et al.* (1997) showed in summer that rectal temperature was lower in cows fed niacin than in control cows during periods of mild or severe heat stress.

Black cumin seeds (*Nigella sativa*) are a suitable protein source (30% or more, Khalifa, 1995) to be included in the diets of farm animals due to its cheap price compared with the traditional protein sources. *Nigella sativa's* oil can be used as antioxidant agent as it inhibited the non-enzymatic peroxidation (Houghton *et al.*, 1995 and Saad *et al.*, 1998) which may increase the immunity (Cole *et al.*, 1994) this increase of the immunity may help the animals to tolerate the heat stress. Meanwhile, the research focused on the effect of *Nigella sativa* seeds supplementation for animals under heat stress was lake.

The objective of this study was to evaluate Niacin or *Nigella sativa* seeds supplementation as a means of improving thermoregulatory responses of Friesian calves during summer under Upper Egypt conditions.

MATERIALS AND METHODS

This study was carried out at the Animal Production Dept., Faculty of Agriculture, El-Azhar University at Assiut. Nine Friesian calves, averaged 140 kg live body weight and aged 5 months were used during summer months (July and August). They were randomly allocated into three equal groups. Animals of the first group (NA) were supplemented with 12 mg niacin (NA)/day per calve for (60 days). The second group (NS) was supplemented with 100 mg *Nigella sativa seeds* (NS)/kg body weight while the last group (C) served as a control with no supplemental Niacin or *Nigella sativa seeds*. The chemical analysis of freshly crushed nigella sativa seeds (NS) was 37.9% ether extract , 20.5% crude protein, 14.9% crude fiber, 4.5% Ash, 19.3% NFE and 6.9% moisture.

The animals were housed indoors (semi-open shed) and were individually provided daily with concentrate mixture and roughage (berseem hay) ad lib. All experimental animals received *ad libitum* concentrate mixture consisting of 50% corn, 15% cottonseed meal, 25% soybean meal and 10% crushed barely, 2% limestone and 1% common salt. Chemical analysis showed that the concentrate mixture contained 9.84% moisture, 15.6% crude

protein, 2.72% either extract, 7.99% crude fiber, 57.37% nitrogen free extract and 6.48% ash.

The animals of the three groups were kept under the same managerial and hygienic conditions. Water was available all the day.

Rectal temperature (RT), skin temperature (ST) and respiration rate (RR), were recorded at 0800 h and 1400 h and at 0800, 1200, 1600 and 2000 h. Meanwhile, the thermal responses were measured at 1000 h pre exposure directly solar radiation and 3 h after exposure at 1300 h. Ambient temperature was recorded daily through out the experimental period using a thermometer hanged at a level of about two meters from the floor with a hygrometer for the relative humidity (RH, %) recording. Averages of air temperature and RH% through out the experimental periods are illustrated in table (1). Body weight (BW) and daily gain were recorded at the beginning of the study and at the end of the experimental period which lasted for 60 days.

Table (1): Average air temperature (AT) and relative humidity (RH) allover the day time during the experimental period.

Day time	AT °C	RH %
0800 h	38.0	73.8
1400 h	39.8	67.6
1000 h (pre exp.)	39.0	65.4
1300 h (3h after exp.)	41.6	62.6
0800 h	38.0	73.6
1200 h	39.0	68.8
1600 h	40.1	54.2
2000 h	38.2	56.7

Exp. Exposure.

Blood samples (about 10 ml) were weekly obtained from the jugular vein before feeding during the experimental period. Sera were obtained by centrifugation of the blood samples for 20 minuets at 3000 rpm. Sera glucose, urea-N, total protein and albumin concentrations were determined using bio Merieux Rains Kits (France). Total globulin was calculated by subtracting albumin from total protein concentrations.

Data were statistically analyzed using the general linear model GLM (SAS, 1985).

RESULTS AND DISCUSSION

1) Body performance

Initial and final body weight (BW) and daily weight gains are given in Table, 2

Table (2): Effect of *Nigella sativa seeds* (NS) and Niacin supplementation (NA) on growth of Friesian calves (X±SE) during the experimental period (60 days).

