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Triiodothyronine and Blood Metabolites in Relation to Milk Yield and Spray Cooling of Heat Stressed Lactating Friesians and Holsteins in Egypt.

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TO study the relationship between milk yield and blood metabolites, 48 Friesian and Holstein cows in their second lactation during 90 - 120 days post-partum were used in the I st experiment. Triiodothyronine was negatively and total protein, globulin, lipids, cholesterol and urea were positively correlated with daily milk yield during the hot summer season in Egypt. Whereas, haemoglobin, haematocrit, albumin and creatinine were not correlated with milk yield. The animals with the highest milk yield exhibited significantly lower value of T_3 and tended to have significantly higher levels of total protein, globulin, total lipids, cholesterol and urea than the cows with the lowest milk yield during hot summer. whereas concentrations of haemoglobin, haematocrit, albumin and creatinine did not differ appreciably between high and low-yielding animals. In the 2 *nd* experiment, twenty heat stressed lactating Friesian and Holstein cows were used to study the effect of tap water sprinkling on milk yield and some related physioglogical Parameters. Subjecting the heat stressed animals to sprinkling with tap water lead to a significant increase in each of daily milk yield, blood haemoglobin and haematocrit, plasma T_3 and total protein. While, rectal temperature and respiration rate decreased significantly ($p < 0.05$). The other parameters studied did not change significantly as a function of sprinkling treatment.

Key words : Friesian, Holstein, Milk production, Heat stress, Triiodothyronine, Blood metabolites, Sprinkling .

Varies management practices have been used to reduce or eliminate negative impact of heat stress on beef and dairy cattle. They include, physical means such as : spray and sprinkling , shade structures, fans, drinking cool water, air conditioning , zone air cooling and inspired air cooling physiological means such as : administeration of hormones, antihormones, diaphoretics, diuretics and acid- base balance regulators, as well as nutritional management to improve acquisition and utilization of nutrients (Beede and Collier , 1986 : Stermer *et al.*, 1986 ; I gfono *et al.*, 1987 ; Her *et al.*, 1988 ; and zoa-Mobe *et al.*, 1989) . Strategies to manage better moderate to high producing dairy cows to lessen impact of heat stress should result in greater productivity in tropical and subtropical environments.

Direct wetting of the animal is a very effective practice . It is often used in an emergency situation to reduce heat stress. The use of direct wetting by sprinkling as a measure for increased animal performance is still unsetteld (Hahn, 1985). Objectives of present experiments were to evaluate efficacy of water hose sprinkling to increase milk yield of Friesian and Holstein cows during Egyptian Summer heat stress and to compare the levels of thyroid hormones, blood metabolites and haematological parameters in relationship to milk yield in high and low producing Friesians and Holsteins maintained under summer climate in Egypt in order to identify animals at any early age with the ability to produce large amounts of milk efficiently .

Material and Methods

Two expirements were conducted on lactating F & H cows under hot summer in El-Tarouty farm, Fakous, Sharkeya Governorate, Egypt. Experiment I was designed to study the relationship between milk yield and each of blood T_3 and metabolites. Comparison between high and low-yielding animals for daily milk yield, blood haematology , T_3 and blood metabolites were also done in this experiment. Experiment 2 was carried out to study spray cooling effects on milk production and some related physiological parameters in heat stressed F & H cows under Egyptian climate .

Twenty four lactating F cows (12 high and 12 low yielding cows) were chosen from a herd containing 200 F and the same numbers of lactating H cows were chosen from a herd containing 170 H were used un Experiment I. Twenty lactating F & H cows were assigned randomly to two equal groups (each group contained 5F and 5H cows) were used in Experiment 2. The cows borned and reared under Egyptian climatic conditions. The cows were subjected to natural hot summer season during July and August, 1991 and lasted for 30 days with out any treatment in Experiment I. While, in Experiment 2 one group was used as a control and the other group was subjected to tap water sprinkling (25°C) using a water hose 7 times daily (each hose duration about 3 minutes) during the high temperature period of the day from 10.00 - 17.00 hr. Ambient temperature (AT) and relative humidity (RH%) averages from 10.00- 17.00 hr were 36.5 ± 0.6 c° and 51 ± 1.5 %, respectively . The average minimum and maximum AT during the experimental period were 24°C and 37°C, while, RH % averages were 76 and 40, respectively. The AT remained above 32°C for 12 h daily . AT and RH % were recorded daily using a thermohygrograph.

