Metabolic diseases – introduction

Amongst domestic farm animals the metabolic diseases achieves their greatest importance in dairy cows and pregnant ewes. In other species these diseases occur only sporadically.

The high producing dairy cow always verges on abnormal homeostasis, and the breeding and feeding of dairy cattle for high milk yield is etiologically related to metabolic diseases so common in these animals.

Peril parturient period

In dairy cows, the incidence of metabolic disease is highest in the period commencing at calving and extending until the peak of lactation is reached, and their susceptibility appears to be related to the extremely high turnover of fluids, salts and soluble organic materials during the early part of lactation. . with this rapid rate of exchange of water , sodium , calcium , magnesium , chlorides , and phosphates , a sadden variation in their excretion or secretion in the milk or by other routes , or a sudden variation in their intake because of changes in ingestion , digestion , or absorption , may cause abrupt , damaging changes in the internal environment of the animal.

It is the volume of the changes in intake and secretion and the capacity with which they can occur that affects the metabolic stability of the cow. In addition, if the continued nutritional demands of pregnancy are exacerbated by an inadequate diet in the dry period, the incidence of metabolic disease will increase.

The effect of pregnancy is particularly important in ewes, especially those carrying more than one lamb.

Disease of lactation:

In the next phase of the production cycle, parturition is followed by the sudden onset of a profuse lactation, which, if the nutrient reserves have already been seriously depleted, may further reduce them to below critical levels and clinical metabolic disease then occurs.

Most attention has been paid to variations in balances of:

1.Calcium and inorganic phosphates relative to parturient paresis.

2.. Magnesium relative to lactation tetany.

3.Blood sugar and ketones and hepatic glycogen relative to ketosis.

and 4. Potassium relative to hyperkalemia on cereal grazing.

The period of early lactation

It is unstable on in all species. Hormonal stimulation at this stage is so strong that nutritional deficiency often does not limit milk production and a serious drain on reserves of metabolites may occur.

Breed susceptibility

The fact that some dams are affected much more by these variations than others is probably explainable on the basis of variations in internal metabolism and degree of milk production between species and between individuals.

Between groups of cows, variations in susceptibility appears to depend on either genetic or management factors.

Certainly jersey cows are more susceptible to parturient paresis than cows of other breeds, and Guernsey's, in on experience, seem to be more susceptible to ketosis.

Management practices

Management practices of most importance are housing and nutrition.

In these sections of North America when cattle are housed during the winter, and in poor pasture areas, ketosis is prevalent. In New Zealand metabolic disease arte complex and the incidence is high , both probably related to the practice of having the cows calve in the later winter when feed is poor , to the practice of depending entirely on pasture for feed , and to the high proportion of Jerseys in the cattle population .

Occurrence and incidence:

Largely because of variations in climate, the occurrence of metabolic disease varies from seasons to seasons and from year to year. In the same manner, variations in the types of disease occur, for example in some seasons most cases of parturient paresis will be titanic, in others, and most cases of ketosis will be complicated by hypocalcaemia. Further, the incidence of metabolic disease and the incidence of the different syndromes will vary from region to region.

Ketosis may be common in areas of low rainfall and on poor pasture. Lactation tetany may be common in colder areas and where natural shelter is poor.

Production diseases

The term production disease includes those diseases previously known as metabolic diseases; such as parturient paresis (milk fever), hypomagnesaemia, acetonemia, all of which are attributable to an imbalance between the rated of input of dietary nutrients and the output of production.

When the imbalance is maintained it may lead to a change in the amount of the body reserves of certain metabolites, or their through put, and sufficiently larger changes in throughput will give rise to signs of production disease.

The generalization applies principally to the hypoglycemia (Ketosis) and hypomagnesaemia and partly to the hypocalcaemia.

In these diseases , output is greater than input either because of the selection of cattle which produce so heavy that no naturally occurring diet can maintain the cow in nutritional balance or because the diet is insufficient in nutrient density or unevenly balanced .

Compton metabolic profile test

The Compton metabolic profile is based on the concept that the laboratory measurement of certain components of the blood will reflect the nutritional status of the animal, with or without the presence of clinical abnormalities. For example, a lower than normal mean blood glucose in a group of dairy cows in early lactation may indicate an insufficient intake of energy which may or may not be detectable clinically.

Test procedure

Blood samples are collected from three groups of seven cows each;

1. Dry cows
2. Medium yield lactating cows
3. High – yield lactating cows

The samples are collected sat least three times yearly, summer, autumn, and winter or when nutritional imbalance is suspected. The samples must be collected at the same time if day at each collection and should be done with a minimum of excitement of the cows.

An aliquot of 5 ml, of blood is placed in vials containing oxalate – fluoride for glucose and serum inorganic phosphorus, and 20- 30 ml in heparinized vials for the determination of the other components.

The samples must be dispatched to the laboratory within a few hours and must not be subjected to delays in delivery or to heat or cold.

Ideally the samples should be landed similarly each time.

In some cases, urine samples are collected from each test lactating cows and tested for the presence of urinary ketones, and the results correlated with the blood glucose levels of each cow.

The following laboratory analyses have been carried out in the Compton metabolic profile test:

Blood glucose

Packed cell volume

Hemoglobin

Blood urea nitrogen

Serum inorganic phosphate, magnesium. Calcium, potassium and sodium.

Total serum protein, albumin and globulin.

Other analytes

Serum copper

Serum iron

Plasma non – esterified free fatty acids.

Amini profile test:

Which measures levels of blood glucose , serum urea nitrogen and albumin in cows between 4 and 10 weeks after calving has been recommended as a sufficient test to assess the a adequacy of energy and protein intakes .

The sampling is done at intervals of 4-6 weeks.the time of sampling can affect the results.

The values will change with the season and stage of lactation. In general, sampling should be done when nutritional imbalance and \ or the occurrence of metabolic diseases are anticipated, which is usually during early lactation as cows approach their peak in the lactation curve.

At the time of sampling, the following supplementary information should be collected:

1. Relating to the individual animal sampled: age; exact milk yield and mastitis status.

 Date of calving; weight of concentrated fed per day

2. Relating to the whole herd:

Estimates of the average daily forage intakes.

Analyses of forage and grains

Total herd production and number of cows in milk

Most recent bulk milk quality data

Interpretation of results and causes of variation

The mean values for each lactational group of cows for each parameter are calculated and compared with the population mean values which have been predetermined by survey.

Most of the values of individual cows and the mean values of the lactational groups will fall within the normal ranges for the population. Animals whose values are 2 SD (standard deviation) or more different from the population means are considered abnormal.

Protein intake and serum urea:

There is a direct relationship between protein intake and the

Concentration of blood urea nitrogen.

Low concentrations of urea indicate that protein intake is minimal.

Low level of albumin and hemoglobin are indicative of a long –

Standing low protein status.

, mean values of packed cell volume, hemoglobin and serum iron are consistently higher in non- lactating cows than in lactation cows.