Items	Control	NS	NA	P
No. of animals	3	3	3	
Initial BW kg	139.5	140.5	139.9	NS
Final BW kg	192.5	193.3	187.3	NS
Daily gain kg/d	0.89±0.90	0.88±0.99	0.79±0.80	NS

No significant differences were observed in body gain during the experimental period. But calves fed diets supplemented with Niacin tended to be lowered in body weight gain during the experimental period than calves fed *Nigella sativa* seeds or the control diet. Di costanzo *et al.* (1997) reported that cows fed 36 g niacin/d per cow tended to gain less body weight during 17 days than cows fed the control diet.

2) The thermal and respiratory responses :

Thermal and respiratory responses at 0800 h and 1400 h are shown in table,3 and Figs. 1, 2 & 3.

Table (3): Effect of *Nigella sativa seeds* (NS) and Niacin (NA) supplementation on thermal responses at 0800 h and 1400 h of Friesian calves.

	Dietary treatment		
Item	Control [1]	*Nigella sativa*	Niacin
0800 h			
Rt (°C)	39.3 ± 0.18 b	39.1 ± 0.11 ab	38.9 ± 0.30 a
St (°C)	38.1 ± 0.13 b	38.0 ± 0.21 b	37.8 ± 0.12 a
RR (rpm)[2]	35.0 ± 1.48 B	33.0 ± 1.18 B	26.0 ± 2.35 A
1400 h			
Rt (°C)	40.0 ± 0.26 C	39.5 ± 0.06 B	39.0 ± 0.09 A
St (°C)	39.3 ± 0.30 C	38.6 ± 0.19 B	38.0 ± 0.09 A
RR (rpm)[2]	49.0 ± 3.24 C	38.0 ± 1.28 B	31.0 ± 1.90 A

[1] No supplemental NS or NA. a,b,c (P < 0.05)
[2] Respiration rate, number per minute. A,B,C (P < 0.01)
RT: Rectal temp. & ST: Skin temp. & RR: Respiration rate

As shown in Table (3) and Figs. (1, 2 & 3) the thermal responses were affected significantly by *Nigella sativa* seeds (NS) or Niacin supplementation (NA). Comparison of rectal temperature between control calves and calves fed NS and NA showed higher temperatures (39.3 vs 39.1 and 38.9 °C at 0800 h; 40.0 vs 39.5 and 39.0 °C at 1400 h), skin temperature (38.1 vs 38.0 and 37.8 °C at 0800 h; 39.3 vs 38.6 and 38.0 °C at 1400 h) and respiration rate (35 vs 33 and 26 rpm at 0800 h; 49 vs 38 and 31 rpm at 1400 h, respectively). Meanwhile, exposed animals to heat stress for 3 h showed a significant increase of thermal response for calves fed control diets compared with calves fed *Nigella sativa seeds* or Niacin supplementation, Table 4 and Figs. 4, 5 & 6.

Fig. (1): Effects of niacin and nigella sativa supplimentation on thermal responses at 0800 h and 1400 h of Frisian calves.

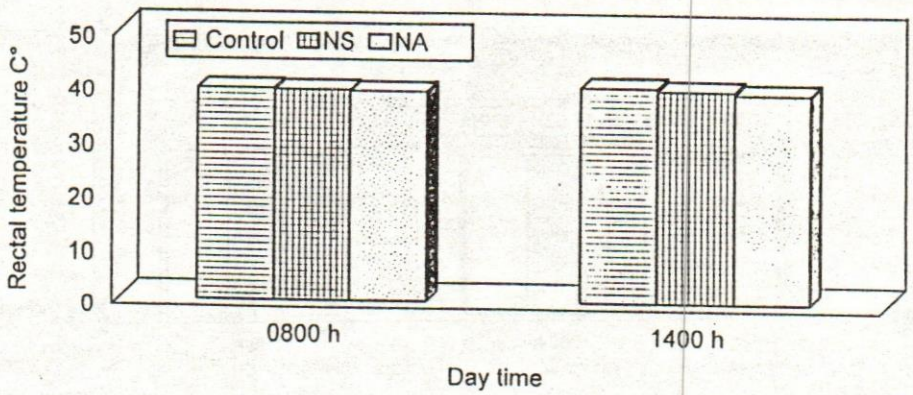


Fig. (2): Effects of niacin and nigella sativa supplimentation on skin tempraure at 0800 h and 1400 h of Frisian calves.

