Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2016; 4(3): 19-22

Received: 03-03-2016
Accepted: 04-04-2016

Amer M Hussain
Assistant. Prof. Dr; Anat. Dept.; Coll. of vet. Med.; Bagh. Univ. Iraq.

Correspondence
Amer M Hussain
Assistant. Prof. Dr; Anat. Dept.; Coll. of vet. Med.; Bagh. Univ. Iraq.

The histological relationship between the environmental stress and milk production in Iraqi Buffaloes; *Bubalus bubalis*

Amer M Hussain

Abstract
The present article deals with the effect of environmental stress and milk production of buffaloes during the summer time. Data of daily milk production and skin samples were collected during 2015. Skin samples were processed by routine histological techniques. The results revealed that buffaloes reared in marshes and running river (abundant water and feeding) recorded a significant higher milk production than buffaloes reared sporadically indoors under (limited regions of water and feeding). The apparent histological result of this study demonstrated that the sweat glands of all buffaloes were simple, poorly developed and lies deeply in the dermis. The secretory acinus was surrounded by few myoepithelial cells. The basal layer of epidermis was loaded with abundant melanocytes. On the other hand, sebaceous glands were large, lobulated and well developed. The results showed that the arteriovenous anastomosis in the skin was limited. Despite the presence of some adaptive responses in buffaloes like the low body temperature, dormant thyroid gland, it was concluded that buffaloes still had poor adaptability to heat stress.

Keywords: Buffaloes, Heat stress, Milk production, Sweat gland.

1. Introduction
Buffalo *(Bubalus bubalis)* is the second most important animal in the world because it shares more than 95% of milk production in South Asia [9].Heat stress has been reported to have a direct effect on breeding efficiency of female buffaloes and reduces the intensity and duration of estrus [16]. Buffaloes exhibit signs of great distress when exposed to direct solar radiation or when working in the sun during hot weather. This is due to the fact that buffaloes body absorbs solar radiation because of their dark skin and sparse coat or hair, and possess less efficient evaporate cooling system due to their poor sweating ability. This evokes a series of drastic changes in biological functions that include depression in feed intake, disturbance in metabolism of water. Such changes result in impairment of growth, production performance [14]. On the other hand sweat glands of buffaloes were poorly developed and normally lie deeply in the dermis of the skin. Whereas, the sebaceous glands were highly developed compared to those of the cow's skin [1]. The thyroid gland of Buffaloes was of dormant type [11]. All cows were dry during the hotter months from June until September [17]. The swamp buffaloes of Southeast Asia are usually considered poor milk producers; the daily milk yield of philippines swamp buffalo is (1.7-2.7) kg (Philippines council for agriculture & sources researches (PCARR) 1978). The Thailand swamp buffaloes yielded (3-5) kg/day. In China, Murrah buffaloes produce (4-5) kg daily.

2. Materials and methods
Data of daily milk production of 1100 healthy Iraqi buffalo (Bubalus *bubalis)* were randomly collected and analyzed from buffalo's keeper and agricultural stations offices in south and middle regions of Iraq in May 2015.These buffaloes were divided into non-stressed and stressed groups. (940 were categorized as non-stressed buffaloes lived freely in abundant-water regions (Natural marshes or running river water in Kut, Missan marshes and artificial ponds in Al-Rashdia and Fudhaylia in Baghdad) (having abundant sources of water and food). The remaining 160 buffaloes were categorized as stressed buffaloes and were living sporadicaly in limited –water sources. The process of milking was carried out twice a day. In order to study the role of sweat glands in the process of thermoregulation and its relation to milk production, skin specimens were collected from abattoir of the same studied regions. Samples were fixed in 10% Neutral buffered formalin solution, routine histological

Preparations were carried out, samples were sectioned at 5-7 um [19]. Hematoxylin & Eosin was used for staining. Histological sections were examined under light microscope. The number of myoepithelial cells /sweat gland acinus was measured based on [7]. The density of sebaceous gland /mm^2 was measured by counting the number of sebaceous glands in twenty microscopic fields from different specimens then get the mean number in one microscopic field which represent the number of sebaceous glands in 1.13 mm^2, then turn it to 1mm^2, this is according to [11]. The average body temperature of 50 buffaloes in each region (at 2.5 pm) were measured rectally. All the Images were done by means of a digital camera (MEM 1300). The measurements were carried out with image J (Java-based image processing program developed at the National Institute of Health) [3].

3. Results

Results of this study showed that the daily milk production of non-stressed buffaloes was significantly higher at $p<0.05$ than the daily production of stressed buffaloes (Table 1).