The F and H cows aged 5-6 years and their body weights average was 500-550 and 470 - 500 kg, respectively. All animals were in their second lactation during 90 - 120 days post-partum.

The animals were provided with a basal ration consisting of pelleted concentrate, rice straw and sorghum according to their nutritional requirements (NRC, 1988) and watered freely *ad libitum*. The pelleted concentrates was offered three times daily before milking process. Rice straw was offered at the rate of 5 kg/head daily after the morning and evening milkings. Sweet sorghum (*Sorghum vulgare*) was offered *ad libitum* once daily after the afternoon milking . The chemical composition and nutritive values of the concentrate feed, rice straw and sorghum are given in Table 1.

TABLE 1. Chemical composition and nutritive values of the experimental feed stuffs.

Ingredients	Concentrate feed mixture*	Rice straw	Sweet sorghum
Moisture	63.7	69.2	778.0
Composition of dry matter (g/kg):			
Grude protein (CP)	163.0	29.8	20.0
Ether extract (EE)	57.0	13.0	2.0
Crude fibre (CF)	168.5	422.8	75.0
Nitrogen free extract (NFE)	421.3	383.4	68.0
Ash	126.5	150.0	56.0
Nutritive values % (Calculated):			
Starch value (SV) **	61.22	9.50	11.60
Total digestibel nutrients (TDN)**	66.18	15.00	14.70
Metabolisable energy (ME)***	2.397	0.543	0.467

* Concentrate feed mixture was composed of 35% undecorticated cotton seed cake, 33% wheat bran, 22% yellow corn, 4% riice bran, 2% lime stone, 1% sodium chloride and 3% molasses.
** Calcutated from Abou-Raya (1967).
*** M. Cal/ kg TDN (%) Catcutated from NRC (1988).

The experimental groups were left loose in separate semi-sheltered yards. The yard measured (120 X 20 m) surrounded with wire. The floor was of soil. One third of the serface area of the yard was covered at about 3.5 m height with an asbestos roof. Each group of animals was housed during day and night and the ventilation was by open air.

The cows were milked three times daily at 4.00, 12.00 and 20.00 hr and the yields were recorded. Milk samples from six consecutive milkings at the last 2 days of the experiment were composited and frozen until analyzed for specific gravity, total solids, total protein, butterfat, solids-not- fat, lactose and ash according to Ling (1963) .

On the last day of each experiment, blood samples were withdrawn at morning before feeding from the mammary vein of each animal. Blood haemoglobin (Hb) and packed cell volume (PCV) were estimated immediately after blood samples collection. The plasma or serum was separated within one hour and stored at - 20 °C until assyed for serum total protein, total lipids, total cholesterol and creatinine using reagent colorimetric methods. The globulin values were obtained by subtracting albumin from total protein . Urea-N and albumin were determined using commercial kits purchased from Bio-Merieux, Laboratory Reagent and Products, France. Plasma triiodothyronine was assayed by kits purchased from Diagnostic Products corporation, Los Angelos, california, USA. Rectal temperature and respiration rate were measured two times weekly during the experimental period .

To determine the statistical differences between the control and experimental data in experiment 2, the unpaired variate studient "t" test was used. Daily milk yield for each animal in experiment I was correlated with blood metabolites and T_3 . Correlation coefficient values were calculated as devicing an index for milk production in F & H cows. The difference between the averages of high, and low-yielding groups were tested by means of the "F" test . The statistical analysis were carried out according to Snedecor and Cochran (1982) .

