POSTER NO 13

The Importance of Adequate Liver Glycogen during Recovery Sleep

BULLOUGH, W S and EISA, E A, "The Diurnal Variations in the Tissue Glycogen Content and Their Relation to Mitotic Activity in the Adult Male Mouse", **Journal of Experimental Biology** 27,257-263 (1950), Published by Company of Biologists 1950, University of Sheffield, Farouk I University, Alexandria.

ABSTRACT

In a recent series of papers on the epidermis of the adult mouse (Bullough, 1949a, b, 1950a, b), it has been repeatedly stressed that the concentration of glucose or glycogen is the most important single factor affecting mitotic activity. In normal circumstances a high mitosis rate is seen only during rest or sleep, and it was suggested by Bullough (1949) that this may be related to the deposition of glucose from the blood at this time. While it is well known that most of the deposited glucose is stored in the liver in the form of glycogen, it also appeared possible that some may be stored on other tissues including the epidermis. Opportunity has now been found to check this hypothesis and to discover whether the diurnal rhythm in the glycogen content of the skin shows any relation to the diurnal rhythm in epidermal mitotic activity.

1. A description is given of the hour-to-hour variation in the liver glycogen content in adult male mice, and it is shown that the concentration is highest while the animals are asleep and lowest while they are awake.
2. A similar cycle is also described in the glycogen content of the skin. Histologically it is shown that a high proportion of the skin glycogen lies in the cytoplasm of the epidermal cells, and that during sleep both the epidermal glycogen content and the epidermal mitotic rate increase considerably. The skin glycogen content and the epidermal mitotic activity also show a marked increase after a subcutaneous injection of 20 mg. starch, while they are both abnormally depressed after two injections of 1/50 unit insulin.
3. These results, together with others previously reported, are in agreement with the theory that at the onset of sleep glucose is deposited from the blood into the tissues where it appears in the form of glycogen. Since it is known that glucose, or glycogen, is a critical substance affecting mitotic activity in the adult mouse, it is logical to find that an increase in the epidermal glycogen content is accompanied by a greatly increased mitosis rate. On waking, the reverse process takes place, glycogen being withdrawn as glucose into the blood and mitotic activity falling to a low level.

EDITOR'S COMMENT

This dated but relevant study from 1950 shows that skin repair is cyclical and variant over time, correlated to sleep, and dependent on the glycogen content of the cell. The authors demonstrated that this content of cell glycogen is related directly to the content of liver glycogen. They show a clear correlation, at 2 hourly intervals over some 14 hours, between liver glycogen, tissue cell (in this case skin) glycogen, and mitosis (repair - formation of new cells).

We now know that when liver glycogen is low, repair of body cells (muscle, bone, and other body tissues) will be inhibited. The cascading steps are:

1. **Low liver glycogen levels lead to**
2. **Release of cortisol which leads to**
3. **Release of IGFBP-1[1] (Insulin-like Growth Factor Finding Protein-1)**

IGFBP-1 inhibits insulin-like growth factor-1, a key repair and recovery factor, which in humans is a sleep driven process. Thus, inadequate liver glycogen plenitude prior to bedtime will inhibit normal recovery and rebuilding of body cells/tissues. Consequently, less fat is burned during rest, since only "optimized recovery physiology" is fat fueled physiology.

Liver glycogen may be selectively replenished prior to bed with honey, inhibiting IGFBP-1 release. The result will be improved sleep, improved recovery/rebuilding of body tissues, reduction of adrenal stress overnight, and optimal fat metabolism (increased fat-burning).

Honey is the perfect food for liver replenishment prior to bed and for activating sleep and optimizing recovery physiology.

[1]Conover et al, "Cortisol increases plasma insulin-like growth factor binding protein-1 in humans", **Acta Endocrinol** (Copenhagen). 1993 Feb;128 (2):140-3).