

## CARBOHYDRATE CONTENT ASSESSMENT IN DIFFERENT COMMERCIAL DOGS DIETS

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### Abstract

The growing awareness of the needs of pets by pet owners has also led to a diversity of diets on the market. Given that a proper diet is the best prevention for diseases such as obesity, diabetes, adverse food reactions, gastrointestinal disorders and even cancer, it is vital to guide owners early on towards an optimal diet for the physiological requirements of each individual pet. An increasingly debated topic in canine nutrition lately is the percentage of carbohydrates in dog food. The International Research Council has concluded that there is no need for carbohydrates at all in dog diets (corn, rice, potatoes, barley, etc.). However, carbohydrates are the dominant ingredient in most dry foods and they are abundantly present. They are not harmful to dogs when present in reasonable quantities. Carbohydrates provide a high source of energy, but the problem is the large amount in which they are found in many types of dry food. While protein, fat, fiber and moisture are always listed on a package label as part of the chemical analysis, pet food manufacturers are not required to list 'carbohydrates' in the food as they are the main macronutrient determining postprandial glucose levels. Because of this concern, we thought it appropriate to bring to the attention of dog owners the percentage of carbohydrates in different categories of dry dog food, as well as the types of cereals included in the dry food that have a different glycemic index, which is a system that measures the effects that carbohydrates in food have on blood sugar levels.

**Key words:** dogs, dry food, carbohydrates, glycemic index

The pet population has been gradually increasing in Europe recently. It is estimated that 80 million European households have at least one pet (FEDIAF 2020). Pets arguably play a particularly important role in the lives of people who consider their pets as "family members" (Di Cerbo A. *et al*, 2017; Rauktis M.E. *et al*, 2017). Due to the increasing number of pets, commercial pet food is also developing dynamically, with owners becoming increasingly interested in its ingredients and quality. The prevalent type of pet food available on the market is dry food formulated in kibble form, as it is easy to store and effective in meeting the nutritional needs of the pet. Dry food diets mostly consist of cereal grains, milling byproducts, and byproducts of animal tissues from the meat-packing, poultry-processing, and fish-canning sectors (Kazimiersk K. *et al*, 2021).

The majority of the carbohydrates in dry food diets, which range from 30 to 60 percent, are starches made from cereal grains including wheat, corn, and rice. (Spears and Fahey 2004, de-Oliveira *et al*. 2008, Case 2011). Carbohydrates are an affordable ingredient and a crucial component of dry food that gives kibbles an adequate

structure. (Hand Michael *et al*. 2010). In particular stages of development, carbohydrates enable dogs to store vital nutrients like amino acids or fatty acids. However, there is no information available regarding the unique carbohydrate needs of companion animals (FEDIAF, 2022; NRC, 2006). Protein, fat, fiber and moisture are always indicated on a packaging label as part of the chemical analysis, whereas pet food manufacturers are not legally required to mention 'ash' or 'carbohydrates' in the food (Vastolo A. *et al*, 2023). Starch digestibility has been demonstrated to be very varied and affected by a number of variables, including sources, particle size, the amylose: amylopectin ratio, processing techniques, and the ratio of starch to protein (Ottoboni M. *et al*, 2019). Additionally, all of these variables may have an impact on healthy dogs' postprandial glycemic levels (Roberti-Filho F.O. *et al*, 2012). Because of this disiderent we thought it appropriate to bring to the attention of dog owners, the percentage of carbohydrates in different categories of dry dog food, as well as the types of cereals included in the dry food that have a different glycemic index, which is a system that measures the effects that

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carbohydrates in food have on blood sugar levels (Gal A. *et al*, 2021).

## MATERIAL AND METHOD

A total of 72 commercial dry dog food were analysed, divided into 3 categories, low cost (20 brands), premium and super-premium (52 brands). The types of dry dog food examined were from supermarkets, veterinary practices, pet shops and veterinary pharmacies as well as from different veterinary websites. Dog dry food is composed of protein, fat, ash, carbohydrates and moisture as analytical composition. Carbohydrates are not measured directly, so we won't see them listed on the label, but we can estimate them by subtracting the key information on the guaranteed analysis located on the pet food packet from 100. Often a company won't list the 'ash' value, but the general estimate for a kibble is between 5-8% (we have used 7% in our calculations). Guaranteed analyses are expressed on an "as fed" basis.

