**-Diyala University -Internal medicine**

**-College of Vet. Medicine - Lecture (1)**

**- Dep. Of Internal and Preventive Medicine**

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**- General systemic states:**

 **-Hypothermia, hyperthermia, fever**.

Hypothermia, hyperthermia and fever -characterized by significant changes in body temperature - are presented here together, along with an introduction to thermoregulation mechanisms of the body.

BODY TEMPERATURE:

 Farm animals maintain a relatively constant body core temperature, homeothermy, during extreme ranges of thermal environments. This homeothermic state is achieved by modify either rates of heat loss from the body or the rate at which heat is produced by metabolism of feed or body energy reserves. For the body temperature to remain constant in changing thermal environments, the rate of heat loss must equal the rate of heat gain. The body Temperature is a reflection of the balance between heat gain from the environment (radiation, conduction, convection) or due to metabolic activity maintenance, exercise, growth, lactation gestation, feeding) and heat loss to the environment (radiation, conduction, convection, evaporation) or due to metabolic activity (milk removal, fecal elimination, urinary elimination) .Absorption of heat from the environment occurs when the external temperature rises above that of the body.

HEAT PRODUCTION

 Heat production occurs as a result of metabolic activity and the digestion of

feed, muscular movement and the maintenance of muscle tone.

HEAT LOSS

 Heat is transferred to or from an animal by the four standard physical phenomena of **convection, conduction, radiation and evaporation**. Convection is a transfer of heat between two media at different temperatures, such as the coat surface and the air. As such, convective heat transfer depends on the temperature gradient between the coat surface and air, the surface area and the air speed over the surface.

Conduction is the transfer of heat between two media that are in direct contact, such as the skin and water. Radiation is the absorption or emission of electromagnetic radiation at the body surface, and depends on the skin surface temperature and area.

Evaporative heat transfer is a process whereby heat is lost by the evaporation of

water, and is dependent on the water vapor pressure gradient between the epithel ial surface and the environment and the air speed over the surface. Evaporation occurs by sweating, salivation and respiration,

HYPOTHERMIA:

Hypothermia is a lower than normal body Temperature, which occurs when excess heat is lost or insufficient is produced Neonatal hypothermia is a major cause of morbidity and mortality in newborn farm animals within the first few days of life.

**ETIOLOGY:**

1-Excessive loss of heat:

 Exposure to excessively cold air temperatures causes heat loss if increased metabolic activity, sustained muscular contraction and peripheral vasoconstriction are unable to compensate.

2-Insufficient heat production:

 Insufficient body reserves of energy and insufficient feed intake result in insufficient heat production.

3-Combination of excessive heat loss and in sufficient heat production.

A combination of excessive heat loss and insufficient heat production is often the cause of hypothermia. Insufficient energy intake or starvation of newborn farm animals in a cold environment can be a major cause of hypothermia.

**Neonatal hypothermia.-**

 Newborn farm animals are prone to hypothermia in cool environments and hypothermia is a major cause of neonatal mortality. The neonates cannot maintain their rectal temperatures at normal values during the first few hours after birth under cold environmental conditions Hypothermia and environmental thermoregulatory interactions are of particular importance in lambs,1- the neonatal ruminant moves from a very stable thermal environment of similar temperature to its core body temperature, to a variable and unstable thermal environment that is colder than its core temperature. 2-The coat is wet with placental fluids and energy loss is increased by evaporation and the low insulate value of a wet coat. 3- The newborn calf becomes hypothermic in the first 6 hours after birth and only limited tissue substrates are available as energy sources. Neonates also are exposed to a variety of environmental pathogens against which they have little specific immunity Thus the neonatal period is one of the most critical to the survival of an animal and during this period the morbidity and mortality can be high under adverse environmental conditions. Why ?.

**-PATHOGENESIS**

Sudden exposure of neonatal animals at birth and during the first few days of life to cold ambient temperature results in subnormal body temperature, shivering and decreased cardiac output, heart rate and blood pressure. This results in muscular weakness and mental depression, respiratory failure, recumbency and a state of collapse and, eventually, coma and death.

The entire body, especially the extremities becomes cold and the rectal temperature is below 37°C and may drop to 30°C in neonates. Cold injury or frostbite of the extremities may occur in extremely cold conditions

The neurological signs of convulsions seen in some cases of hypothermia have not been adequately explained.

In newborn lambs carbohydrate and lipid are the major energy substrates for heat production because protein catabolism is minimal during the first day after birth. Liver glycogen concentrations increase markedly during the last few days before normal parturition. The amount of liver and skeletal muscle glycogen available in the newborn lamb at birth determines how long it can avoid hypoglycemia and hypothermia if not fed The amount of lipid present in the new born lamb can also affect the duration of the glycogen reserves. Hypothermia secondary to other diseases is due to failure of the thermo regulation mechanism and is usually accompanied by varying degrees of shock.

**- CLINICAL FINDINGS**

A decrease in body temperature to below 37°C represents hypothermia for most farm animal species. Weakness, decreased activity, cold extremities and varying degrees of shock are common. Bradycardia, weak arterial pulse and collapse of the major veins are characteristic. The mucous membranes of the oral cavity are cool and there is a lack of saliva. foals exposed to a cold environment within hours after birth or following 12-24 hours of profuse diarrhea accompanied by marked dehydration and acidosis. However, acute dehydration . Hypothermic calves exposed to a cold environment will assume sternal recumbency lie quietly will have a weak suck reflex and will die in a few hours. In later stages, further weakness leading to

coma is common. The mucous membranes of the oral cavity are cool and may be dry. The heart rate is commonly slower than normal and the intensity of the heart sounds decreased. Death is common when the body

temperature falls below 35°C but field observations indicate that the temperature may fall below 30°C and animals still survive if treated intensively.

- CLINICAL PATHOLOGY

Clinical pathological examinations are usually not done because the diagnosis is frequently obvious and the variability in biochemical changes make them of limited value in reaching a diagnosis of hypothermia. The serum concentrations of glucose, non-esterified fatty acids and immunoglobulins are commonly reduced and hypoglycemia may be profound. However, the glucose concentration depends on the level of starvation that coexisted with the hypothermia.

**- TREATMENT**

Using an electronic thermometer, the body temperature of any weak or suspect lamb is taken. or suspect Lambs of any age with mild hypothermia (37-3 9°C) are dried off if necessary to reduce heat loss, given ewe

or cow colostrum by stomach tube and placed in a sheltered pen with the ewe Lambs less than 5 hours of age with severe hypothermia (<37°C) are dried off and given an intraperitoneal injection of 20% glucose at a

 temperature of 39°C. A large lamb (>4.5 kg) is given 50 mL, a

medium lamb (3.0-4.5 kg) 35 mL and a small lamb « 3.0 kg) 25 mL . Hypothermic lambs are then placed in warming pens measuring 2 x 2 m

. Warm air, at 38-40°C is blown into the lower chamber from a

domestic heater When the lamb's temperature reaches 37C, it is removed from the warmer and immediately fed ewe or cow colostrum by stomach tube at a rate of 50 mL/lkg BW. Any lamb that is vigorous and able to

suck is returned to its ewe in a sheltered pen and monitored over the next several hours. Colostrum can be hand milked from the ewe after administration of oxytocin The immersion of hypothermic lambs in water at 38°C can result in the recovery to an euthermic state in about 28 minutes

at a reduced expense in metabolic effort by lambs.