

# Management of feline diabetes mellitus:

## update and challenges

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### AIMS

This study intends to perform an updated revision of the management of feline diabetes mellitus (DM):

- Focusing in the importance of the nutritional management to control blood glucose (BG) values
- Evaluating the different insulin types currently available on the market and comparing its short and long term efficacy
- Emphasizing the importance of the intensive patient monitoring and the difficulties in the real clinical practice

### INTRODUCTION

DM is one of the most frequent endocrinal diseases in cats (prevalence of 0.2-1%). It is defined as a persistent hyperglycaemia caused by a relative or absolute insulin deficiency. The 80% of the cats suffer type 2 DM, characterized by the presence of insulin resistance and  $\beta$  pancreatic cell dysfunction. Despite the fact that is an easily diagnosed disease, its management display important challenges and require the active participation of the owner to accomplish an intensive BG control, especially if the remission of the disease is sought.

### NUTRITIONAL MANAGEMENT

The odds of remission are between 33-100% with the combination of insulin therapy and nutritional management. The objective will be to reduce the high post-prandial glycemia of cats. The different options for the diet are:

#### Low-carbohydrate (CH) / High-protein diet

1st option

$\leq 12\%$  CH  
(of total calories)

$>40\%$  protein  
(of total calories)

- ✓ Stabilize glucose metabolism
- ✓ Reduce or remove the needs of exogenous insulin
- ✓ Avoiding loss of muscle mass
- ✓ To prevent the development of hepatic lipidosis

#### High-fiber diet

Obesity

13% fiber  
(of dry matter)

- ✓ Delay or decrease carbohydrate absorption
- ✓ Contains half caloric density comparing with low CH diets (with greater fat content)

#### Low-protein / Low phosphorus diet

Chronic Kidney Disease

22% protein  
(of total calories)

- ✓ Extend survival time and improve patient life quality

Another important consideration is to feed the animal with a wet-food diet instead of a dry-food diet:

- Lower CH content
  - Lower energy density
  - Highest water content
- Achieve greater feeling of satiety that favours los of weight

