

Marta Żebrowska

„Ocena wpływu WPC-80 na wybrane egzoglikozydazy lizosomalne w wątrobie szczurów”

SUMMARY

Whey is a rich source of essential amino acids. Due to its numerous health properties (antihypertensive, antiviral, antioxidant, central, etc.), it is eagerly used in both, the food sector and pharmaceutical industries. New technologies have created whey protein concentrates (WPC), which can be divided considering its protein content (35%, 50%, 65% and 80%). WPC-80 is a source of wholesome protein in human diet and the requirement for this component depends on general physiological condition of the body. More proteins need children (1.17-0.95 g/kg BW/day), pregnant (1.2 g/kg BW/day) and breastfeeding women (1.45 g/kg BW/day). According to the data of National Food and Nutrition Institute in Warsaw, it was shown that the average adult man needs 0.9 g/kg BW/day of protein. Recently, however, an increased interest in high protein diets can be observed, with doses exceeding 3 g/kg/day.

A diet containing too much protein in relation to actual requirements of the body will result in a positive nitrogen balance, which in turn will increase the production of urea and ammonia. This may cause a significant liver (responsible for the synthesis of urea) and kidneys (responsible for elimination of urea in urine) burden. It is well known that concentrations of aspartate aminotransferase, alanine aminotransferase and gamma-glutamyltransferase are used to assess liver function. However, new parameters, that would more specifically characterize a function of liver are still sought. In this context, exoglycosidases are being considered.

Exoglycosidases cleave single sugar residues from nonreducing end of glycoconjugates in the acidic medium of lysosomes. They catalyze breakdown reactions of glycosidic bonds in sugar chains. They form reaction sequences where the product of one reaction is the substrate for another. N-acetyl- β -hexosaminidase (HEX) is the most active among lysosomal exoglycosides. This group includes also: β -glucuronidase (GLU), β -galactosidase (GAL), α -mannosidase (MAN), and α -fucosidase.

The aim of the study was to evaluate the effect of WPC-80 on the activity of selected lysosomal exoglycosidases and also a total protein concentration in the liver of rats.

Studies were conducted on male Wistar rats. Animals were kept in cages under standard conditions. They had free access to water and to a standard laboratory rat chow. The rats obtained by intragastric gavage WPC-80 solution in a dose of 0.3 or 0.5 g/kg body weight or 0.9% NaCl solution for 7, 14 or 21 days. The study material consisted of rodents' liver. Specific activities of lysosomal exoglycosidases (HEX, GLU, GAL, MAN, FUC) in liver homogenates were determined by colorimetric method, and the commercial BCATM Protein Assay Kit was used to assess total protein concentration. The composition of WPC-80 administered to rats was also analyzed.

It has been shown that WPC-80 is a wholesome product containing 78.2% of proteins, including all amino acids, a wide range of vitamins, minerals and many fatty acids. Specific activities of the majority of examined exoglycosidases were higher in comparison to the group of animals receiving a standard diet with normal protein content. HEX specific activity was significantly higher in liver homogenates of both, control rats and those fed with whey diet, compared to all other hydrolases. There was a significant increase in the specific activity of HEX and GLU in liver homogenates of rats fed with WPC-80 regardless of dose (7, 14 and 21 days) compared to rats in the control group. Specific activity of MAN and FUC in the liver significantly increased with the extension of WPC-80 (also dose independently) exposure compared to control animals. GAL specific activity did not change after administration of WPC-80 compared to values obtained in control group. It was further demonstrated that with increasing time of WPC-80 administration, specific activities of the majority of lysosomal hydrolases were increased. Estimated correlations did not indicate statistical relationships between tested parameters.

Analysis of obtained results led to the following conclusions:

1. Specific activity of HEX, GLU, MAN and FUC depends on high protein diet.
2. Duration of WPC-80 supplementation is a key parameter that regulates the activity of tested exoglycosidases.
3. WPC-80 significantly increases the catabolism of glycoconjugates and liver reconstruction.
4. WPC-80 supplemented diet for over 14 days may impair liver function in range of exoglycosidase activity.