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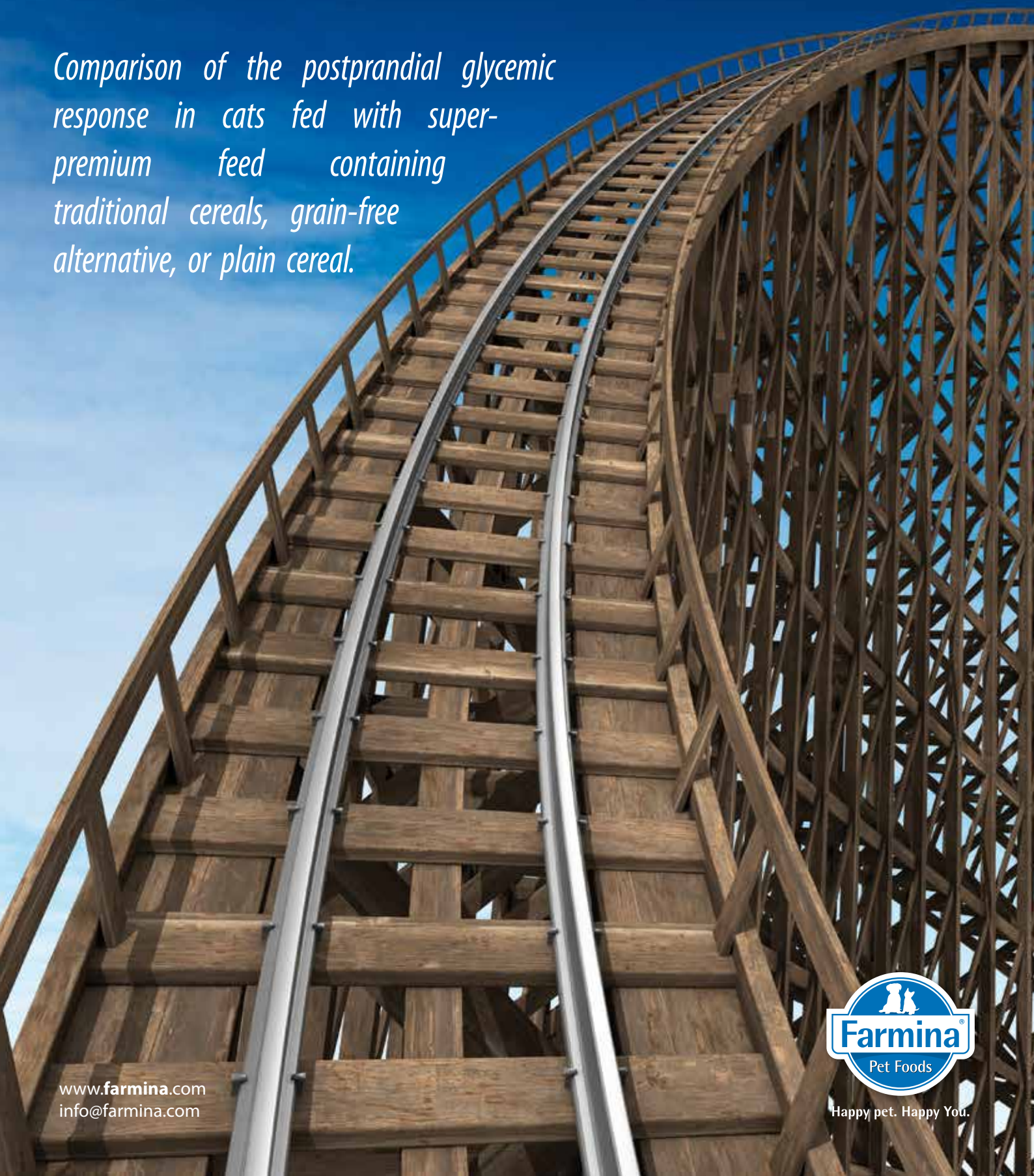
Obesity, diabetes and glycemic curve.

Comparison of the postprandial glycemic response in cats fed with super-premium feed containing traditional cereals, grain-free alternative, or plain cereal.



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Obesity, diabetes and glycemic load.

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As in humans, the incidence of diabetes mellitus and obesity in pets are increasing due to excessive caloric administration and major lifestyle changes that, over the years, were registered in the canine and feline (Hoening, 2002, Guptill et al., 2003).