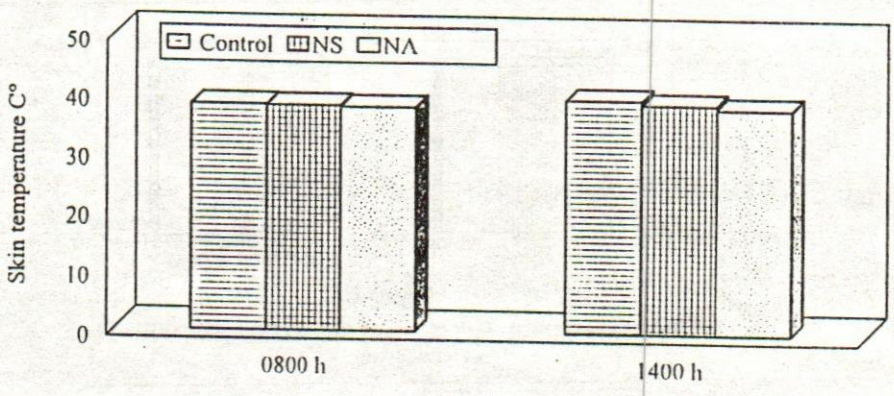


Fig. (3): Effects of niacin and nigella sativa supplimentation on respiration rate at 0800 h and 1400 h of Frisian calves.

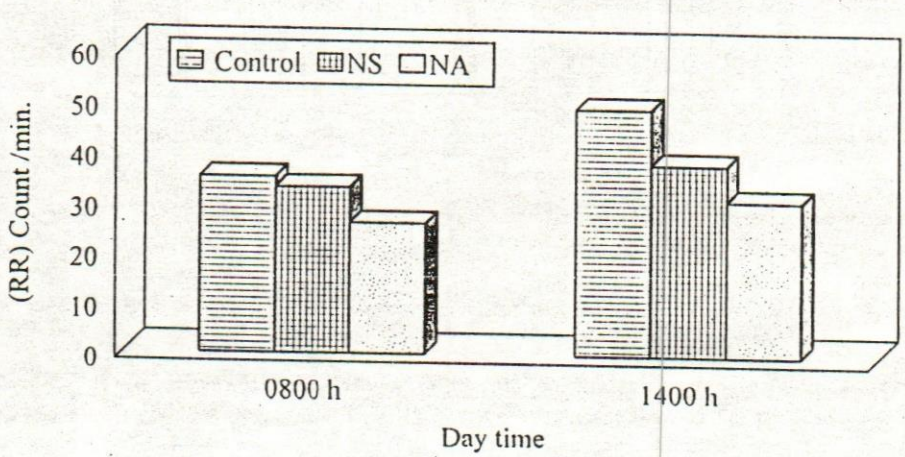


Fig. (4): Effects of niacin and nigella sativa supplimentation on thermal responses at 1000 h and 1300 h of Frisian calves under heat stress.

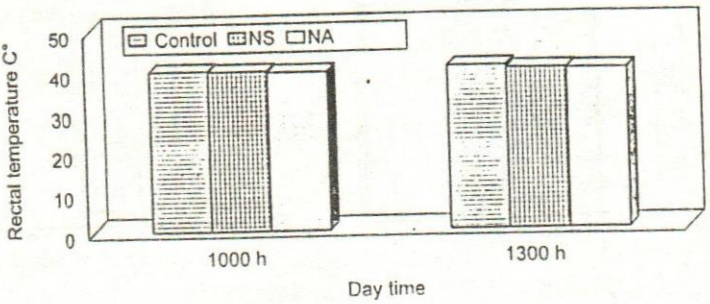


Fig. (5): Effects of niacin and nigella sativa supplimentation on skin temperature at 1000 h and 1300 h of Frisian calves under heat stress.

