THE STUDY OF THE EFFECT OF DIFFERENT COOLING METHODS ON THE DRY BODY WEIGHT GAIN, FEED EFFICIENCY AND THYROID GLAND ACTIVITY OF CATTLE AND BUFFALO UNDER CONTROLLED HOT CLIMATE WITH THE USE OF RADIOISOTOPES

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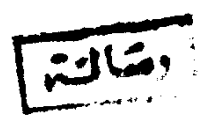

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INTRODUCTION

Under the U.A.R. system of management, the animals are exposed in summer to an environmental temperature which may reach as 35°C. This high temperature engages the animal in a great heat load. It is now an accepted fact that the heat load depresses the voluntry feed intake ; consequently the production is significantly reduced. Certain techniques have been adopted to reduce a part of this heat load in order to improve the production of the animal maintained under high atmospheric temperature.

The object of the present investigation was to study the effect of various cooling techniques on the performance and physiological conditions of Buffalo and Friesian calves in summer as measured by the live and dry body weight gains, feed utilization, thyroid gland activity, rectal temperature and respiration rate.

REVIEW OF LITERATURE

1- Thermoregulation mechanisms in hot climates :

Higher mammals are homeotherms, they maintain a constant body temperature which allows the physiological process in the body to function at, more or less, the same level of efficiency. To maintain a constant body temperature there should be a balance between the heat produced and gained by the body and heat lost from that body to it's environment. This balance between the heat gain and the heat loss is necessary to permit the animal to live without restriction and stress in wide range of environmental temperature (Hancock. 1954). Since the heat gained can vary considerably due to the energy expenditure and the environmental conditions, the mechanisms that control heat loss must be flexible and efficient.

The amount of heat exchanged between the living body and its environment depends on temperature and vapour pressure gradient that exist between the skin and it's surroundings.

These purely physical relationships are influenced by two physiological mechanisms, the cardiovascular system and the sweating mechanism which in addition to changing the rate of heat transfer from the core to the periphery, can alter

both the temperature of and the vapour pressure on the surface of skin thereby also influencing the rate of heat transfer between the body and it's environment.

Within the "comfort zone" , (Rhoad, 1944), the animal maintains heat balance through vasomotor control, which adjust the amount of heat lost by radiation and convection by regulating the amount of blood flow through the cutanous vessels. In addition there is some loss of heat by evaporation through the lungs and also from the surface of the body as a result of diffusion of water through the skin, known as insensible perspiration. As the climate becomes warmer, the amount of water lost by insensible perspiration increases slightly until active sweating starts. The proportion of heat lost in this manner is small and could be ignored in certain circumstances. However, if there is limited water replacement the amount of water lost may become serious.

Above the upper limit of vasomotor thermoregulation, sweating is evoked in increasing quantities to decrease the heat load of the animal. As the total heat load rises, circulation of blood through the skin will continue to increase in order to transfer heat from the core to the periphery, where it can be dissipated by evaporation of sweat from the skin, sweating then constitutes an important protective mechanism of the body against overheating.

A- Nervous control of the thermoregulation :

Hypothalamic centers which control and co-ordinate different physiological processes involved in thermoregulation are known to exist, the thermoregulatory center comprises two anatomically distinct sub-centers, one of which is responsible for heat conservation, while the other is concerned with heat dissipation and sweating. The activity of these sub-centers is coordinated so that presumably while one is in action the other is inhibited. Other autonomic controls (or centers), for example of water balance, vasomotor and humoral activities whose function are known to be located in the hypothalamus. Bazett (1949) considered these centers as functionally unseparated, although anatomically they could be localized. The work of Hamilton and Brobeck (1964) showed that the anterior midline hypothalamus is involved not only with normal regulation of body temperature but also with feed intake, and thus indirectly with internal heat production. Kotby (1967) speculated that overlapping of different hypothalamic centers represent a physiologic mechanism by which these centers may interact in response to stimuli, to maintain homeostasis. Leithead and Lind (1964) believed that the hypothalamic centers respond directly to local brain temperature changes induced by variations in the temperature of the blood supplying the brain as well as to the indirect afferent impulses from thermoreceptors. It was concluded that the precise mechanisms of the C.N.S. control

are complicated and not yet fully understood. They appear to involve reflex sweating and vasomotor responses through all levels of the spinal cord.

B- Role of the circulation :

When the environmental temperature rises, two separate reflex mechanisms are called in action. First, there is small increase in blood flow resulting from the release of vasoconstrictor tone, followed by an active vasodilatation which accounts for the bulk of the maximum possible flow to the skin in man (Roddie, 1961).

Shebiata (1967) concluded that the increase in plasma and blood volumes during the exposure to high environmental temperature which was observed by many other workers (Dale et al., 1956 ; Bianca, 1957 and Howes et al., 1963) may be a symptom of heat stress in cattle, the increase in plasma and blood volumes could be considered as an effective means of ameliorating heat stress by vertue of conducting heat from the core to the periphera, and from that to the external environment.

The circulation bears much of the strain of thermoregulations, for although the actual heat dissipation from the skin is primarily due to the sweating mechanism, the circulatory system remains responsible for the transfer of adequate quantities of heat from the core of the animal to the periphery. Hence although in many cases of heat disorders, other