The histological results revealed that the basal layer of epidermis was heavily packed with cells containing Melanin-filled cytoplasm [Fig.2 and 4].The secretory acini of sweat glands located deeply in the dermis, far away from the surface of the skin with very long secretory canals (66um ± 0.85). These acini were small, lined by simple squamous to low cuboidal epithelium with small lumen. The small ducts consist of one layer of slightly acidophilic epithelial cells while the main excretory duct lined by high cuboidal epithelium. Stratified epithelium was not observed. Only 1-2 myoepithelial cells /acinus were present [Fig 1-3]. On the other hand. Buffaloes had well developed, larger, and lobulated sebaceous glands Fig. [2 and 4]. There was an average of 450 sebaceous glands/cm2 of the skin. The results also revealed that the arteriovenous anastomoses in the skin of buffaloes were limited [Fig.2&3]. The mean values of rectal body temperature ranged from 37.8-39.2 with a mean of about 38.5.

Table 1: Mean milk production (Kg) in stressed and non-stressed buffaloes.

	Number of animals	Female body weight(Kg)	Total daily milk production (Kg)/buffalo	Period of milk production(days)
Stressed buffaloes	160	400-600	10-16	200
Non-stressed buffaloes	940	900- 1000	25-30	200

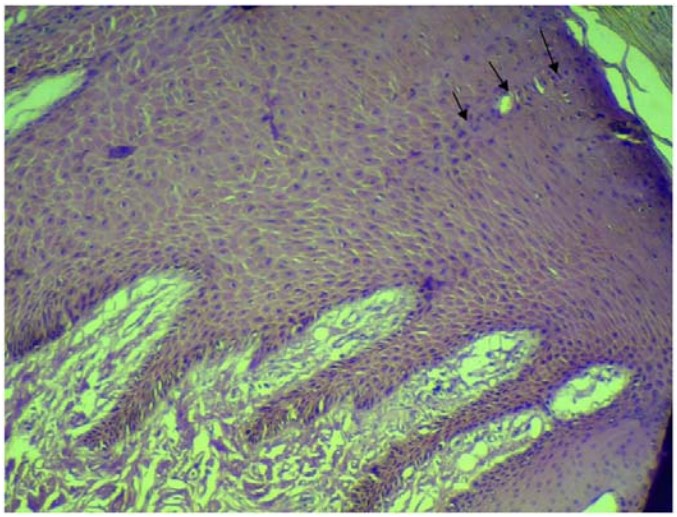

Fig 1: Epidermis of skin of buffalo. Note the direction of one excretory duct of the sweat gland toward the surface of the skin (arrows). H& E stain.X40.

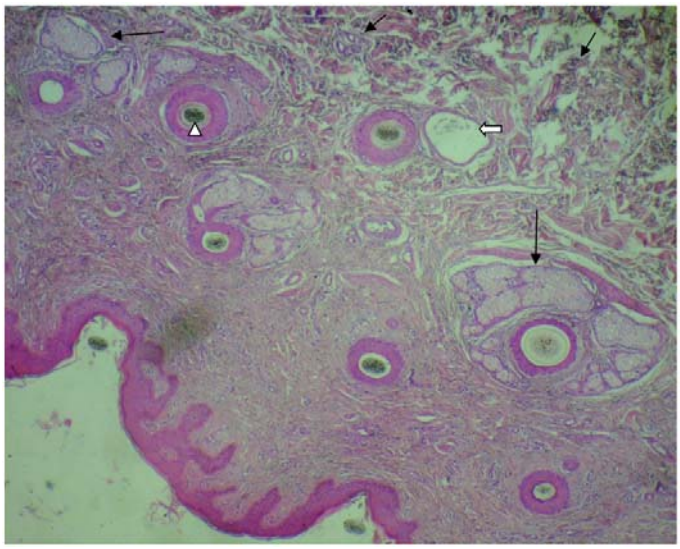

Fig 2: Skin of buffaloes. Note the small deep acini of sweat glands (short black arrows), their ducts (white arrow), the abundant melanocytes (white arrow head) and the lobulated sebaceous glands (Long black arrow). H & E stain. X 100.