### CONCLUSIONS

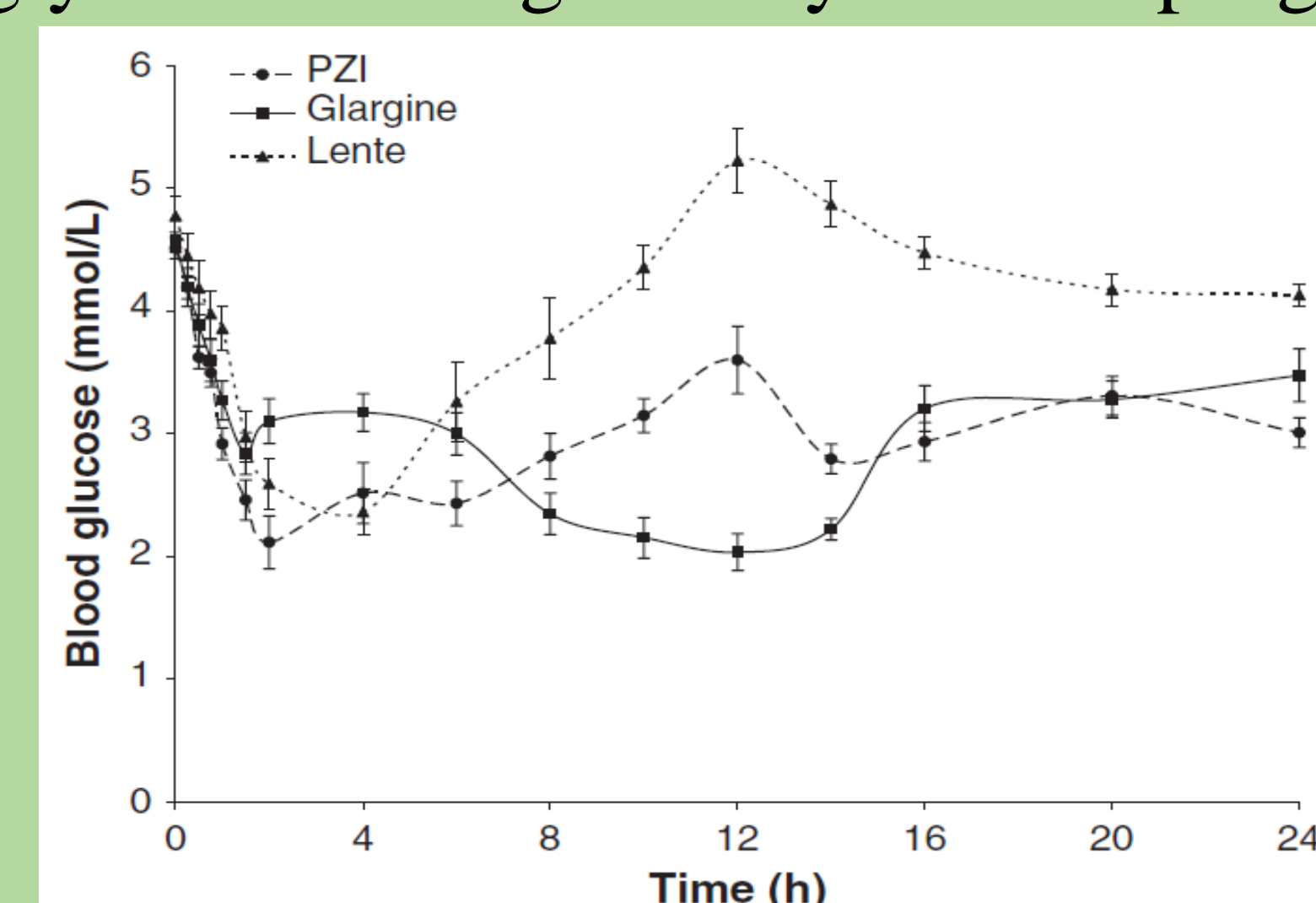
- Although is preferable to fed with a low-CH/high-protein diet, patients should be assessed individually in nutritional management as there is no proper diet for all of them, especially in cases of obesity and chronic kidney disease.
- Most recent experimental studies reveal that long-acting insulins, glargina and detemir particularly, are the best option for the treatment during first months after diagnosis. Administrating the doses every 12 h achieves smaller daily BG fluctuations and greater remission rates.
- Further experimental studies on detemir action are needed. Although different sources affirm that detemir and glargine have very similar therapeutic results, there are certain findings indicating that detemir could have longer duration than glargine.
- It is necessary to improve home monitoring tools and involve the owner for tight control of the disease, which increases remission possibilities.