The formula used to calculate the percentage of carbohydrates in dry dog food has been as follows:

$$\% \text{ carbohydrate (as fed)} = 100 - \% \text{ protein} - \% \text{ fat} - \% \text{ fiber} - \% \text{ moisture} - \% \text{ ash}.$$

## RESULTS AND DISCUSSIONS

Carbohydrates (CHO) are the most common macroelements found in dry extruded pet food products (~40-60% dry matter). After evaluating the labels of the 20 low cost dry pet food brands we identified that 90% of the low cost dry dog foods have cereals as the first ingredient, even in percentages of 58%. 13 types of food have the cereal specification, but not the cereal type, and in the remaining brands (n=7) we observed that the cereal types used were corn, wheat, barley, wheat bran, rice.

In terms of Kcalorie requirements, of the 20 types of low cost dry food, only 4 types show the kcal/100 g product.

In figure 1 it can be seen from the data on the label that the protein percentage of the low cost dry food was between 17-24%, the fat percentage between 6-12%, the fiber percentage between 2.2% - 4.5%, the ash percentage between 5% - 8% and the carbohydrate percentage which was not listed on the label and which was calculated according to the calculation formula was between 46 - 60%. Only 2 types of low cost food taken in the study had carbohydrate percentage below 50% (46%, 47 respectively), the remaining 18 samples had carbohydrate percentage between 50% and 60%.

To calculate the percentage of carbohydrates in premium and super-premium dry food, a total of 52 types of dry food were studied, each with a variety of ingredients, mainly meat and meat by-products as the major ingredient. Out of a total of 52 types of premium and super premium dry dog food, 25 had a kcal/100 g product number specified.

From figure 2 it can be seen that the percentage of nutrients listed on the label for protein ranged from 20.8% to 32%, the percentage of fat ranged between 7.5% and 20%, fiber - 1.08% to 4.5% and ash ranged between 1.5% and 9%. As for the percentage of carbohydrates, the calculation showed that they ranged between 30.5 % and 53 %. 4 of the brands had the highest value of carbohydrates, between 50.4 % and 53 %, the rest had a carbohydrate value between 30.5 % and 50 %. 39.58 % of the premium and super-premium food types had even a percentage below 40% carbohydrates. In the case of the 4 brands where the percentage of carbohydrates was higher than 50%, we observed that they had a high amount of cereals as the main ingredient.

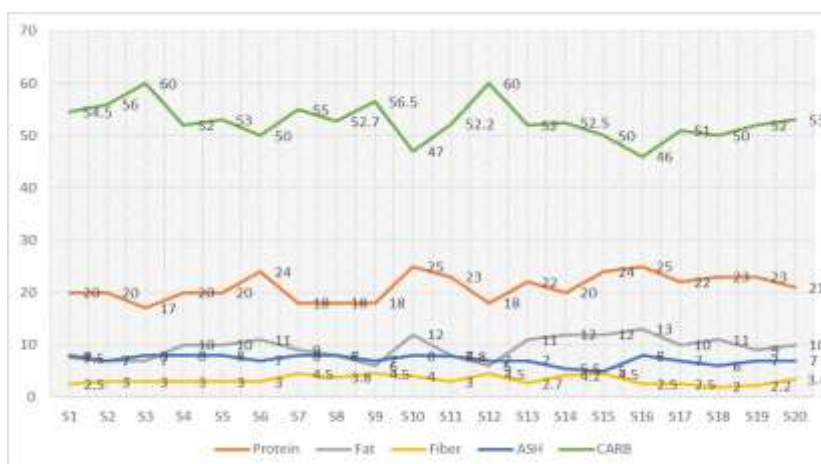


Figure 1 Analytical composition of low cost commercial dog dry food according to label data and concentration of carbohydrates after calculation