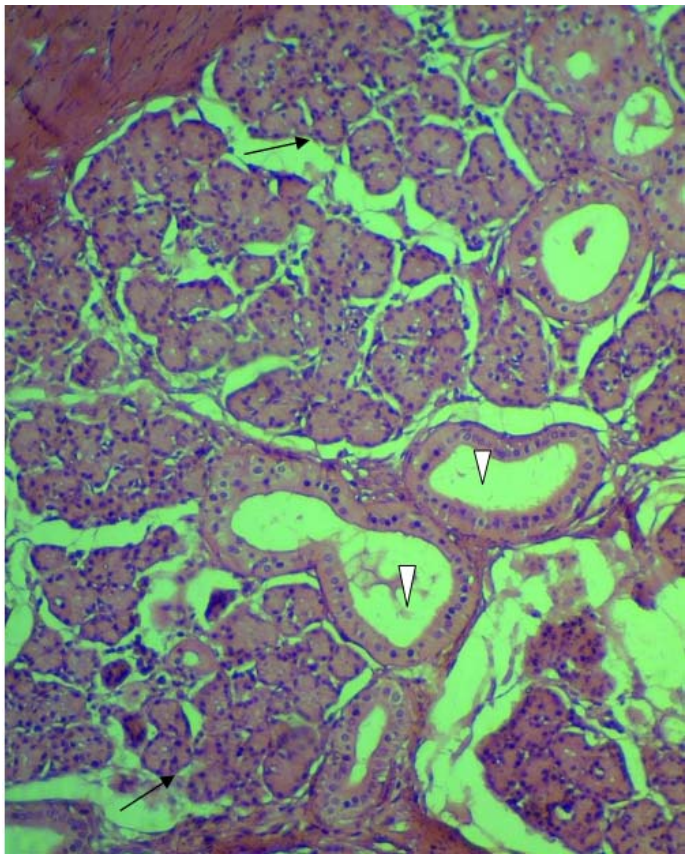

Fig 3: High magnification of buffaloe skin dermis refers to the secretory acini (black arrows) and their duct system (white arrow heads) of sweat glands. H&E stain. X 400.

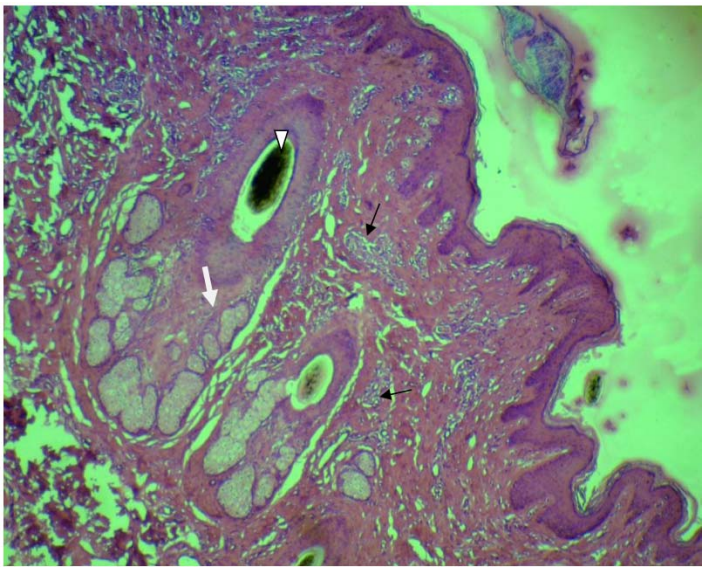

Fig 4: Skin of buffaloe. Note the distribution of simple sweat glands (black arrows) and sebaceous glands (white arrow).The dark spot (white arrow head) refers to the melanocyte within the hair follicle. H & E stain. x200.

4. Discussion

Heat stress is a common problem causing great loss to buffalo and dairy industry. Heat stress affects directly milk production in females. It occurs when there is imbalance between heat production within the body and its heat dissipation [12]. Reduction in milk output is the principal economic loss of environmental stress in buffaloes. [12]. Decrease in milk production due to heat stress was more apparent in buffaloes reared in water- abundant regions compared to water-limited regions. This decrease becomes stronger with decrease in feed intake by the animals to compensate heat stress [4, 17]. In fact 35% of reduced milk production is due to decreased feed intake while the remaining 65% is attributable to direct effect of heat stress [4]. Milk production in cow has been found to be reduced when ambient temperature and temperature humidity index increases above critical threshold. Quantity of milk protein and solid not fat (SNF) have been found to be reduced during heat stress in dairy cattle [4, 8]. 20% less milk yield in cattle kept in sun than milk yield in cattle kept in shed [13]. Similarly, there was a 10.7% higher milk production in cows kept in shed than that in cows kept in sun during hot weather [15]. The study was in accordance to the findings of [17] in different species of cows and in variance with [5] who reported that buffaloes had better adaptability to harsh climatic conditions, alleviate heat stress, tolerant to tropical diseases and survived under poor crop residue feeding and management