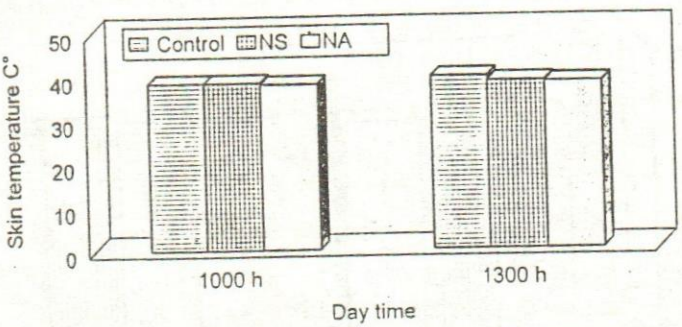


Fig. (6): Effects of niacin and nigella sativa supplimentation on respiration rate at 1000 h and 1300 h of Frisian calves under heat stress

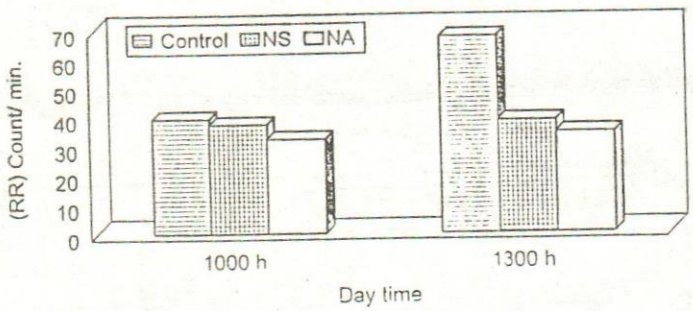


Table (4): Effect of *Nigella sativa* seeds (NS) and Niacin (NA) supplementation on thermal responses of Friesian calves exposed to direct solar radiation from 1000 h to 1300 h.

Item	Dietary treatment		
	Control [1]	*Nigella sativa*	Niacin
1000 pre exposure			
Rt (°C)	39.7 ± 1.10 b	39.5 ± 0.13 b	39.2 ± 0.16 a
St (°C)	38.4 ± 0.03 b	38.4 ± 0.14 b	38.0 ± 0.34 a
RR (rpm)[2]	39 .0± 0.34 C	37.0 ± 1.18 B	32 .0± 0.59 A
1300 post exposure			
Rt (°C)	40.2 ± 0.15 B	39.5 ± 0.03 A	39.3 ± 0.03 A
St (°C)	39.5 ± 0.12 C	38.4 ± 0.12 B	38.1 ± 0.27 A
RR (rpm)[2]	67.0 ± 1.22 C	38.0 ± 0.90 B	34.0 ± 0.59 A

[1] No supplemental NS or NA. a,b,c (P < 0.05)
[2] Respiration rate, number per minute. A,B,C (P < 0.01)
RT: Rectal temp. & ST: Skin temp. & RR: Respiration rate

In this field rectal temperature, skin temperature and respiration rate were significantly affected by *Nigella sativa seeds* or niacin supplementation at 0800 h, 1200, 1600 h and 2000 h (Table, 5 and Figs. 7, 8 & 9).

Table (5): Effect of *Nigella sativa seeds* and niacin supplementation on thermal responses of Friesian calves at 0800 h 1200 h 1600 h and 2000 h.

Item	Dietary treatment		
	Control [1]	*Nigella sativa*	Niacin
0800 h			
Rt (°C)	39.3 ± 0.20 B	39.0 ± 0.18 AB	38.8 ± 0.30 A
St (°C)	38.1 ± 0.28 ab	38.0 ± 0.20 a	37.8 ± 0.12 a
RR (rpm)[2]	35.0 ± 1.48 B	33.0 ± 1.28 B	26.0 ± 1.18 A
1200 h			
Rt (°C)	39.6 ± 0.12 b	39.4 ± 0.08 ab	39.1 ± 0.018 a
St (°C)	38.2 ± 0.14 b	38.0 ± 0.12 ab	37.7 ± 0.18 a
RR (rpm)[2]	35.0 ± 1.48 C	32.0 ± 0.90 B	26.0 ± 1.80 A
1600 h			
Rt (°C)	39.9 ± 0.26 B	39.4 ± 0.05 AB	39.1 ± 0.08 A
St (°C)	39.2 ± 0.30 C	38.4 ± 0.19 AB	38.1 ± 0.09 A
RR (rpm)[2]	48.0 ± 3.24 C	35.0 ± 0.86 B	30.0 ± 0.99 A
2000 h			
Rt (°C)	39.6 ± 0.12 b	39.2 ± 0.15 a	39.2 ± 0.16 a
St (°C)	38.4 ± 0.12 b	38.4 ± 0.12b	38.0 ± 0.12 a
RR (rpm)[2]	37.0 ± 1.17 B	34.0 ± 0.18 B	27.0 ± 1.80 A