### INSULIN TREATMENT

**Table 1.** Relevant data of different insulin types <sup>1</sup>

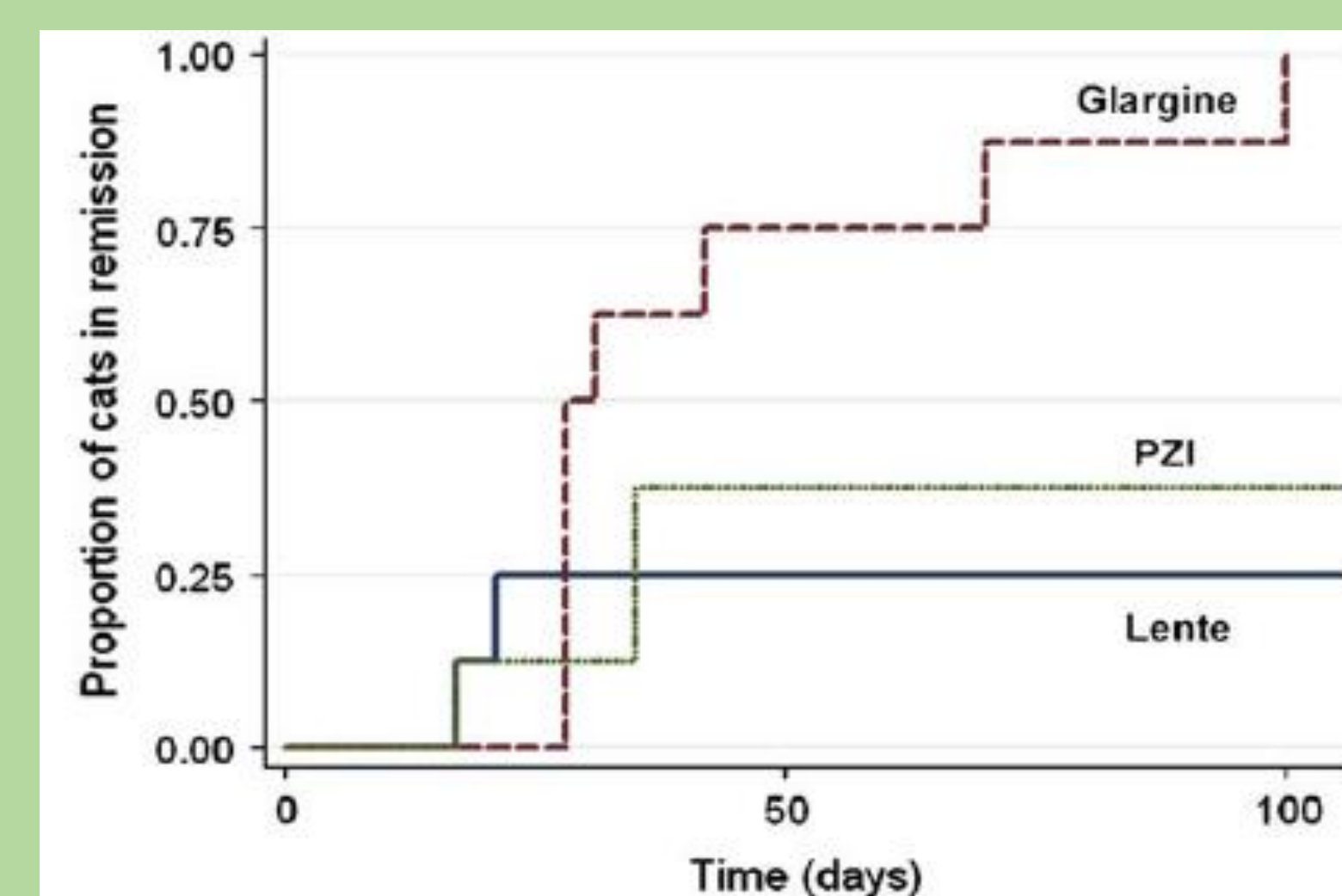
Insulin types	Peak activity (post-injection)	Duration of effect	Frequency of administration
<b>Medium-acting</b>	2-8 h	8-10 h	q8-12 h
Lente insulin			
<b>Long-acting</b>	2-6 h	13-24 h	q12h
Protamine zinc insulin (PZI)			
Glargine	12-14 h	12 a >24h (10-16h)	q12h
Detemir			

The different duration between insulin types lead to diverse mean 12h BG concentrations (Figure 1). Lente insulin shorter action induce periods of hyperglycemia during the day and the progression of disease.



**Figure 1.** Mean BG concentration curve of different insulin types <sup>2</sup>

Glargina and Detemir have a consistent profile activity instead of acute peak activity of Lente insulin and PZI, providing lower probability of clinical hypoglycaemia and a tight BG control.



**Figure 2.** Cumulative proportion of cats going into remission <sup>2</sup>

An intensive treatment with Glargina or Detemir including correct nutritional management achieves greater remission rates than Lente insulin or PZI.

### MONITORING

Intensive monitoring is necessary to apply the correct changes in insulin dose, which should be based in clinical signs, BG values and the insulin action duration.

Insulin types	Initial dose	BG values	Maximum dose change frequency
<b>Medium-acting</b>	0.25-0.5 UI/kg	Nadir	Every 3-5 days
<b>Long-acting</b>	q12h	Pre-insulin	Every 5-7 days

In large term, the information provided by the owner will be essential to indicate the disease development. The most important parameters are daily water intake (20 ml/kg/day in a good control), urine production, body weight, urine glucose and BG as often as possible.

[1]: Sparkes AH, Cannon M, Church D, Fleeman L, Harvey A, Hoenig M, Peterson ME, Reusch CE, Taylor S, Rosenberg D. 2015. ISFM Consensus Guidelines on the Practical Management of Diabetes Mellitus in Cats. J Feline Med Surg 17:235-250.

[2]: Marshall RD, Rand JS, Morton JM. 2008. Glargine and protamine zinc insulin have a longer duration of action and result in lower mean daily glucose concentrations than lente insulin in healthy cats. J. Vet. Pharmacol. Ther. 31:205-212.