Results and Discussion

Milk yield and blood parameters

The level of T_3 was higher in the low yielding groups and there was a negative relationship between milkyield and plasma T_3 level in each of Friesian and Holstien cows (Tables 2& 3) . Such negative relationship have been described previously in cattle under thermoneutral conditions (Hart *et al.*, 1978 ; Walsh *et al.*, 1980 and Blum *et al.*, 1983 and buffalo (El- Masry and Habeeb, 1989). The relatively low T_3 hormone level in high-yielding, as compared to low-yielding Friesians and Holsteins may be an expression of differences in energy metabolism between low and High-yielding Friesians and Holsteins. Since , Blum *et al.*(1979 and 1980), Blum and Kunz (1981) and Kunz and Blum (1981) claimed that low energy intake and negative energy balances were associated with the decrease in thyroid hormones, especially T_3, level in pregnant and lactating cows, growing steers and mature sheep. The association of low circulating thyroid hormone levels in high-yielding cows with a reduction of maintenance requirements remains to be clarified. Another explanation of this phenomenon was suggested by Vanjonack and Johnson (1975) who reported that , because thyroid hormones are excreted by the mammary gland, cows with high milk production lose greater amounts of these hormones through the udder, thus resulting in lower plasma concentrations. These authors also discussed the possibility of an enhanced uptake of thyroid hormones by target organs.

Data presented in Table 2&3 showed that rectal temperature, respiration rate and blood haemoglobin and packed cell volume in lactating Friesians and Holsteins did not differ significantly as a function of either production level or strain differences. These

TABLE 2. Daily milk yield and its composition, thyroid function, blood haematology and blood metabolites ($\bar{X} \pm S.E.$) in high and low-yielding Friesians and Holsteins maintained under subtropics.

Items	Friesians		Holsteins	
	High-yielding	Low-yielding	High-yielding	Low-yielding
Daily milk yeild (kg)	23.2 ± 0.3^{Aa}	13.4 ± 1.3^{Ac}	22.0 ± 0.4^{Bb}	9.9 ± 0.3^{Bd}
Yield of milk components (kg/ day):				
Total solids	2.8 ± 0.1^{Aa}	1.7 ± 0.1^{Ac}	2.1 ± 0.1^{Bb}	1.1 ± 0.1^{Bd}
Fat	0.7 ± 0.1^{Aa}	0.5 ± 0.0^{Ac}	0.5 ± 0.0^{Bb}	0.3 ± 0.0^{Bd}
Protein	0.5 ± 0.0^{Aa}	0.4 ± 0.0^{Ac}	0.5 ± 00^{Bb}	0.2 ± 0.0^{Bd}
Lactose	1.5 ± 0.1^{a}	0.6 ± 0.1^{c}	1.0 ± 0.1^{b}	0.5 ± 0.0^{d}
Ash	0.2 ± 0.0^{Aa}	0.1 ± 0.0^{Ac}	0.2 ± 0.0^{Bb}	0.1 ± 0.0^{Bd}
Solids-not-fat	2.2 ± 0.1^{Aa}	1.2 ± 0.1^{Ac}	1.6 ± 0.0^{Bb}	0.8 ± 0.0^{Bd}
Specific gravity	1.0283±0.0	1.0292±0.0	1.0303±0.0	1.0264± 0.0
Thyroid function:				
T3 (ng/ dl)	68.4 ± 7.2^{a}	89.4 ± 7.5^{c}	66.8 ± 6.8^{b}	82.6 ± 9.4^{d}
Blood haematology :				
Haemoglobin (g/dl)	8.3±0.3	8.9±0.1	8.2±0.1	8.4±0.2
Packed cell volume (%)	37.0±2.8	39.3±3.2	37.6±2.2	39.2±1.2
Blood metabolites:				
Total protein (g/dl)	6.7 ± 0.2^{a}	6.0 ± 0.2^{c}	6.6 ± 0.1^{b}	6.1 ± 0.2^{d}
Albumin (g/dl)	3.3±0.2	3.4±0.2	3.2±0.1	3.2±0.1
Globulin (g/dl)	3.4 ± 0.2^{a}	2.6 ± 0.3^{c}	3.4 ± 0.2^{b}	2.9 ± 0.1^{d}
A/G ratio	1.1±0.1	1.5±0.3	1.0±0.1	1.1±0.0
Total lipids (mg/ dl)	388.1 ± 17.7^{Aa}	319.8 ± 17.9^{Ac}	352.6 ± 27.6^{Bb}	314.1 ± 23.3^{Ad}
Cholesterol (mg/ dl)	102.0 ± 6.9^{a}	80.9 ± 7.3^{c}	101.4 ± 6.9^{Bb}	81.3 ± 4.8^{d}
Urea-N (mg/dl)	15.8 ± 0.4^{Aa}	14.5 ± 0.6^{Ac}	14.9 ± 0.4^{Bb}	14.0 ± 0.5^{Bd}
Creatinine (mg/dl)	1.3±0.1	1.1±0.1	1.1±0.1	1.1±0.1
Rectal temperature (°C)	39.6±0.1	39.8±0.1	39.7±0.1	39.9±0.3
Respitration rate (rpm)	72.6±3.3	79.6±2.5	72.0±3.2	76.8±4.5