[1] No supplemental NS or NA. a,b,c (P < 0.05)
[2] Respiration rate, number per minute. A,B,C (P < 0.01)
RT: Rectal temp. & ST: Skin temp. & RR: Respiration rate

As shown in tables (3, 4 & 5) thermal and respiratory responses were significantly lower for calves fed diets supplemented with niacin than for calves fed diets supplemented with *Nigella sativa seeds* (NS) or the control diet. Skin temperature were the most items significantly less (P<0.01) in

Fig. (7): Effects of niacin and nigella sativa supplimentation on thermal response at 0800 h , 1200 h, 1600 h and 2000 h of Frisian calves.

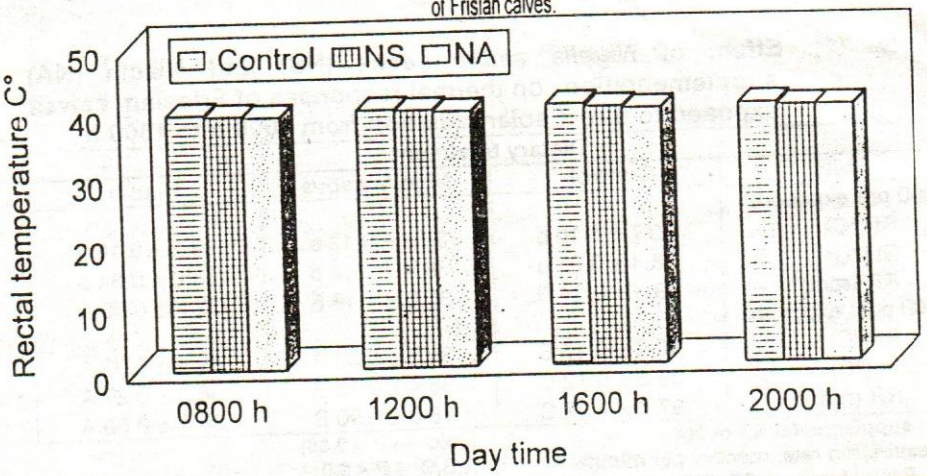


Fig. (8): Effects of niacin and nigella sativa supplimentation on skin temperature at 0800 h , 1200 h, 1600 h and 2000 h of Frisian calves.

