Effect Environment Stress on the Nutrition Needs

Stress - Any circumstance that tends to disrupt the normal, steady functioning of the body and its parts.

Heat stress A condition in which environmental conditions make it difficult for the animal to lose the heat it produces, so that body temperature tends to rise (hyperthermia). Heat stress may be caused by high environmental temperature alone or in conjunction with high humidity, which limits evaporative heat loss. Heat stress can be Alleviated by shade, by increased air movement and, in non-sweating species, by the provision of sprinklers, wallows, etc.

Heat or thermal stress can be defined as the point where the animals cannot dissipate an adequate quantity of heat to maintain body thermal balance.

Temperature stress is a phenomenon that can impart physical and economical losses to livestock production in tropical and subtropical regions of the world. Temperature stressed animals undergo a series of metabolic and physiological changes. These changes are necessary for adaptability and survivability of the animal. Nutritional balance is an important factor in thermal stress which is deleterious to performance.

Thermal stress in livestock production results in increased demand for net energy for maintenance and subsequent reduction in energy for tissue growth and production. Interactions between nutrition and heat stress results in nutrient deficiencies which affects animal's ability to counter the stress. Thermal stress has negative effect on feed consumption and metabolic activities.

Changes in thermal environment caused by variations in temperature, humidity, wind, precipitation and radiation induce a variety of physiological responses in animals. Wind is known to have a significant effect on heat loss from cattle.

All animals have a range of ambient environmental temperatures termed the thermo neutral zone.

This is the range of temperatures that are conducive to health and performance. The upper critical temperature is the point at which heat stress effects begin to affect the animal.

A number of changes occur in the animal as a result of heat stress. These include:

1. **Elevated body temperature > 39 °C (normal is 38.5 °C).**
2. **Increased respiration rates > 70-80/minute.**
3. **Increased maintenance energy requirement**

Dairy cows will activate mechanisms in an attempt to dissipate the excess heat and maintain body temperature. The increased respiration rate is one example. The maintenance energy requirement may increase by 20-30% in animals under heat stress. This decreases the intake energy available for productive functions such as milk

production. Blood flow to the skin will increase in an attempt to dissipate heat. At the same time, blood flow to the core of the body will decrease.

Vasodilatation and increased flow in heat stressed animals help dissipation of excessive heat load. These changes result in reduction of blood supply to the internal organs including the ruminant fore stomach. The blood to the digestive tract is greatly influenced by the level of feed intake, a factor which is related to the environmental temperature. Increase in the energy requirement by thermally stressed animals.

Significantly reduced protein deficiency ratio. Glucocorticoid level increase during heat stress.

For efficient utilization of dietary protein during heat stress, protein intake should be adjusted in proportion to expected reduction in average daily gain.

4. Feed nutrient utilization: An increased loss of sodium and potassium is usually associated with heat stress. This is due to losses associated with the increased respiration rate. This can shift the acid-base balance and result in a metabolic alkalosis. There can also be a decrease in the efficiency of nutrient utilization. At environmental temperature of 40°C, there was a 28-fold increase in the urinary excretion of potassium compared to cows maintained at 15°C. Addition of dietary potassium and sodium salt has been reported to increase DMI and milk production in heat stressed dairy cows.

5. Dry matter intake: Dry matter intake decreases in dairy cows subjected to heat stress. This depression in dry matter intake can be either short term or long term depending on the length and duration of heat stress. Decreases of 10 to 20% are common in commercial dairy herds. A reduction in metabolic rate resulted in cattle exposed to heat stress. These responses helped in maintaining heat balance.

Thermal stress has an indirect relationship to feed intake. Heat stress induces alterations in the activity of the digestive system. The increase in environmental temperature has been associated with the reduced activity of the thyroid gland which results in reduced gut motility and rate of passage of digesta.

6. Milk production: There is normally a decrease in milk production for cows under heat stress. This decrease can be either transitory or longer term depending on the length and severity of heat If heat stress lowers milk production in early lactation dairy cows, potential milk production for the lactation will be decreased. Dairy cows in later lactation may recover slowly from the effects of heat stress.

7. Reproduction: Heat stress has also been reported to decrease reproductive performance in dairy cows. There are a number of changes in reproductive performance that have been reported. The effects on reproduction can be prolonged and impact the animal for months after the heat stress exposure. These include:

a) The length and intensity of the estrus period decreases.
b) Decreased conception (fertility) rate.
c) Decreased growth, size and development of ovarian follicles.

d) Increased risk of early embryonic deaths.
e) Decreased fetal growth and calf size.