Many production houses produce pet food diets formulated specifically for the treatment of metabolic disorders and / or pathological states, but little is done to prevent such diseases.

Carbohydrates are the main energy source for many bodily functions and are essential components of composite foods for pets with an incidence varying from 30 to 60 % of weight (Carciofi et al., 2007; de Olivera et al., 2008) in dry and wet compound feed, respectively.

In particular, carbohydrates are mainly present in starch feed.

It is a polysaccharide consisting of amylose and amylopectin, connected together by a bond of type 1-4 alpha. The main sources of starch are cereal grains such as rice, maize, barley, spelled, oats and some tubers such as potatoes and cassava (manioca).

Monogastric mammals like humans, dogs and cats, are not able to digest the raw starch for which the sources of such carbohydrate are to be subjected to thermal treatments before they can be administered.

In mammals, the digestion of starch is made mainly of two amylase, ptyalin of salivary origin, almost absent in domestic carnivores, and pancreatic amylase. The apparent digestibility of the starch in the dog ranges from 40 to 90% (Walker et al., 1994; Murray et al., 1999), while in the cat from 40 to 100% (Wilde and Jansen, 1989; Kienzle, 1994b).

The wide variation depends on several intrinsic and extrinsic factors

of the animal. Classification of starch was proposed as a function of the rapidity with which it can be digested: rapidly and slowly digestible starch and resistant starch.

Such latter escapes of digestion in the small intestine can be fermented in the large intestine. Starch is also considered a nutrient that influences more significant to the speed and the intensity of the glycemic response / post-prandial insulin (Nguyen et al., 1994; Kienzle, 1994a; Bouchard and Sunvold, 2000; Appleton et al., 2004; Wolever and Bolognesi, 1996; Nguyen et al., 1994; Bouchard and Sunvold, 1999; Carciofi et al., 2007).

Other principal nutrients that affect the postprandial response are the proteins and dietary fibers (Nuttall et al., 1984; Welch et al., 1987; Nishimune et al., 1991;

Nguyen et al., 1998). Which is particularly relevant, it seems to be the ratio of protein / carbohydrate in the diet, in fact, the use of low-calorie diets, so high-protein induces a greater use of hepatic gluconeogenesis, which allows the conversion of proteins into glucose.

This change leads to reduced metabolism of glucose levels (Mazzaferro et al. 2003, Frank et al. 2001; Debraekeleer, 2007).

Dietary fiber plays a key role in the determination of: rate of passage of digestion, fecal volume, satiety and production of short fatty acids chain and, consequently, blood levels of glucose, insulin and cholesterol. In particular, the use of soluble fiber, by changing the viscosity of the digestion slows transit along the digestive tract by limiting the postprandial glycemic response (Dikeman et al., 2007).

Taking into account that some physiological conditions (age, gravidity state),

paraphysiological (stress) and pathological condition (inflammatory, neoplastic processes, endocrinopathies) alter the normal glycemic control (Kahn et al., 2001), it is recommended to use diets which can minimize and extend the post-prandial glycemic response (Bouchard and Sunvold, 1999; Dikeman et al., 2007).

MATERIAL AND METHODS

For the test, we used 6 adult neutered cats of both sexes (average weight 4.65 ± 0.34 kg, BCS of 5.7 ± 0.47, 3.5 ± 0.21 years old) living in a colony in the province of Naples. During the test, we used for the 3 complete compound feeds for maintenance of adult cats: SPT, made up of traditional sources of starch such as rice and corn; N & D grain free high-protein, characterized by the absolute absence of grains, whose low intake of starch derived from potato, N & D low grain characterized by the presence of alternative cereals such as barley and oats. Characteristic chemical nutrition of food is shown in the Table 1.

Table 1- Chemical and nutritional diets characteristics

Diet	SPT	N&D grain free	N&D low grain
		% t.q.	
PG	32	44	36
EE	15	20	20
CG	3,4	1,8	1,9
EI	34,6	16,7	26,0
EM (kcal/kg)	3606	3824	3870

The experimental period for each dietary treatment lasted a total of 30 days (10 adaptive and 20 test) in which each diet was administered in proportion of 100kcalEM/kg0, 67.

On the thirtieth day, fasting cats were weighed and allowed for a blood sample, to determine the metabolic profile, and then were recovered in order to make the blood glucose curve. During the 24 hours of observations, we made 12 blood glucose measurements and animals have had access to food in proportion of 50kcalEM/kg0, 67/paste, for 30 minutes immediately after the first and sixth sampling. All results were subjected to analysis of variance in order to evaluate the effect of diet on blood parameters and on the glycemic response by using Proc GLM of SAS (2000).

