

炭素磁気共鳴分光法による肝臓の グリコーゲン評価方法の確立及び日内変動の検討

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Diurnal Variation in the Glycogen Content of Human Liver Using ^{13}C -MRS

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ABSTRACT

Carbohydrate is stored as glycogen in the liver and muscle, and it is an important energy source for endurance exercise. The roles of liver and muscle glycogen were different: the former contributes to maintain whole body blood glucose while the latter provides energy to contract muscle fiber. Our previous study demonstrated that the diurnal variation of the glycogen content in human thigh muscle was relatively small. On the other hand, there were few studies that addressed the diurnal variation of the liver glycogen. Since the liver glycogen continues to supply glucose even while sleeping, there is the possibility that the liver glycogen shows larger diurnal variation than the muscle. The purpose of this study was to investigate and compare the diurnal variation in the glycogen content of the liver and muscle using carbon magnetic resonance spectroscopy (^{13}C -MRS). Five healthy male were recruited to the present study after providing written informed consent. They were instructed to maintain sedentary and to refrain from performing exercise during experiment. Three meals prior to first measurement and two meals during study were individually standardized according to the estimated energy requirement for Japanese. The liver and calf muscle

(gastrocnemius + soleus muscles) glycogen content were determined noninvasively by ^{13}C -MRS using a clinical MR system at 3-T. ^{13}C -MRS was performed after supper on the first day, and every 3 hours from 0700 h to 1900 h on the second day. The changes in the muscle glycogen concentration were small through an experimental period. The larger diurnal variation of the liver glycogen content was shown: the lowest value was observed early in the morning (at 0700 h). The reason for it is thought to be that the turnover rate of glycogen metabolism in the liver is faster than that in the muscle, and that a relatively long time has passed from the last meal (supper) to the next morning. The present study reveals the different diurnal variation in the glycogen content between the liver and muscle in human using ^{13}C -MRS.

要 旨

本研究は肝臓のグリコーゲン濃度を評価する方法を確立し、座位中心の通常生活下における肝臓グリコーゲンが1日の中でどのように変動するか検討することを目的とした。測定方法を検討するため直径10cmおよび15cmの表面コイルを用い、繰り返し時間、積算回数、フリップ角の条件を変えた測定を繰り返し、肝臓のグリコーゲンのスペクトルを得る最適と思われる条件を検討した。その結果、直径10cmのコイルを用い、繰り返し時間160ms、積算回数6000回の条件に決定し、1回のスペクトルを得るために要する時間は約16分となった。この条件にて、健常な成人男性5名を対象に、食事を統制した通常生活における肝臓のグリコーゲン濃度を3時間毎に測定した。骨格筋とは異なり肝臓のグリコーゲンは起床後朝食前がもっとも低く、夜に向けて徐々に高くなっていくことが明らかとなった。