Heat Dissipation in Cow

The animal has a number of mechanisms available to assist in trying to dissipate heat and maintain a normal body temperature. These mechanisms include:

1. Conduction – Heat moves from a warmer to a cooler surface. A cow needs direct contact with a surface for this to occur.
2. Convection – The layer of air next to the skin is replaced with cooler air.
3. Radiation – Heat can radiate from a warmer environment to a cooler environment.
4. Evaporation – Sweat or moisture is evaporated from the skin or respiratory tract.

The cow can primarily control or regulate only the evaporative cooling mechanism. She has little ability to control the sensible losses (conduction, convection and radiation).

Strategies to contract Heat Stress

There are a number of strategies to minimize the effect of heat stress on dairy cattle. The two primary options are making ration adjustments and altering the environment that the cow lives in.

1) Ration adjustments:

The goal is to adjust rations to increase energy and protein intake while maintaining rumen and cow health. The following strategies may be considered during dietary adjustments.

1. Select and feed higher quality forages
2. Lowering ration fiber (ADF, NDF) levels slightly while maintaining effective fiber levels. (ADF Acid -detergent fibre. NDF, neutral-detergent fibre.)
3. Addition of some fat to the ration. Total ration fat levels should not exceed 5 – 5.5% of total ration dry matter.
4. Selection of feed ingredients with a high digestibility in the animal. This lowers the heat produced by nutrient utilization within the animal.
5. Balance ration protein levels to minimize high levels of soluble and rumen degradable protein. Animal must expend energy to excrete excess protein from the body.
6. Adding buffers (sodium bicarbonate, magnesium oxide, and sodium sesquicarbonate) to help in maintaining a normal rumen environment.
7. Increasing ration potassium levels to counteract the higher potassium losses in heat-stressed cows. Ration magnesium levels may also need to be increased.
8. There may be some benefit to adding yeast or yeast cultures to the ration.

2.) Feeding management:

Some of the key considerations in this area are:

1. Fresh, palatable, high quality feed should be in the feed bunk at all times to provide maximum opportunity for feed consumption. If the feed in the bunk is warm, musty or spoiled, it needs to be removed and discarded.
2. Uniform mixing and delivery of rations on a daily basis.
3. Provision of separate feeding manager for each cow.
4. Addition of water or molasses may help the feed stick together better.
5. It may be useful to shift feeding times to match cow behavior. Cows tend to change meal patterns and eat more feed during the cooler times during the day.
6. Provision of clean and fresh water throughout the day and after milking.
7. There should be at least 2-3 inches of water space per cow.
8. Provision of more than 1 watering device for each group of cows may encourage water consumption and decrease competition.

3.) Housing and facility adjustments:

1. Minimize overcrowding of cows
2. Provision of shade to cows reduces the effect of radiation.
3. Proper ventilation with the addition of fans will be required to assist in increasing air flow.
4. Provision of misters or sprinklers to increase evaporative cooling by wetting the skin. The goal is to wet the cow not soak the cow.

Types of Stress

1. Caloric

Solar radiation, wind speed, air temperature and humidity are all factors which are concerned with the presentation of heat stress. An early reproductive responses to heat stress are the decrease in the intensity of estrus and consequently low fertility. It is known that mammalian females are more sensitive to heat stress, during the 12 days before estrus, increasing this sensitivity on day 2 before.

2. Nutrition

In 1998, Zapiola said that in cattle, stress during transportation, has a detrimental effect on the physiology of the animal that the stress caused by lack of food and drink, for a period of equal length, which is because the blood flow is diverted from the internal organs, to the peripheral tissues in an attempt to reduce the body temperature by increasing heat losses. This mechanism leads to a reduction of blood flow, aimed at internal organs such as the uterus, fallopian tubes and ovaries, decreased blood supply to these organs also implies low nutrient availability and therefore low functional capacity.

3. By Handling

The interactions between employees and animals influence the response of cattle to stress management known as. Studies was indicated that the way to handle livestock, animals may produce an unnecessary handling stress, which may affect the biological mechanisms of reproduction and the immune response. On the other hand, electrical bites, immobilization and other stress factors management weaken the female reproductive functioning.

There are many driving situations can cause stress seriously affecting the reproductive process of the species, such as excessive mobilization of inseminated females before, the use of aggressive or driving the separation of animals, mobilization of animals on the sleeve of management for different purposes, etc..

The time when stress management, represents greater adverse effects on reproduction, it is just no time to estrus.

ADF : The detergent fibre analysis scheme was introduced to overcome inadequacies in the use of the traditional acid–alkali crude fibre estimation when applied to fibrous forage feeds for ruminants.
ADF : An insoluble matrix prepared by the extraction of food plants and mixed feeds in a solution of sodium dodecyl sulphate (SDS) and ethylene diamine tetraacetic acid (EDTA) in a phosphate buffer at pH 7.