RESULTS AND DISCUSSIONS

During the test, there were no significant changes in the weight of the subject as shown in Table 2.

Table 2 - Average weight gain and daily voluntary intake

Diet	Weight	Ingestion
	kg	g/kg^0,67
SPT	4,70±0,35	26,15±2,61
N&D grain free	4,63±0,33	21,39±5,47
N&D low grain	4,60±0,39	23,66±3,56

In table 3, there are reported average values of the blood parameters. There were no statistically significant differences among dietary treatments for indicative parameters of protein metabolism, nor the activity of the liver, while concentrations of glycated proteins were significantly higher after administration of the feed SPT, both with respect to the feed of cereals (P <0.05) than that formulated with alternative cereals (P <0.01).

Figure 1 describes the postprandial glycemic response. It seems evident that the two rice and corn-free diets induce a moderate rise in blood sugar: blood sugar levels up to 82.6, 72.8 and 71.3 mg / dl, respectively, with diets SPT, N & D grain-free and low-N & D grain. Despite the high individual variability, typical for the species (Kienzle, 1994a; Sunvold and Bouchard, 2000), no differences were statistically significant (P <0.01) from the fourth sampling to the tenth, in which the feed has made SPT recorded blood glucose levels higher than either of the feed N & D.

These results are in accordance with what was reported by de Olivera et al., 2008.

Despite the fact that graphical representation shows a different trend of the curves obtained with the post-prandial grain-free feed and such formulated with the oats and barley, there were no statistically significant differences when comparing the two treatments. However, the grain free N & D feed seems to induce a slower rise

and persistent blood glucose levels, compared to the N & D low grain feed, and this can be attributed to increased use of gluconeogenesis originated from the protein.

Table 3 - Average values of biochemical parameters recorded with the three diets

Diet	Azotemia mg/dl	Creatinin mg/dl	GOT U.I.	GPT U.I.	γ GT U.I.	FA mg/dl	Prot glic µmol/l
SPT	50,6±3, 1	1,50±0,09	30,0±2,8	35,4 ±3,0	2,86 ± 0,22	40,4 ± 2,9	347 ± 17Aa
N&D grain free	51,1±3,1	1,53±0,09	30,7±2,7	36,1 ± 3,0	2,43 ± 0,22	34,3 ± 3,1	318 ± 17Ab
N&D low grain	45,3±3,3	1,32±0,10	34,0±3,0	40,0 ± 3,2	2,50 ± 0,24	36,7 ± 2,9	246 ± 18B
Rif	40-70	0,5-2	< 90	< 78	< 10	< 78	219-347

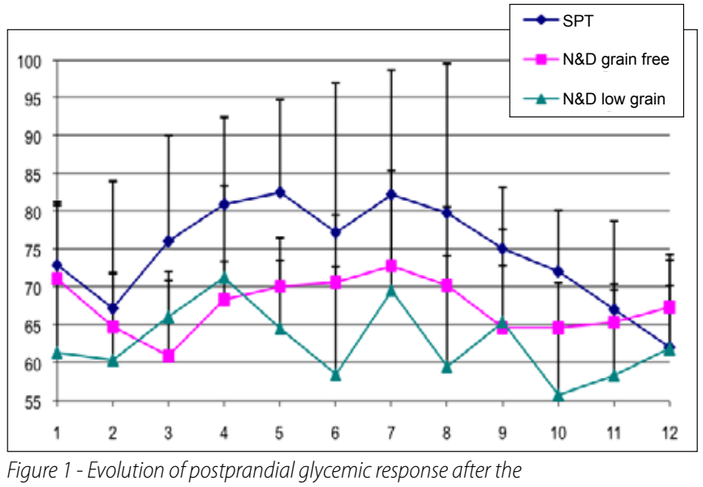

Figure 1 - Evolution of postprandial glycemic response after the administration of the three diets

In conclusion, these first results show how you can use the free feed containing cereals or grain alternative to rice and corn, allowing you to control the postprandial glucose response in cats, limiting the risk of onset of insulin-resistance typical for diabetes mellitus in cat, and lypogenic activity which favors the formation of adipose tissue, by inhibiting the hydrolysis of triglycerides by adiposity stored by lipase.

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