

Carbohydrates in Cat Diets: Digestion and Utilization

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The natural diet of the cat, a true carnivore, contains very little carbohydrate, and virtually no simple sugars. In contrast, commercial cat diets (dry diets) often contain as much as 40% of the diet as complex carbohydrates (starches). In addition, semi-moist diets and sometimes canned cat food can contain as much as 15% of the diet as simple sugars to act as gelling agents. Therefore, it is necessary to know if the cat can effectively digest and utilize dietary carbohydrates.

Carbohydrate Digestion

Digestibility studies have indicated that the cat can effectively digest both complex and simple carbohydrates. Digestibility values ranged from 94 to 99% for purified starch, sugars (sucrose and lactose) and glucose (1, 2). However, it is interesting to note that the activity of the enzyme lactase decreased in activity with increasing age in the kittens (1, 2). This means that the adult may be lactose intolerant. Furthermore, the digestibility of corn and wheat starch ranged from 79 to 97% and, consistent with carbohydrate digestibility studies in other domestic animals, grinding and cooking (gelatination) of the starch significantly increased its digestibility or availability to the cat (2).

However, it should be noted that in these digestibility studies, the levels of carbohydrate used in the trials were lower than what is normally found in some of the commercial cat diets (dry type). This could be of significance, because digestibility studies in other carnivores have indicated that high levels of starch inclusion (>25% of the diet) can inhibit starch digestibility. Further studies should be conducted to determine the effect of the inclusion level of starch and sugars on their digestibility in the cat.

Glucose Metabolism and Dietary Utilization

Ultimately all carbohydrates would eventually be absorbed and converted to glucose. The effective utilization of glucose as an energy source requires the activation in the various tissues of the glucose to glucose-6-phosphate. There are two enzymes which are responsible for activation of glucose, hexokinase and glucokinase. Hexokinase is a non-adaptive enzyme with a universal tissue distribution. This enzyme is not normally responsive to fluctuating levels of dietary carbohydrates. In contrast, glucokinase is, in most animals, an adaptive enzyme found only in the liver, and is generally very responsive to increased blood glucose levels due to increased intakes or digestion of dietary carbohydrates. In relation to the cat, studies have indicated that glucokinase has an extremely low level of activity (3). Furthermore, most of the hepatic enzymes in the cat are not adaptive to different dietary treatments (4). Therefore, it is possible that the cat may not tolerate increased levels of dietary carbohydrate.

However, Drochner and Müller-Schlösser (5) have observed that the blood glucose levels are not significantly higher in cats reared on sugar and glucose diets as compared to cats reared on control diets. Furthermore, these authors concluded that moderate levels (15% of the diet) of dietary carbohydrates are well accepted and tolerated by cats. However, higher levels of carbohydrates (25% of the diet), particularly lactose, caused very moist stools and sometimes diarrhea in the cat (2, 5). This is consistent with the low lactose levels of the adult cat. Drochner and Müller-Schlösser (5) also observed that glucosuria was common in cats reared on the carbohydrate diets. This may indicate that even though the cats are efficiently absorbing the different forms of dietary carbohydrate, they are not effectively utilizing these carbohydrates as dietary energy sources. If this is correct, then the term "empty calories" may have some meaning in relation to dietary

carbohydrates and their utilization as energy sources in the cat. Obviously, more studies are required on the utilization of dietary carbohydrates as energy sources in cats.

References

1. HORE, P and MESSER, M. 1968. Studies on disaccharidase activity of the small intestine of the domestic cat and other carnivorous mammals. *Comp. Biochem. Physiol.* 24: 717-725.
2. MORRIS, JG, TRUDELL, J and PENCOVIC, T. 1977. Carbohydrate digestion by the domestic cat (*Felis catus*). *Br. J. Nutr.* 37: 365-373.
3. BALLARD, FJ. 1965. Glucose utilization in the mammalian liver. *Comp. Biochem. Physiol.* 14: 437-443.
4. ROGERS, QR, MORRIS, JG and FREDLAND, RA. 1977. Lack of hepatic enzymatic adaptation to low and high levels of dietary protein in the adult cat. *Enzyme* 22: 348-356.
5. DROCHNER, W. and S. MÜLLER-SCHLÖSSER. 1980. Tolerance of various sugars in cats. In "Nutrition of the Dog and Cat", Ed. R.S. Anderson. Pergamon Press, Toronto. pp. 101-111.

