

## Heat Stress and Sweating

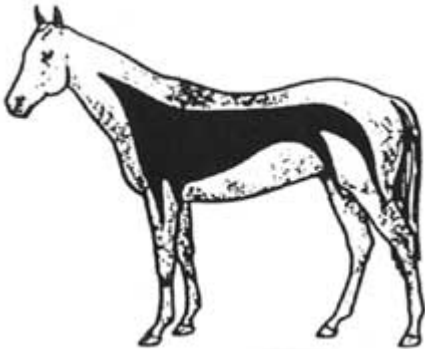

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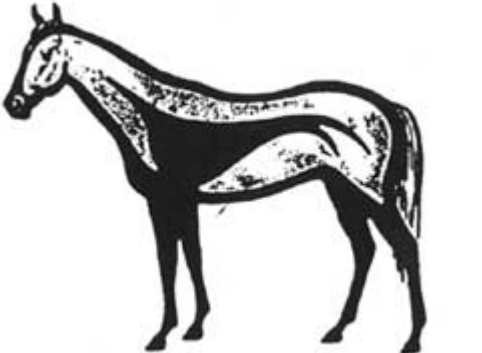

Digestion of food produces heat. The amount of heat produced depends on whether the food is digested in the small or the large intestine. Different feeds have different digestibilities in the small intestine and therefore produce different amounts of heat during the digestion process.

**Digestion in the small intestine** is desirable, as fermentation in the large intestine produces more heat and can also cause high lactic acid levels - a major cause of tying up, diarrhoea and laminitis.

**The amount of heat produced during digestion** depends on the amount of fibre in the feed. Low fibre diets can precipitate a wide range of colics and other serious diseases, but excess fibre increases **heat of digestion** and the **heat load** the horse must cool by sweating.

**Heat of digestion** does not cause 'hot' or 'fizzy' behavior. It keeps the horse **warm** in cold weather, but in **hot weather** it increases **heat stress**. During a 2 minute race, a horse produces enough heat to bring 9 litres of water to the boil. The **heat of digestion** further increases sweating and hence the fluid and electrolyte losses. Also, **energy** lost as **heat** is unavailable for exercise or body condition.

| THE EXERCISING HORSE MUST COOL 3 TYPES OF HEAT                                      |  |
|---|--|
|   | <p>1. <b>METABOLIC HEAT</b> produced. by food digestion. This heat maintains normal body temperature.</p> <p style="text-align: center;"><b>TOTAL HEAT<br/>=<br/>METABOLIC<br/>HEAT</b></p>  |
|  | <p>2. <b>EXERCISE</b> generates heat from muscle contraction - only 25% of the energy generated by muscle contraction is available for work - 75% is converted to heat (a car has an energy conversion efficiency of only (15%))</p> <p style="text-align: center;"><b>TOTAL HEAT<br/>=<br/>METABOLIC<br/>+<br/>EXERCISE</b></p> |

|  |  |
|--|--|
|   | <p><b>3. HOT WEATHER</b> both METABOLIC and ENVIRONMENTAL heat act on the horse.</p> <p style="text-align: center;"> <b>TOTAL HEAT</b><br/> <b>=</b><br/> <b>METABOLIC</b><br/> <b>+</b><br/> <b>ENVIRONMENT</b> </p>  |
|  | <p><b>4. EXERCISE IN HOT WEATHER</b> All 3 sources of heat are acting on the horse which is exercising in hot and humid climates and increase the heat load the horse must cool.</p> <p style="text-align: center;"> <b>TOTAL HEAT</b><br/> <b>=</b><br/> <b>METABOLIC</b><br/> <b>+</b><br/> <b>EXERCISE</b><br/> <b>+</b><br/> <b>ENVIRONMENT</b> </p> |

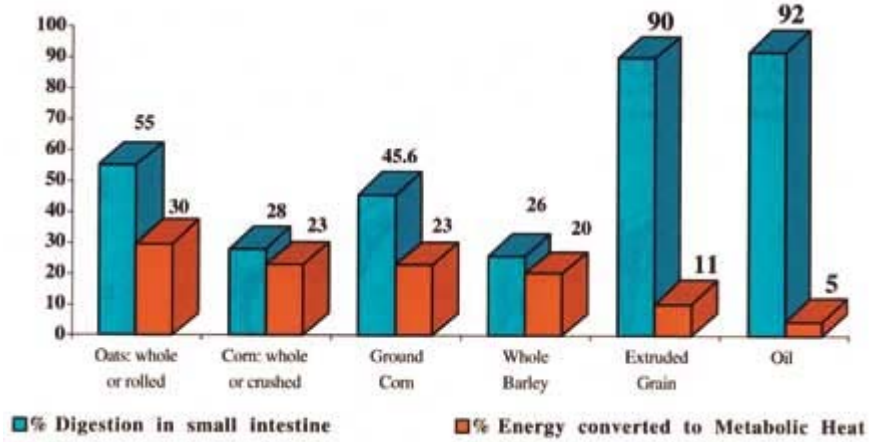
A diet that minimises *heat of digestion* will significantly reduce the heat burden.

| THE PERCENTAGE OF FEED ENERGY CONVERTED TO HEAT DURING DIGESTION |     |
|--|-----|
| Pasture chaff and hay  | 75% |
| Whole or rolled oats   | 30% |
| Crushed and ground corn  | 23% |
| Whole Barley   | 20% |
| Protein meals and beans  | 45% |
| Lucerne chaff and hay  | 40% |
| <i>Extruded grains and feeds</i>                                 | 11% |
| Oil  | 5%  |

**Extrusion increases digestion in the small intestine**

**Percent Digestion in Small Intestine and Amount of Energy Converted to Metabolic**

## Heat during Digestion



By shifting the site of digestion back to the small intestine, *steam extrusion processing* reduces fermentation of grains and starch and production of lactic acid in the large intestine **but** it also reduces heat stress, sweating, fluid and electrolyte losses. **Steam extruded feeds** require less storage space and have increased stability and palatability.

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