practices. On the other hand, the stratum basale layer includes satellite cells with melanin-filled cytoplasm [18]. This confirms the finding of the present results concerning the dark color of skin buffaloes. Sweat glands play an important role in thermoregulation in production of fluid which evaporates on the body surface, thereby the surface becomes cooler. The limited amount of the sweat secretion and their deep location induce stress. In addition, the abundant melanocytes, the small number of myoepithelial cells around each secretory acinus. All these factors will decrease the efficacy of cooling mechanism leading to heat stress. This is confirmed by the findings of [1] about sweat glands of buffaloes and sebaceous glands, who also stated that the arteriovenous anastomosis was common in cows in comparison to buffaloes. This anastomosis participates in regulation of body temperature. When the environmental temperature elevated, the peripheral blood vessels of the skin were dilates to aid in thermoregulation [10]. Buffalo skin has one-six the density of sweat glands that cattle skin has [8]. However, buffaloes endured solar radiation with heat and water deprivation better than Friesians [12]. The study confirmed by the seasonal results of [7, 11]. All the above histological properties were adversely affecting the thermoregulatory mechanism of the skin, which in turn could have an adverse effect on milk production. Moreover, heat stress makes the buffaloes to stay daylong in water to avoid hot climatic stress and finally to reserve the output of milk production. The present study recommended that rearing of Iraqi buffaloes should be carried out only in abundant water-containing regions with shade or wallow otherwise stress and reduction in milk production takes place.

5. References

1. Al-a'atbi RSI. Comparative histological study on the integument of Buffaloe and Cow. MSc Thesis. Baghdad University. Iraq, 2010.
2. Al-Bideri AW. Ultrastructure and cellular organization in different anatomical sites of some adult Iraqi mammal's epidermis. MSc Thesis, Al-Qadissiya University, 2003.
3. Ballesteros R, Bonsfills N, Chacon N, Garcia J, Gomez, E. Histomorphometry of the Ligaments using a Generic-purpose Image processing Software, a New strategy for semi-Automatized Measurements. Journal of Digit Imaging. 2012.
4. Bajagai YS. Effect of heat stress on milk production in cattle. Food and environment. WWW. Food and Environment. Com/2012/12/effects-of-heat-stress=in-milk.html. 2012.
5. Chaudhari BK, Singh M, Maurya PK, Singh AK, Singh JK. Stress markers in the plasma and milk of murrah Buffaloes during summer. Agricultural reviews. 2013; 34(1):21-35.
6. Cockrih WR. The buffaloes of china. FAO. Rome, 1976.
7. Dellmann HD, Brown EM. Text book of veterinary histology. Lea and Febiger, Philadelphia. 1976, 40-42.
8. Greenston demo (diglib. Auburn. Edu/gsdl/cgi-bin/library. Auburn university digital library, 1984. axepero:b21 wae. Htm.
9. Javaid SB, Gadahi JA, Khaskeli M, Bhutto MB, Kumbher S, Panhwar AH. Physical and chemical quality of market milk sold at Tandojam, Pakistan. Pak. Vet. J. 2009; 29:27-31.
10. Kamal TH, Ibrahim II. The effect of the natural climate of the sahara and controlled climate on the rectal temperature and radiorespiratory activities of Friesian cattle & water buffaloes. International journal of biometeorology. 1969; 13(3-4):275-285.
11. Kany MM. Seasonal histological study of thyroid gland in Iraqi buffaloes. MSc thesis. Baghdad University, 2006.
12. Kayer SR, Banchero N. Myocardial capillary in acclimation to hypoxia. Pflugars Arch 1985; 44:391-325.
13. Kumar SBV, Ajeet K, Meena K. Effect of heat stress in tropical livestock and different strategies for its amelioration. Journal of stress physiology and biochemistry. 2011; 7(1):45-54.
14. Mallonee PG, Beede DK, Collier RJ, Wilcoc CJ. Production and Physiological responses of dairy cows to varying dietary Potassium during heat stress. Journal of dairy science. 1985; 68(6):1479-1487.
15. Marai IFM, Haeeb AAM. Buffalo biological functions as affected by heat stress-A review Livestock science, Elsevier 2010; 127:89-109.
16. Roman-Ponce H, Thatcher WW, Buffington DE, Wilcox CJ, Van Horn HH. Physiological and production responses of dairy cattle to a shade structure in a subtropical environment. American Dairy Science Association. Elsevier inc, 1977.
17. Singh M, Chaudhari BK, Singh JK, Singh AK, Maurya, PK. Effects of thermal load on Buffaloe reproductive performance during summer season. Journal of biological sciences. 2013; 1(1):1-8.
18. Srikandakumar A. Johnson EH. Effect of heat stress on milk production, rectal temperature, respiratory rate and blood chemistry in Holstein, Jersy and Australian milking zebu cows. Trop. Anim. Health prod. 2004; 36(7):685-92.
19. Sulaimom SS, Kitchell BE. The biology of melanocytes. Vet. Dermatol 2003; 14(5):57-67.
20. Suvarna SK, Layton C, Bancroft JD. Bancroft's theory and practice of histological techniques.7th ed. Elsevier. Nottingham, UK, 2013.
21. Yuji Y, Satoshi I, Hidenori W, Zalfa A, Tatek K. Mesenchymal-epithelial interactions in the skin: increased expression of diekkopfl by palmoplantar fibroblasts inhibits melanocyte growth and differentiation. J Cell Biol. 2004; 165(2):275-285.