A & B Means having unlike supersript letters differ significantly due to strain ($P < 0.05$)
a,b,c & d Means having unlike superscrpit letters differ significantly due to production level (High or low- yielding), $P < 0.05$.

TABLE 3. Relationships between milk yield and blood parameters.

Items	Friesians	Holsteins
T_3	-0.392*	-0.402*
Haemoglobin	-0.054	-0.017
Haematocrit	-0.099	-0.201
Total protein	0.390*	0.459*
Albumin	0.211	0.198
Globulin	0.410*	0.397*
Total lipids	0.407*	0.390*
Cholesterol	0.411*	0.402*
Urea	0.389*	0.397*
Creatinine	0.256	0.159

* $P < 0.05$

findings are in agreement with Blum *et al.* (1983) who found no association between milk yield and Hb or PCV.

Total protein and globulin were higher in high than low yielding Friesians or Holsteins and there was a significant ($p < 0.05$) relationship between milk yield and each of total protein and globulin the two strains. The albumin level did not significantly differ between high and low yielding cows and did not correlate with milk yield. A similar pattern of changes were described in cattle (Blum *et al.*, 1983) and goats (El-Deen *et al.*, 1985) under thermoneutral conditions.

Total lipids and cholesterol concentrations were positively correlated ($p < 0.05$) with milk yield in friesian and Holstein cows and there were significant ($p < 0.05$) higher levels in the high-yielding than in the low-yielding group. Hart *et al.* (1978) found that the concentrations of non-esterified fatty acids and B-hydroxybutric acid were higher in the high than low-yielding cows. In contrast, Blum *et al.* (1983) found no difference in phospholipids and cholesterol between cows with a high and those with a low milk yield.

Plasma urea concentrations presumably are a reflection of amino acid catabolism in the liver. Thus, urea-N level in the present study was significantly higher in the high yielding as compared to low yielding animals. There was a significant ($p < 0.05$) positive correlation between plasma urea and milk yield in Friesians or Holsteins. Stark *et al.* (1978) suggested that there is a genetic connection between plasma urea nitrogen and milk production. Contrary to these findings, Blum *et al.* (1983) found no significant differences between high and low yielding cows. The same authors reported that differences in the intake of protein and its digestion in the intestinal tract, changes of tissue protein breakdown, utilization of amino acid N at the cellular level and the urinary excretion rate may have accounted for the changes of plasma concentrations. plasma creatinine level did not correlate significantly with milk yield and there were no significant differences between high and low-yielding Friesians and Holsteins in plasma creatinine level.

Remarkable differences in milk yield and its composition as well as , in plasma total lipids and urea levels were observed between Friesians and Holsteins maintained under high environmental temperature (Table 2) . This may be due to the genetical differences and to hyperthermia of animals under hot conditions .