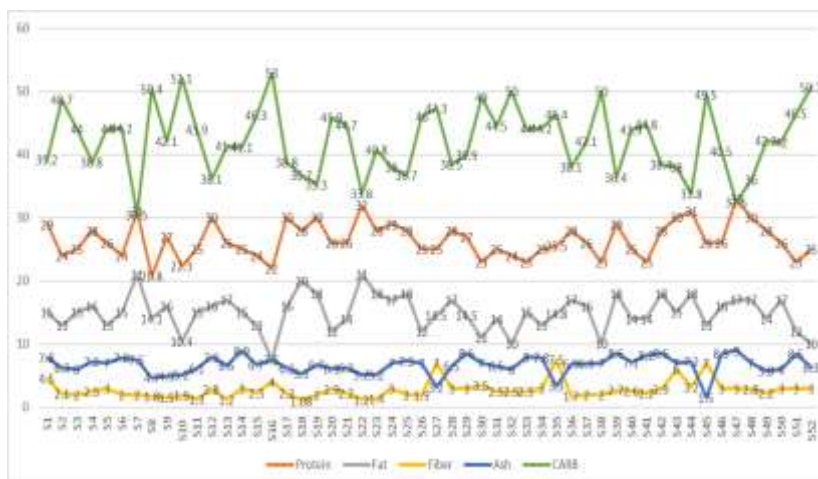


Figure 1 Analytical composition of low cost commercial dog dry food according to label data and concentration of carbohydrates after calculation

Comparing the ingredients between the low cost and the premium and super premium dry dog food we noticed that in the premium and super premium food there was a greater diversity of ingredients and the cereals in most of them are not in the first place as in the low cost brands. Also in most types of super-premium and premium food the types of cereals are declared. With a greater diversity of ingredients and less cereals in the composition, the percentage of carbohydrates is much lower compared to low cost food.

Cereals are an important source of carbohydrates in dog diets; most extruded dog food contains carbohydrates (Bradshaw J.W.S, 2006). Nutritionally, carbohydrates are not essential nutrients (Cabrita A.R.J. *et al*, 2022); however, compared to animal protein or fat, carbohydrates are a highly economical source of energy for use in pet foods (Beloshapka A.N. *et al*, 2016; 2021). Although grains are a carbohydrate source within the pet food industry, many pet owners are concerned about feeding grains to their pets, and studies on the safety of carbohydrate sources available in dog foods are limited (Beaton L., 2014).

Carbs are not made equal. Depending on where a carb is ranked on the Glycemic Index, the way our dog's body processes various carb sources can differ significantly. Glycemic index (GI) is a measure used to determine how different foods increase blood glucose levels after being consumed by the animal. Although carbohydrates provide energy and activity, not all carbohydrates are good. The glycemic index is important for pets because it determines how much carbohydrate (sugars and starches) your dog or cat consumes and how it affects their health (Rankovic A. *et al*, 2020).

According to the Pet Obesity Prevention Association, 52.7% of dogs and 57.9% of cats in

are clinically overweight or obese. Unfortunately, these percentages mean that a substantial number of dogs and cats have weight-related problems that can turn into serious conditions and diseases (Suarez L. *et al*, 2022).

Low GI foods are considered good carbohydrates, they contain carbohydrates that digest slowly, providing energy that lasts for a long time. Low GI foods are better assimilated in the body and lead to healthier blood glucose and insulin control, which further facilitates weight control, disease prevention, increased energy and improved mood (Rand J.S. *et al*, 2004). Benefits of providing your pet with a low glycemic index carbohydrate diet: may improve/minimize diabetes symptoms; reduces risk of heart disease; reduces blood cholesterol levels; satisfies hunger and keeps your cat/dog feeling fuller for longer; helps prolong physical endurance (Rand J.S. *et al*, 2004).

Many of the carbohydrates consumed by dogs are rapidly absorbed and converted to glucose - resulting in a quick source of energy that becomes stored in the muscles and liver. It is this rapid rise in blood glucose that can trigger the insulin response in the body - specifically in the pancreas. This effect can also put pressure on the pancreas as it struggles to 'keep up' to produce enough insulin. High GI foods, by contrast, are those with carbohydrates that are digested quickly and easily, leading to a rapid energy spike followed by a rapid crash. This adversely affects insulin and blood sugar control, provides unwanted calories and can cause health problems such as obesity and diabetes ((Rand J.S. *et al*, 2004; Barclay A.W. *et al*, 2008). Maize, wheat, white rice, potatoes and peas have a considerably high glycemic index. Similarly, fruit, cucumbers, cauliflower, pears, quinoa, buckwheat, chickpeas, lentil have a low glycemic index, making them

very healthy options of choice. The higher the glycemic index, the faster the rise in blood sugar levels and the higher the blood sugar concentration. Conversely, the lower the glycemic index, the slower the rise in blood sugar levels and the lower the blood sugar concentration (Brummer Y. *et al*, 2014).

