

Summary

The effect of nutrition on bone metabolism

The bone has a function for support and protection, and is also a place for hematopoiesis and for mineral homeostasis.

The subject of interest of this thesis is to evaluate the effect of chosen proteins, amino acids, iron and the conditions such as long-term under-nutrition, short-term starving and repeated blood withdrawals on the bone parameters – the length and the diameter of the bone, the width of corticalis, and the mechanical properties – resistance to bending, tension and torsion. There were evaluated changes in the concentration of bones markers, changes in the bone mineral density and changes in lean mass and adipose mass in healthy adult males of the Wistar rats .

During my doctorate studies I was studying the effect of these components on the bones. In the 1st experiment the rats were fed by the chosen proteins and amino acids: glutamine (GLN), branched-chain amino acids- valine, leucine and isoleucine (BCAA), and caseine (KAS) *ad libitum*. Further we monitored the effect of one-week realimentation by standard laboratory diet (SLD) after long-term supplementation by the diet enriched by the above mentioned proteins and amino acids. The group fed by SLD *ad libitum* was the control group. In the 2nd experiment the effect of paired-feeding of the group fed by SLD and caseine was followed up and the amount of food complied with the group fed by BCAA from the 1st experiment (long-term under-nutrition). The effect of diet supplemented by arginine (Arg) and creatine (Krea) *ad libitum* and the effect of 24-hour starving (short-term starving) was followed up in the 3rd experiment. The 4th experiment followed the effect of iron enriched diet in two different concentrations alone or in combination with repeated blood withdrawals.

In the 1st experiment was found neither the effect of glutamine nor caseine supplementation on bone mass in healthy male adult rats. The significant effect on bone mass was found after branched-chain amino acids supplementation; the lower increase in length of femur, decreased resistance of femur to bending, the decrease in bone remodelling turnover, the decrease in gain of body weight and the decrease on bone mineral density of tail vertebrae. We think that this complex deterioration of bone metabolism was caused by both the composition of diet and the decrease in diet intake. The realimentation by SLD caused the increase of bone turnover in the group supplemented by caseine and the activation of osteoblast in the group supplemented by BCAA and the decrease of bone mineral density of femur in the group supplemented by glutamine. Nevertheless, we think that the effect of the realimentation on the bone mass would occur after longer period of time.

To confirm the above mentioned hypothesis, we'd decided to follow up the effect of pair-feeding based on BCAA group by SLD and the caseine group in the 2nd experiment. Both pair-fed groups showed deterioration of bone mass status compared to the groups fed *ad libitum*. Otherwise the status of the bone mass was better in both pair-fed groups compared to the BCAA group. So we can state that the changes in the bone mass are connected not only with the amount of diet intake as well as with the quality of the diet.

In the 3rd experiment we concluded that the effect of arginine and creatine on bone was rather negative, although a deterioration of resistance of tibia to bending was found in the arginine group only. The short-term starving had a negative effect on bone tissue, because it caused the decrease in resistance of tibia to torsion only for the group SLD. The deterioration of the mechanical properties was not found for the arginine group. We even found a support of bone formation during short-term starvation for the creatine group.

Neither the iron over-supplementation nor repeated blood withdrawals resulted in changes of the bone properties to the healthy adult male of the Wistar rats. The good ability to compensate this state was due to their health and the short period of the experiment.

We didn't prove that supplementation by the chosen proteins, amino acids, iron and the combination of long-term under-nutrition, short-term starving or repeated blood withdrawals could result in serious changes of the bone mass by healthy adult male of the Wistar rats. For recognition of mechanisms by which the healthy organism can deal with the changed conditions, could be the subject of interest for the next research. The question is how could female rats, the subjects with bone or any other diseases or aged subjects react to these conditions.