The results from this experiment revealed that plasma triiodothyronine, total protein, globulin, total lipids, cholesterol and Urea-N concentrations may be used to identify cows differing in milk yield under hot climate.

Effect of sprinkling

Sprinkling has been shown to be effective in reducing heat stress and improving animal's performance and productivity and has been economically feasible in Arizona (Stott and Wiersma, 1974) , the United Arab Emirate (Ansell, 1976 and 1981), Columbia (Igono *et al.*, 1987), Florida (Garner *et al.*, 1986) and Israel (Her *et al.*, 1988). Other responses have ranged from no response in Oklahoma (Nelson *et al.*, 1961) to a variable response over three summers in Misisipi (Brown *et al.*, 1974) which showed that water sprinkling of heat stressed lactating cows in summer (1970) improved milk production significantly, though in summers of 1971 and 1972 the same treatment showed no significant response in milk production. Similarly, in Tanzania, Macfarlane and Steevens (1972) obtained no benifit by spraying the cows in summer and attributed that to the high relative humidity (90 to 98%) during the study and to the inadequate duration of sprinkling as the spray was applied only prior to and after milking.

Ibrahim (1990) working on the same cows and the same experimental conditions of the present study, reported that rectal temperature increased ($p < 0.01$) in Friesians (40.2 vs 38.8) and Holsteins (40.3 vs 38.7) during summer than winter season of Egypt. Respiration rate, also increased ($p < 0.01$) in Friesians (90 vs 32) and Holsteins (81 vs 32). The same author added that daily milk yield and its components, blood haematocrit and serum T_3 , creatinine, urea, total protein, albumin, globulin, total lipids and cholesterol decreased ($P < 0.01$) as a function of exposing Friesians and Holsteins to hot summer season of Egypt.

In the present study (Table 4) sprinkling Friesians and Holsteins under Egyptian climate with a water hose (25°C) 7 times daily (each hosed duration about 3 minutes) improved daily milk yield significantly by 7.3 in Friesians and 17 % in Holsteins.

TABLE 4. Effect of sprinkling tap water on milk yield, yeild of milk components, respiration rate, rectal temperature, blood haematology and some blood metabolites (Mean ±S.E) of heat-stressed lactating Friesian and Holstein cows in Egypt.

Items	Friesians			Holsteins		
	Summer season	Sprinkling tap water	Change (%)	Summer season	Sprinkling tap water	Change (%)
Milk yield (kg/day)	19.2 ± 1.4	20.6 ± 1.8	7.3*	18.2 ± 0.8	21.3 ± 1.6	17.0**
Yield of milk components(kg/day):						
Total solids	2.0 ± 0.2	2.3 ± 0.2	14.0	1.0 ± 0.1	2.1 ± 0.2	20.8
Fat	0.6 ± 0.1	0.7 ± 0.2	3.6	0.4 ± 0.1	0.5 ± 0.1	22.8
Protein	0.4 ± 0.0	0.7 ± 0.1	29.1	0.5 ± 0.0	0.6 ± 0.0	18.2
Ash	0.1 ± 0.0	0.1 ± 0.0	1.8	0.1 ± 0.0	0.1 ± 0.0	- 0.2
Lactose	0.8 ± 0.2	0.9 ± 0.2	16.0	0.7 ± 0.1	0.9 ± 0.1	18.1
Solids-not-fat	1.4 ± 0.2	1.6 ± 0.2	19.0	1.3 ± 0.1	1.6 ± 0.1	20.2
Specific gravity	1.0305± 0.0	1.0300± 0.0	- 0.1	1.0312± 0.0	1.0277± 0.0	- 0.3
Respiration rate (r.p.m.)	85.8 ± 3.7	64.2 ± 5.3	- 25.2**	80.2 ± 3.4	62.2 ± 6.5	- 22.4**
Rectal temperature (°C)	39.7 ± 0.3	39.3 ± 0.3	- 1.0*	40.0 ± 0.1	39.8 ± 0.3	- 0.5*
Blood haematology:						
Haemoglobin (g/dl)	8.6 ± 0.8	9.1 ± 0.4	5.8*	8.5 ± 0.1	9.0 ± 0.4	5.9*
Packed cell volume (%)	25.7 ± 3.0	27.8 ± 2.6	8.2*	25.5 ± 2.8	29.0 ± 2.8	13.7*
Blood metabolites:						
Triiodothyronine (ng/dl)	75.8 ± 4.0	84.2 ± 6.9	11.1*	74.0 ± 4.6	84.0 ± 7.1	13.5*
Creatinine (mg/dl)	1.3 ± 0.1	1.4 ± 0.1	7.7	1.2 ± 0.1	1.3 ± 0.1	8.3
Urea-N (mg/dl)	15.5 ± 1.0	16.5 ± 0.8	6.5	14.8 ± 0.6	15.8 ± 0.6	6.8
Total protein(g/dl)	6.0 ± 0.3	6.5 ± 0.3	8.3*	6.0 ± 0.4	6.4 ± 0.3	6.7*
Albumin (g/dl)	3.4 ± 0.2	3.6 ± 0.2	5.9	3.3 ± 0.1	3.5 ± 0.2	6.1
Globulin (g/dl)	2.6 ± 0.3	2.9 ± 0.3	11.5	2.7 ± 0.5	2.9 ± 0.2	7.4
A/G ratio	1.5 ± 0.4	1.3 ± 0.2	- 13.3	1.4 ± 0.4	1.2 ± 0.1	- 14.3
Total lipids (mg/dl)	262.6 ± 27.7	308.8 ± 21.0	17.6	313.8 ± 26.3	363.4 ± 29.1	13.6
Cholesterol (mg/dl)	107.0 ± 8.0	116.2 ± 6.2	8.6	101.2 ± 6.8	111.8 ± 1.3	10.5