Foods are rated on a scale of 1 to 100, with low GI foods having an index of 55 or less, high GI foods having an index of 70 or higher, while the range 56-60 is considered to be medium GI foods (Rand J.S. *et al*, 2004). Most commercial dog foods are unnecessarily high in carbohydrates and exceptionally low in protein. And high quality protein barely exists in commercial dog food. It is important to note that the FDA (Food and Drug Administration) does not evaluate glycemic claims and there is no currently accepted protocol for investigating GI (glycemic index) for pet food. This is primarily due to the complexity in determining an actual GI value for many pet foods on the market. In addition to the fact that the GI value is affected by the food itself and the way it is prepared, it is important to note that not every pet will have a similar glycemic response to the same food. So even though the GI values applied to pet foods are general guidelines, they may not fit your pet's specific needs, nor may they be consistent across the entire dog population (Rankovic A. *et al*, 2020).

However, given the overwhelming scientific evidence supporting the health benefits of a healthy low GI diet, the glycemic index is one of the best guides for pet owners looking for healthier and more nutritious food options for their dog - especially when it comes to weight management and other weight-related diseases (Rankovic A. *et al*, 2020). In conclusion, even though the glycemic index has proven to be a useful guide in choosing healthier foods for your pet, always the owner should consult with their veterinarian to determine a nutritional diet that works best for the pet's individual needs.

Worldwide there has been an increase in the prevalence of obesity in dogs as well as humans (Suarez L. *et al*, 2022). Obesity in dogs and cats frequently predisposes to the development of glucose intolerance as well as abnormal insulin response and abnormal basal insulin concentrations (Rand J.S. *et al*, 2004). In obese pets, it has been theorized that persistent hyperinsulinemia is an important contributor to the development of diabetes (Case L. *et al*, 2011). but for this more knowledge is needed to be able to effectively prevent and treat these diseases and therefore it is important to investigate carbohydrate metabolism.

## CONCLUSIONS

Although they are not actually necessary for a dog's diet, carbohydrates provide a number of advantages for health that shouldn't be disregarded. Depending on the dog, the optimal amount of carbohydrates in the diet will vary.

This nutrient, so much debated lately, is not bad for dogs but, in reasonable quantities, can even be a practical source of energy. We only need to choose the right plants—low-glycemic fruits, vegetables, and seeds in the right amounts for the carnivore—knowing that high-glycemic carbs cause a lot more harm than a low-glycemic carb.

## REFERENCES

- Barclay A. W., Petocz P., McMillan-Price J., Flood V.M., Prvan T., Mitchell P., Brand-Miller J.C., 2008** - *Glycemic index, glycemic load, and chronic disease risk—a meta-analysis of observational studies*. Am. J. Clin. Nutr. 87:627–637. doi:10.1093/ajcn/87.3.627
- Beaton L., 2014** - *Grain-free petfood: A top trend in the U.S. pet market*. Petfood Industry, 56, 68–70.
- Beloshapka A.N., Buff P.R., Jr. Fahey G.C., Swanson K.S., 2016** - *Compositional Analysis of Whole Grains, Processed Grains, Grain Co-Products, and Other Carbohydrate Sources with Applicability to Pet Animal Nutrition*. Foods, 5(4), 23, doi:10.3390/foods5020023
- Beloshapka A.N., Cross T.W.L., Swanson K., 2021** - *Graded dietary resistant starch concentrations on apparent total tract macronutrient digestibility and fecal fermentative end products and microbial populations of healthy adult dogs*. Journal of Animal Science, 99, 409, doi: 10.1093/jas/skaa409
- Bradshaw J.W.S., 2006** - *The evolutionary basis for the feeding behavior of domestic dogs (Canis familiaris) and cats (Felis catus)*. The Journal of Nutrition, 136(7 Suppl):1927S–1931S, doi: 10.1093/jn/136.7.1927s
- Briens JM, Subramaniam M, Kilgour A, Loewen ME, Desai KM, Adolphe JL, et al., 2021** - *Glycemic, insulinemic and methylglyoxal postprandial responses to starches alone or in whole diets in dogs versus cats: relating the concept of glycemic index to metabolic responses and gene expression*. Comp Biochem Physiol., 257:110973. doi: 10.1016/j.cbpa.2021.110973
- Brummer, Y., Kaviani M., Tosh S., 2015** - *Structural and functional characteristics of dietary fibre in beans, lentils, peas and chickpeas*. Food Res. Int. 67:117–125. doi:10.1016/j.foodres.2014.11.009
- Cabrita A.R.J., Guilherme-Fernandes J., Valente I.M., Almeida A., Lima S.A.C., Fonseca A.J.M., Maia M.R.G., 2022** - *Nutritional Composition and Untargeted Metabolomics Reveal the Potential of Tetrademus obliquus, Chlorella vulgaris and Nannochloropsis oceanica as Valuable Nutrient Sources for Dogs*. Animals 2022, 12(19), 2643.