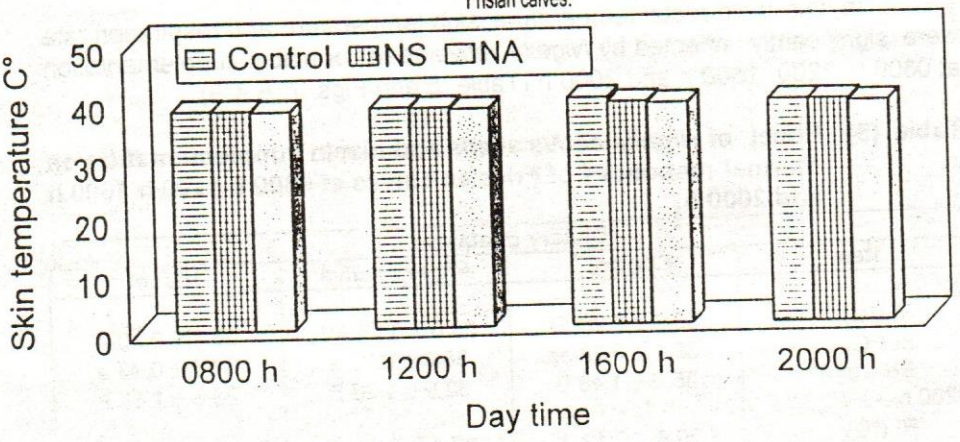
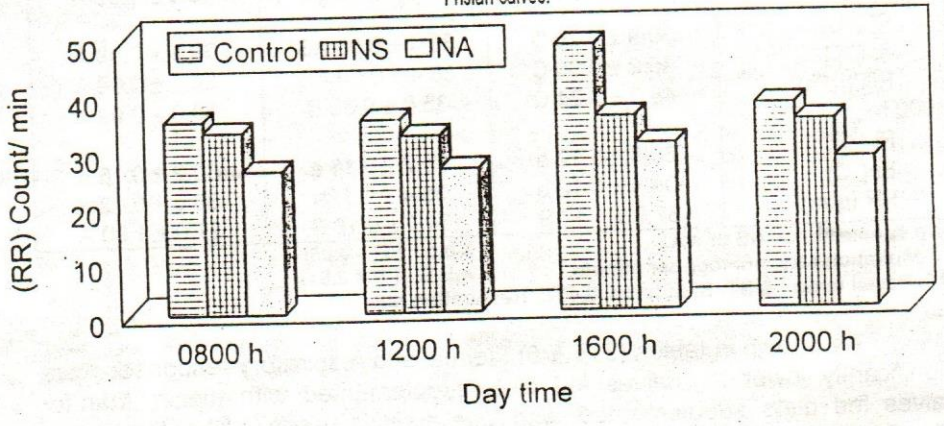


Fig. (9): Effects of niacin and nigella sativa supplimentation on respiration rate at 0800 h , 1200 h, 1600 h and 2000 h of Frisian calves.



calves fed NA than calves fed NS or the control. This observation was reported by Di costanzo *et al.* (1997) that skin temperature was significantly lower for cows fed diet supplemented with NA (12 g/h for 17 days) than for cows fed the control diet at both the 0800 and 1600 h while no significant effect of dietary treatment on rectal temperature at 0800h or 1600 h were observed. In this field, Di costanzo *et al.* (1997) found that rectal temperatures at 0800, 1600 and 2200 h were not affected by dietary treatments. In contrast, skin temperature at 0800 h was significantly lower for diet supplemented with NA than for cows fed the control diet. Similarly, skin temperature at 1600 and 2200 h followed a decreasing trend in cows fed diets supplemented with NA (24 g for 17 days).

Two possible explanations are available for the reduction in skin temperature for calves fed diets supplemented with niacin as reported by Di costanzo *et al.* (1997). The likely explanations is that heat transfer might have been reduced, thus a comparable reduction in heat production would be expected as the core temperature is to remain constant. Another explanation would be increased evaporative heat loss, which cool the skin, lower temperature, and increase the thermal gradient for heat loss. If heat loss had taken place, then heat production would have been controlled and would have allowed the calves to maintain a constant core temperature. Additional studies are needed to determine the specific changes in heat transfer that are produced by NA treatment. Further evaluation is also required to determine different doses or treatment schedules of NA that could result in a significant improvement in production during periods of heat stress.

3) Biood metabolites :

Serum metabolites concentrations for calves fed diets supplemented with *Nigella sativa* seeds or Niacin and calves fed the control diet are reported in table (6).

Table (6): Effect of *Nigella sativa* seeds (NS) or niacin (NA) supplementation on metabolic profile of Friesian calves.

Metabolites	Dietary treatment			
	Control [1]	NS	NA	± SE
Total protein (g/dl)	7.02	7.22	7.28	0.38
Albumin (g/dl)	2.98	3.07	2.90	0.22
Total globulin (g/dl)	4.04	4.15	4.38	0.38
Glucose (mg/dl)	64.80 B	66.70 B	73.20 A	2.01
Urea N (mg/dl)	25.6	26.7	24.4	1.09

1 No supplemented NS or NA.
A,B ($P < 0.01$)

As show in Table (6) total protein and its fractions (albumin and globulin) and urea N were not affected by treatments. But serum glucose concentration in calves fed diets supplemented with Niacin were significantly higher ($P<0.01$) than for calves fed diets supplemented with Nigella sativa seeds or calves fed the control diet. Previous reports of Thornton and Schuetz (1980) indicated that administration of 6.5 to 17 g/d of Niacin to goats elevated blood glucose and insulin. In this field, Di costanzo *et al.* (1997) found that plasma glucose concentrations were significantly higher in

cows fed 36 g/d niacin for 17 days. This increase in serum glucose concentration might be an indication of greater gluconeogenic activity promoted by the partial lipogenic suppression elicited by niacin at the cellular level as reported by Ruegsegger and Schaltz (1986).

