Veterinary Bioscience: Metabolism

WEEK 3 – THE LIVER IN DISEASE

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INTENDED LEARNING OUTCOMES

At the end of this lecture, you should be able to:

- describe the normal biochemical processes that occur with fasting/starvation and the central role of the liver in these processes
- explain how ruminants derive energy from complex carbohydrates
- describe the metabolic changes associated with ketosis and fatty liver disease.

KEYWORDS

negative energy balance, starvation, ketones, ketosis, pregnancy toxaemia, fatty liver, ketoacidosis, volatile fatty acids

LECTURE 8 – BOVINE KETOSIS AND OTHER FATTY LIVER SYNDROMES IN DOMESTIC ANIMALS

Under normal physiological conditions, hepatic production of the ketone bodies, acetoacetate and β-hydroxybutyrate, is minimal. With food deprivation, the production of ketone bodies is rapidly accelerated as a normal response of the body to a shortage of carbohydrate; in cases of prolonged starvation, the increased concentration of ketones ensures an energy supply to the brain.

In contrast to the "physiological ketosis" of fasting/starvation, some pathological conditions (most notably, ketosis/ketoacidosis) are characterised by excessive accumulation of ketone bodies in the blood.

Since the liver is central to the body's metabolic inter-relationships, any insult to the liver can be associated with major metabolic derangements. During this lecture, we will consider, using a case of bovine ketosis as an example, the biochemical (and hormonal) factors operative in the overall control of hepatic ketone production, the circumstances which alter these control measures and the subsequent pathological consequences.

We will also consider the biochemical bottlenecks that are associated with other syndromes characterised by fatty livers:

- metabolic changes that occur in the lactating cow
- pregnancy toxaemia in the ewe
- hepatic lipidosis in horses.

FURTHER READING

Alberts *et al.* *Molecular Biology of the Cell*. 6th ed. Taylor and Francis (2015) (eBook available through University Library)

Klein. *Cunningham's Textbook of Veterinary Physiology*. 6th ed., Elsevier (2020)

Nelson and Cox. *Lehninger's Principles of Biochemistry*. 7th ed., Freeman (2017)

Smith. *Large Animal Internal Medicine*. 6th ed., Elsevier (2020), pp.1408-1412 (eBook available through University Library)