- Case L., Daristotle P.L., Hayek M., Raasch M.** - *History and regulation of pet foods, Canine and Feline Nutrition* 2011.
- Di Cerbo, A., Morales-Medina J.C., Palmieri B., Pezzuto F., Cocco R., Flores G., Iannitti T., 2017** - *Functional foods in pet nutrition: Focus on dogs and cats*. *Research in Veterinary Science*, 112, 161–166, doi:10.1016/j.rvsc.2017.03.020
- FEDIAF.** Nutritional guidelines for complete and complementary pet foods for dogs and cats. Bruxelles: European Pet Food Industry Federation (2022).
- Gal A., Cuttance W., Cave N., Lopez-Villalobos N., Herndon A., Giles J., Burchell R., 2021** - *Less is more? Ultra-low carbohydrate diet and working dogs' performance*. *PLOS One*, 23;16(12).
- Kazimierska K, Biel W., Witkowicz R., Karakulska J., Stachurska X., 2021** - Evaluation of nutritional value and microbiological safety in commercial dog food. *Veterinary Research Communications*, 45:111–128.
- NRC.** Nutrient requirements of dogs and cats. Washington, DC: National Academy Press (2006).
- Ottoboni M, Tretola M, Luciano A, Giuberti G, Gallo A, Pinotti L., 2019** - *Carbohydrate digestion and predicted glycemic index of bakery/confectionary ex-food intended for pig nutrition, Italian*. *J Anim Sci*.18:838–49.
- Rand J.S., Fleeman L.M., Farrow H.A., et. al., 2004** - *Canine and feline diabetes mellitus: nature or nurture?*. *Journal of Nutrition*, 134 (suppl 8):2072S–2080S, doi: 10.1093/jn/134.8.2072s
- Rankovic Alexandra, Adolphe J.L., Ramdath D.D., Shoveller A.K., Verbrugge A. 20220** - *Glycemic response in nonracing sled dogs fed single starch ingredients and commercial extruded dog foods with different carbohydrate sources*. *Journal of Animal Science*, Vol. 98, No. 8, 1–11
- Rauktis M.E., Rose L., Chen, Q., Martone R., Martello A., 2017** - *Their Pets Are Loved Members of Their Family”: Animal Ownership, Food Insecurity, and the Value of Having Pet Food Available in Food Banks*. *Anthrozoös* 30(4):581-593.DOI: 10.1080/08927936.2017.1370225
- Roberti-Filho FO, Palagiano C, da Silva FL., 2012** - *Processing effects on starch gelatinization and its influence on digestibility, fermentation products and microbial composition of the faeces, and glucose metabolism of dogs fed kibble diets*. In *Proceedings of the 16th Congress of the European Society of Veterinary and Comparative Nutrition*, Bydgoszcz, Poland.
- Suarez L., Bautista-Castaño I., Romera C.P., Montoya-Alonso J.A., Corbera J.A., 2022** - *Is Dog Owner Obesity a Risk Factor for Canine Obesity? A “One-Health” Study on Human–Animal Interaction in a Region with a High Prevalence of Obesity*. *Vet Sci.*, 9(5): 243.
- Vastolo A., Gizzarelli M., Ruggiero A., Alterisio M.C., Calabro S., Ferrara M., Cutrignelli M.I., 2023** - *Effect of diet on postprandial glycemic and insulin responses in healthy dogs*. *Front. Vet. Sci.* 10:1201611. doi: 10.3389/fvets.2023.1201611