CONCLUSION

The present experiment determined wheather *Nigella sativa seeds* or Niacin supplementation could modify the thermoregulatory ability of Friesian calves during summer conditions. Results indicated that, rectal temperature, skin temperature and respiration rate were reduced in calves fed Niacin or *Nigell sativa seeds* during heat stress than calves fed the control diets. But, the thermal responses were less in calves fed Niacin than calves fed *Nigell sativa seeds* supported a possible positive effect of Niacin supplementation on calves exposed to hot summer conditions. Measurements of blood flow and metabolic rate are necessary to determine the mechanism by which Niacin influences heat transport and calves comfort.

REFERENCES

Altschul, R. (1994). Niacin in vascular disorders and hyperlipemia. Charles C. Thomas, Springfield, IL.

Cole, N.A.; R.H. Gallavan; S.L. Rodiguez and C.W. purdy. (1994). Influence of triiodotyrosine injection on calf immune response to an infectious bovine rhinotracheitis virus challenge and nitrogen balance of lambs. J. Anim. Sci., 72: 1263.

Di costanzo, A.; J.N. Spain and D.E. Spiers (1997). Supplementation of nicotinic acid for lactating Helestein cows under heat stress conditions. J. Dairy Sci., 80: 1200.

Houghton, P.J.; R. Zarka; B.H. Delas and J.R. Hoult (1995). Fixed oil of N,Sativa and derived thymouinone inhibit Eicosanied Generation in leukocytes and membrane lipid peroxidation. Planto Medic. 336.

Khalifah, M.M.M. (1995). Nigella seed oil meal as a protein supplement in broiler diets. M. Sc. Thesis Fac. Of Agric., Alexandria Univ.

Ruegsegger, G.J., and L.H. Schaltz (1986). Use of a combination of propylene glycol and niacin for subclinical ketosis. J. Dairy Sci., 69: 1411.

Saad, I.E.; R.A. Amal and A.A. Mandor (1998). Effect of administration of alpha. Tochopherol, *Nigella sativa seeds* together with deeps fried fat on glutathione dependent enzymes and lipid peroxidase in rats liver. Assiut vet. Med. J., 38: 151.

SAS (1985) SAS/ATAT. Guide for personal computer, 1985. SAS inst. Cary N, C. USA.

Schwab, C.G. (1983). Supplemental niacin for lactating cows. New England Dairy Feed conf., Concord, NH.

Shearer, J.K., and D.K. Beede. (1990). Thermoregulation and physiological responses of dairy cattle in hot weather. Agri. Practice 11: 5.

Thornton,J.H. and L.H.Sclultz. (1980). Effects of administration of nicotinic acid on glucose, insulin and glucose tolerance in ruminants. J. Dairy Sci., 63:262.

Younas, M.J.; J.W. Fuquay; A.E. Smith and A.B. Moore (1993). Estrous and endocrine responses of lactating Holstein to forced ventilation during summer. J. Dairy Sci., 76: 430.

تأثير إضافة النياسين وبذور حبة البركة للعجول الفريزيان تحت ظروف الإجـــهاد الحرارى