* $P < 0.05$
** $P < 0.01$

Similarly, plasma T_3 and total protein and haemoglobin and packed cell volume increased significantly ($p < 0.05$) in both Friesians and Holsteins. Rectal temperature and respiration rate decreased significantly ($p < 0.05$) as a function of tap water sprinkling. On the other hand the other blood parameters studied (Table 4) did not change appreciably as a result of exposing the heat stressed Friesians and Holsteins to sprinkling treatment. The increase in daily milk yield and blood components in the heat stressed cows due to sprinkling may be attributed to improvement in the appetite of animals which caused an increase in protein utilization either from feed or from digested rumen microorganisms (Habeeb *et al.*, 1989). Another explanation of that phenomenon is the role of cooling technique in alleviating the thermal hormonal alterations and other factors which depressed the milk yield under heat stress. In addition, the energy used for cooling processes may be spared for production functions. Moreover, cooling technique aids animals to reach a steady physiological state which leads to increase in blood metabolites. On the other side, daily yield of milk components increased insignificantly as a function of sprinkling treatment. This may be due to the small numbers of Friesians and Holsteins used in this experiment.

References

Ansell, R.H. (1976) Maintaining European dairy cattle in the Near East. *World Anim. Rev.* **20**:1.

Ansell, R.H. (1981) Extreme heat stress in dairy cattle and its alleviation. In environmental aspects of housing for animal production, edited by *J.A. Clark, Butterworths,* London, 285.

Beede., D.K. and Collier, R.J. (1986) Potential nutritional strategies for intensively managed cattle during thermal stress. *J. Anim. Sci.*,**62** : 543.

Blum, J.W. ; Gingins, M.; Vitins, P. and Bickel, H. (1980) Thyroid hormone levels related to energy and nitrogen balance during weight loss and regain in adult sheep. *Actaendocr. Copnh.* **93** : 440.

Blum, J. W. and Kunz, P. (1981) Effects of fasting on thyroid hormone levels and kinetics of reverse triiodothyronine in cattle. *Acta Endocr. Copnh.* **98** : 234.

Blum, J.W.; Kunz, P.; Leuenberger, H.; Gautschi, K. and Keller, M. (1983) Thyroid hormones, blood plasma metabolites and haematological parameters in relationship to milk yield in dairy cows. *Anim. Prod.* **36** :93.

