



COMPARISON OF GLYCAEMIA AND INSULIN PRODUCTION IN HORSES AFTER PALATINOSE AND GLUCOSE ORAL INTAKE

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Food supplements are generally given by oral administration, mixed with a carrier. This carrier is often a sugar, which has the advantage of being appetising for the horse. However, the carrier must be as neutral as possible in the horse's metabolism, and especially it should not interfere with its carbohydrate metabolism.

Palatinose is a pure and sweet white carbohydrate obtained from a natural source of sucrose. It is produced by an enzymatic rearrangement involving the conversion of the connection alpha 1.2 between glucose and the fructose into a connection alpha 1.6. The result of this rearrangement is an extremely slow-reacting sugar which ensures a better distribution of the energy contribution in the horse. Thanks to its slow assimilation, palatinose appears much more slowly in blood and therefore produces only a limited increase in blood glucose. The energy released by palatinose is consequently present

much longer and ensures a constant contribution for periods longer than, for example, glucose (see graphic).

The two characteristics below make palatinose a good candidate as a food carrier for horses:

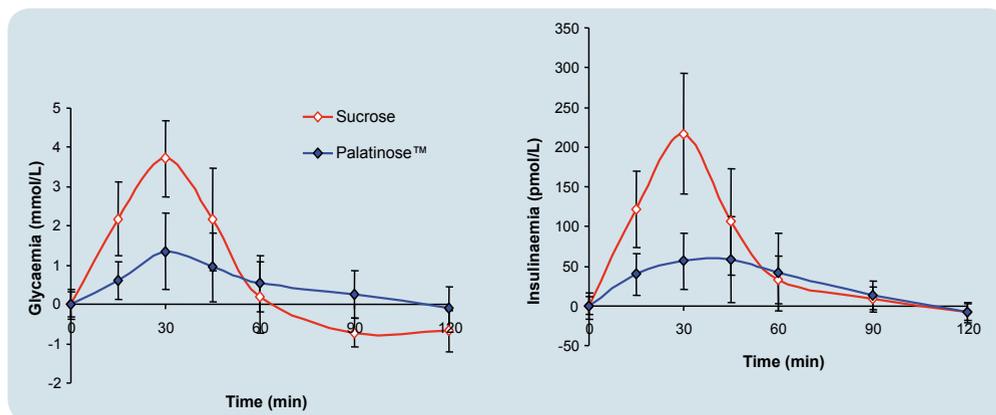
1) Its low glycaemic index

The glycaemic index of food determines its influence on the level of blood glucose. In humans palatinose has a low glycaemic index of 32 (high GI is around 70; while weak GI is below 40).

2) Its low insulin index

Palatinose is also characterised by a weak insulin index. This weak insulin index (value of 30) thus helps to maintain a normal insulin level in the horse.

Consequently, palatinose could be a useful food carrier, but it has nevertheless never been used in horses.



The aim of this work was to compare the effects of the oral administration of palatinose on glycaemia and insulin blood levels with the effects of an equivalent dose of glucose in the horse. The results would determine whether palatinose is a useful substrate that could be used as a carrier for the administration of food supplements: selection criteria would be firstly its palatability and secondly a lack of significant interference with carbohydrate metabolism.

MATERIAL AND METHOD

Animals

Six adult horses (description in appendix), in good health at the clinical examination, were used.

The horses were kept in the same stable and were fed in the same way: litter of straw, 1 litre of concentrate every morning and hay silage ad libitum.

Protocol

Firstly, two horses were used to determine the minimum amount of palatinose necessary to induce a rise in glycaemia as well as a variation in insulin production. Two doses were tested: 50 g and 200 g.

Then divided into 2 groups, glucose and palatinose, the horses were fed for the last time the day before the test at 4.00 pm with silage (6 kilos).

The next morning at 8.00 (t₀), the first blood samples were obtained. After this the horses received 100 g of concentrates, together with one of the two amounts of palatinose to be tested. The next blood samples were obtained 90 minutes (t₉₀) and 3 hours (t₁₈₀) after the oral administration of the sugar, during which period the horses did not receive any feed. The test was repeated after 24 hours by reversing for each horse the dose to be tested. The dose of 200 g was selected for the protocol, according to the results of this preliminary test (very weak changes observed with the 50 g dose).