محمد محمد عزب عوض الله

قسم الإنتاج الحيوانى – كلية الزراعة – جامعة الأزهر – فرع أسيوط

قسمت تسعة عجول فريزيان (متوسط الأوزان ١٤٠ كجم وعمر ٥ شهور) عشوائياً إلـــى ثـــلاث مجاميع متساوية . المجموعة الأولى غذيت عليقة تحتوى على ١٢ جرام نياسين/يوم/حيوان لمدة ٦٠ يـــوم . المجموعة الثانية غذيت علىعليقة تحتوى على ١٠٠ ملليجرام من بذور حبة البركة /كجم مـــن وزن الجســم بينما المجموعة الأخيرة (الثالثة) تم إعتبارها مجموعة كنترول لم تتغذ على أى من النياســـين وبـــذور حبـــة البركة . تم تسكين الحيوانات فى إسطبل شبه مفتوح أثناء فترة التجربة بمزرعة الكلية بأسيوط بهدف دراســـة هل اضافة النياسين وبذور حبة البركة لها تأثير ايجابى على العجول المعرضة لظروف ارتفاع الحرارة فـــى الصيف وخاصة مصر العليا التى تعانى من اجهاد حرارى على الحيوان دون ان يكون هناك تـــأثير ســـلبى على فسيولوجيا الحيوان وايهما افضل.

متوسط الحد الأعلى من درجة الحرارة والرطوبة النسبية كـــانت ٣٩,٩°م ، ٦٧,٤% بـــالترتيب خلال فترة التجربة . درجة حرارة الجسم والجلد ومعدل التنفس تم قياسها فى كل من الساعة الثامنة صباحـــا ،الثانية عشر ظهراً، والرابعة عصراً وأيضا الثامنة مساء . علاوة على الاستجابات الحرارية المختلفة (فـــى كل من درجة حرارة الجسم والجلد ومعدل التنفس) والتى تم أخذها أيضا الســـاعة العاشـــرة صباحـــا قبـــل التعرض وبعد ثلاث ساعات من التعرض المباشر لأشعة الشمس الســـاعة الواحـــدة ظـــهراً وقـــد تـــأثرت. الاستجابات الحرارية بالمعاملات . مقارنة درجة حرارة الجسم للمجموعة الكنترول بكل من العجول المغـــذاة على بذور حبة البركة والنياسين. أظهرت الدراسة إرتفاع حرارة الجسم (٣٩,٣ °م مقارنـــة بـــ ٣٩,١ و ٣٨,٩ °م الساعة الثامنة صباحا ، ٤٠,٠°م مقارنة بـــ ٣٩.٥ – ٣٩,٠ °م الساعة الثانية ظهراً) وحـــرارة الجلد (٣٨,١ °م مقارنة بـــ ٣٨,٠ و ٣٧,٨ °م الساعة الثامنة صباحا ، ٣٩,٣ °م مقارنـــة بـــ ٣٨,٦ و ٣٨,٢ °م الساعة الثانية ظهراً) ومعدل التنفس (٣٥ مقارنة بـــ ٣٣ ، ٢٦ مرة فى الدقيقة الســـاعة الثامنـــة صباحا و ٤٩ مقارنة بـــ ٣٧ و ٣٢ مرة فى الدقيقة الساعة الثانية ظهراً) . علاوة على ذلك للمجاميع الثـــلاث على التوالى التعرض للاجهاد الحرارى لمدة ثلاث ساعات أظهر إرتفاعاً معنوياً فى الاســـتجابات الحراريـــة للعجول المغذاة على العليقة الكنترول مقارنة بالمغذاة على كل من النياسين وبذور حبة البركة .

أظهرت العجول المغذاة على النياسين إنخفاضا فى معدل التنفس ودرجة حرارة الجلـــد مقارنـــة بالمجـــاميع الأخرى مما يؤيد إمكانية التأثير الإيجابى لإضافة النياسين للعجول المعرضة لظروف ارتفاع الحـــرارة فـــى الصيف.

اتجهت العجول المغذاة على النياسين إلى إنخفاض فى وزن الجسم مقارنة بالعجول المغذاة علـــى بذور حبة البركة والكنترول .

أظهرت المعاملة بالنياسين تغيرات ميتابوليزمية إنعكست على زيادة غير معنوية فى كل من البروتين الكلـــى والجلوبيولين الكلى وزيادة معنوية فى مستوى سكر الدم مقارنة بالعجول المغذاة على بـــذور حبـــة البركـــة والكنترول .

أوضحت النتائج تأثير ايجابى لإضافة النياسين لعجول الفريزيان المعرضة لظروف حر الصيف خاصة تحـــت ظروف مصر العليا التى تعانى من اجهاد حرارى .