Blum, J.W. ; Kunz, P.; Schnyder, W.; Thomson, E.F.; Vitins, P.; Blom , A. and Bickel, H., (1979) Changes of hormones and metabolites during reduced and compensatory growth of steers. *Annls. Rech. Vet* **10** : 391.

Brown, W.H.; Fuquay, J.W.; McGee, W.H. and Lyengar, S.S.(1974) Evaporative cooling for Misisipi dairy cows. Trans. *Amer. Soci. Agric. Eng.* **17**: 513.

El-Deen, A.M.; Hassan, A.; Samak, M. and Abo-Elezz, Z.R. (1985) Changes in milk yield and certain blood biochemical components of cross-bred (Baladi X Angora) goats and their correlation associated with lactation, pregnancy and dry seasons. *World Rev. Anim. Prod.* **21**: 35.

El-Masry, K.A. and Habeeb, A.A. (1989) Thyroid function in Lactating Friesian cows and water buffalos under winter and summer Egyptian condition. 3 *rd.* Egypt. British Conf. on Anim., *Fish and Poultry Prod. Alexandria, Egypt*, **2**: 613.

Garner, J.C.; Bucklin , R.A. and Kunkle, W.E. (1986) Sprinkling water and fans to reduce heat stress of beef cattle. *Amer. Soci. Agric. Engin.* No; **4021** : 1.

Habeeb, A.A. ; Abdel-Samee, A.M. and Kamal, T.H. (1989) Effect of heat stress, feed supplementation and cooling technique on milk yield, milk composition and some blood constituents in Friesian cows under Egyptian conditions. 3 *rd.. Egyptian-British Conf . on Anim., Fish and Poultry Prod. Alexandria, Egypt*, **2** : 629.

Hahn, G.L. (1985) Management and housing in hot environments. In, stress physiology in livestock, Mohamed K.Yousef (Ed). *CRC Press, Inc. Boca Raton, Florida:* 151.

Hart, I.C.; Bines, J.A.; Morant, S.V. and Ridley, J.L (1978) Endocrine control of energy metabolism in the Cow: Comparison of the levels of hormones (Prolactin, GH, insulin and thyroxine) and metabolites in the plasma of high and low yielding cattle at various stages of lactation. *J. Endocr* **77**: 333.

Her, E.; Wolfenson, D.; Flamenbaum, I.; Folman, Y. ; Kaim , M. and Berman, A. (1988) Thermal, productive and reproductive responses of high yielding cows exposed to short-term cooling in summer. *J. Dairy Sci.* **71**: 1085.

Ibrahim, H. (1990) Studies on alleviating thermal stress in imported Friesian cattle under Egyptian environmental conditions. *Ph. D. Thesis* . Faculty of Agric., Zagazig Univ., Egypt.

Igono, M.O.; Johnson, H.D.; Steevens, B.J.; Krause, G.F.and Shanklin, D.M. (1987) Physiological, productive and economic benefits of shade, spray and fan system versus shade for Holstein cows during summer heat. *J. Dairy Sci.* **70** : 1069.

Kunz, P. and Blum, J.W. (1981) Effect of pre and post parturient energy intake on blood plasma levels of hormones and metabolites. In, metabolic disorders in farm animals. Proc. 4 *th int Conf. on Production Disease in Farm Animals*. Instut fur physiologie, Physiologische Chemie Und Ernahrungs physiologie, Tierarztliche, *Fakultat der Universitat Munchen*. **49**.

Ling, E.R. (1963) *Atext book of dairy chemistry*, volume **2**, Practical. 3 rd. edchampan and hall ltd. London.

Macfarlane, J.S. and Steevens, B.A. (1972) The effect of natural shade and spraying water on the productivity of dairy cows in the tropics. *Tropical Animal Health Production*, **4** : 249.

Nelson, G.L.; Mahoney, G.W.A. and Berouseh, E.R. (1961) Hot weather shelter for lactating dairy cattle. Oklahoma State University *Tech. Bull. T*- 87.