The principal test was conducted as follows. 6 horses were used to compare the effects of an amount of 200 g of either palatinose or glucose on glycaemia and insulin production. The horses were fed for the last time, the day before at 4.00 pm with silage (6 kilos). They were then randomly divided into 2 groups.

The following morning at 8.00 (t₀) the first blood samples were obtained. After this the horses received 100 g of concentrates, with either 200 g of palatinose (in one group), or an equivalent dose of glucose (in the other group). Further blood samples were taken at t₉₀ and t₁₈₀, during which period the horses did not receive any feed. After 48 hours of wash-out, the same protocol was followed by reversing the tested sugars.

SAMPLING AND ANALYSIS

For the glycaemia analysis, blood was taken in vacuum tubes coated with fluoro-acetate.



After centrifuging, the plasma samples were cooled, and analysed within 3 hours. Glucose levels were analysed at the medical laboratory of the Faculty of Veterinary Medicine of Liège, Belgium..

The samples intended for the insulin analysis were taken in dry tubes, centrifuged and frozen. They were analysed later at the Laboratory Frank Duncombe (in Caen-France), by chemiluminescence (Immulite 2000, Siemens).

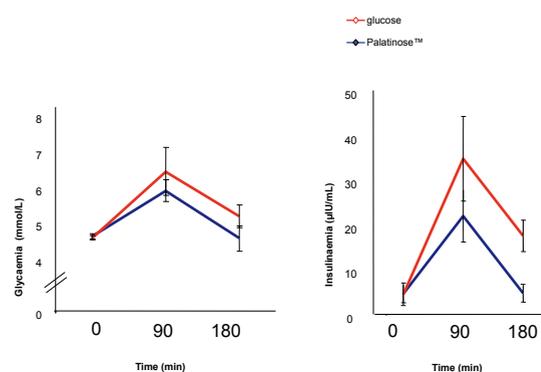
Statistical analysis

The data are given as mean + standard error. They were analysed by reference to a general linear model in SAS, with the horse, the time and the type of sugar as variables. The threshold of 0.05 was considered as significant.

RESULTS AND DISCUSSION

Practical and technical considerations. For ethical reasons and in order to respect the welfare of the horses, sugars were not administered with a naso-gastric tube but were given mixed with concentrates (100 g), which, even in small quantity, may have partly influenced the results. The palatinose was spon-

aneously consumed by all the horses. The palatability of the glucose was much lower. There was even one horse that totally refused to take it. This horse had to be replaced by another horse.



Glycaemia. A significant glycaemia peak was observed at 90 minutes with both carbohydrates, followed by a progressive decrease and return to the initial value, which was complete 180 minutes after administration in the case of the palatinose, but not in the case of glucose (the difference was nevertheless not significant). These observations differ from those reported in man, in which the glycaemia peak with palatinose is also weaker but lasts longer than with sucrose.

Insulin levels. Insulin production reached a peak at 90 minutes, more marked in the case of glucose (non-significant difference). This increase in insulin production with glucose was prolonged without return to normal 180 minutes after administration. Consequently, insulin production in the horses that received glucose remained significantly higher than in the horses that received palatinose.

The differences of the peaks of glycaemia and insulin production between the 2 carbohydrates were non-significant which could be due to the small number of individuals used for the investigation, as well as the relatively important variations between individuals, in particular with insulin production.

DESCRIPTION OF THE HORSES

Horse	Breed	Sex	Age	Weight
Gadjo	BWP	m	9	635
Qorrída	standardbred	f	9	465
Babette	-	f	16	569
Lola	pinto	f	14	555
Springy	-	m	20	527
Alix*	arab	f	23	414

*Supplementary horse

CONCLUSIONS

Although the number of horses was low and although the fact that the sugars were administered with concentrates, the results of this study suggest that the administration of glucose interferes more with carbohydrate metabolism than the administration of palatinose. Moreover, this latter sugar was obviously more palatable for the horses. Consequently and for these two reasons, palatinose is an excellent candidate as a carrier for the administration of food supplements.