National Research Council (1988) Nutrient requirements of dairy cattile. *Sixth Revised edition, National Academy Press*. Washington, D.C. 1988.

Snedecor, C.W. and Cochran, W.G. (1982) Statistical Methods. 7 *th*. Edition, Iowa Univ. *Press. Ames, USA.*

Stark, A.J.; Manston, R. and McLintock, A.E. (1978) The blood composition of Friesian bulls: Variations with age and relationships with the results of progeny tests. *J. Agric. Sci.* Cambridge **91**: 579.

Stermer, R.A. ; Brasington, C.F.; Coppock, C.E.; Lanham, J.K. and Milam, K.Z. (1986) Effect of drinking water temperature on heat stress of dairy cows. *J. Dairy Sci.* **69** : 546.

Stott, G.H. and Wiersma, E. (1974). Response of dairy cattle to an evaporative cooled environment . Proc. Inter. Livestock Environ. Symp., ASAE : 88.

Vanjonack, W.J. and Johnson, H.D. (1975) Effects of moderate heat and milk yield on plasma thyroxine in cattle. *J. Dairy Sci.* **58** : 505.

Walsh, D.S. ; Vesely, J.A. and Mahadevan, S. (1980) Relationship between milk production and circulating hormones in dairy cows. *J. Dairy Sci.* **63** : 290.

Zoa-Mboe, A. ; Head, H.H. ; Bachman, K.C.; Baccari, F.; JR. and Wilcox, C.J. (1989) Effects of bovine somatotropin on milk yield and composition , dry matter intake and some physiological functions of Holstein cows during heat stress. *J. Dairy Sci.* **72** : 907.

العلاقة بين انتاج اللبن وهرمون التراى أيوونيرونين ومكونات الدم وتأثير رش الماء على ومكونات الدم وتأثير رش الماء على الابقار الفريزيان والهولستين المعرض للعبء الحرارى فى مصـــــر

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فى التجربة الاولى : لدراسة العلاقة بين انتاج اللبن ومكونات الدم تم اختيار ٤٨ حيوان من أبقار الفريزيان والهولستين فى موسم حليبها الثانى (٩٠ - ١٢٠ يوم بعد الولادة) . وضعت الحيوانات لمدة شهر تحت ظروف المناخ الحار صيفا فى مصر ، وتم تسجيل انتاجها وبعض الخصائص الفسيولوجية ، وكانت النتائج كما يلى : -

١- وجدت علاقة سالبة معنوية بين كمية اللبن الناتج وتركيز هرمون الترأي أيود وثيرونين فى دم كل من السلالتين .

٢- وجدت علاقة موجبة مهنوية بين كمية اللبن الناتج وبين تركيز البروتين ، الجلوبيولين ، الليبدات الكلية ، الكلولسيترول واليوريا فى الدم فى كل من الفريزيان والهولستين .

٣ - لم يتضح وجود علاقة بين كمية اللبن الناتج وبين تركيز الهيموجلوبين ، الهيماتوكريت ، الاليبومين والكرياتنين فى الدم .

فى التجربة الثانية : تم اختيار ٢٠ حيوان أخرى قسمت الى مجمــوعتين كــل مجموعـــة اشتمــلت علــى ٥ أبقـــار فريزيــــان ،

٥ هولستين . أستخدمت احدى المجموعتين للمقارنة وتم تعريض الاخرى للرش بالماء ٧ مرات يوميا عند ارتفاع درجات الحرارة . أدت معاملة الرش بالماء الى تحسين معنوى فى انتاج اللبن ، هيموجلوبين الدم ، الهيماتوكريت ، هرمون التراى أيود وثيرونين ، والبروتين الكلى فى الدم وفى نفس الوقت انخفض معدل التنفس ودرجة حرارة الجسم انخفاضا معنويا فى كل من السلالتين بينما لم يحدث تغير معنوى فى بعض المقاييس الفسيولوجية الاخرى المدروسة .