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Short Report

Effect of Dietary Restriction on Survival Rate and Serum Biochemical Parameters in Hepatectomized Rats

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Key words: hepatectomy, survival rate, body weight, triglycerides, food restriction

Abstract

The aim of the present study was to evaluate the effect of a moderate diet restriction on survival rate in hepatectomized rats. After partial hepatectomy, animals were divided into an ad libitum group (group A; n=12) and an energy-restricted group (group ER; n=10). Body weights of the ER group were lower than those of group A. In addition, the survival rate of the ER group was higher than that of group A. Therefore, in adult rats, attenuation of body weight increase by energy-restriction may be considered to be a factor prolonging the life span, irrespective of hepatectomy.

Introduction

Since the first successful operation in 1989 [1], living donor liver transplantation (LDLT) has become an important choice of treatment for children with end-stage liver diseases [2–4]. An essential prerequisite for LDLT is to perform donor hepatectomy with minimal risk [5]. The liver can restore tissue loss by regeneration. This potential is of physiological relevance in numerous diseases of the liver such as viral and alcoholic hepatitis, and metabolic disorders, or recovery from liver surgery [6]. But the authors reported previously that the mean survival rate of 30% hepatectomy (30%H) rats was lower than that of normal rats, and that partial hepatectomy affected serum lipid levels. Moreover, weight gain, increased food intake, and increased serum lipids might decrease longevity [7,8]. Therefore, this experiment was designed to examine the growth rate and life span of 30%H rat under restricted feeding conditions.

Materials and Methods

Animals

Male Sprague-Dawley rats weighing about 500±5g were used in this study. All animals were housed in a temperature controlled room with a 12 h light/dark cycle. After an overnight fast, rats were anesthetized with pentobarbital sodium, and the abdomen was opened with an upper midline incision. The left lateral lobes (30% of the total liver volume) were resected according to the method of Higgins and Anderson [9]. After two days fasting, the operated animals were randomly divided into two groups: group A (n=12) received a commercial stock diet ad libitum and group ER (n=10) was restricted to 80% of the amount

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consumed by group A. Water was provided ad libitum.

The survival time for group ER was compared with that of group A.

Measurements

Body weight was measured once a week throughout the experimental period. After a 17hour fast, blood was collected from the tail vein under light ether anesthesia at 24 weeks and the serum was preserved at −40 ℃. Serum triglycerides (TG), total cholesterol (TC), esterified cholesterol (EC) and free cholesterol (FC) were assayed with an automatic analyzer (Hitachi, Model 7170).

Statistical analysis of results

Differences were analyzed by Student's t-test, and $p<0.05$ was taken to indicate significance. Values were expressed as mean±SEM.

Results

Body weight

Figure 1 shows the growth curve during the first 24 weeks post-operation for each group. Group A rats gained weight more rapidly than those in group ER.

Serum lipids

TC, EC, FC and TG results are shown in Fig.2. At 24 weeks post surgery cholesterol and triglycerides were slightly lower in group ER than group A.

Survival rate

A comparison of survival rates showed that group ER rats lived longer those in group A (fig3). The median survival time of group ER was 91±7 weeks while that of group A was 72±6 weeks.

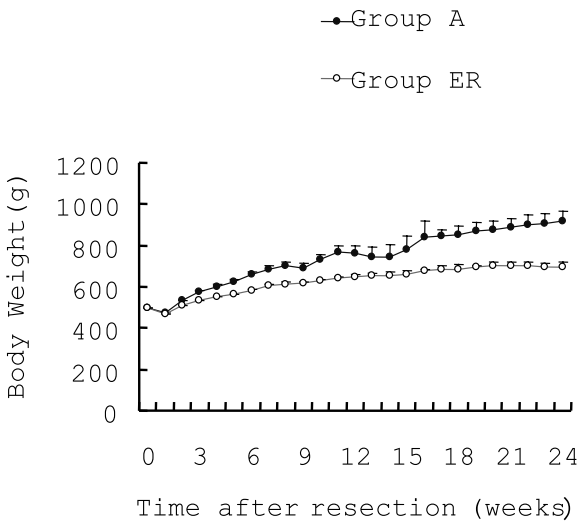

Fig. 1 A comparison of body weight changes after partial hepatectomy between the ad libitum group (n=12) and energy-restricted group (n=10). All values are expressed as means±SEM.

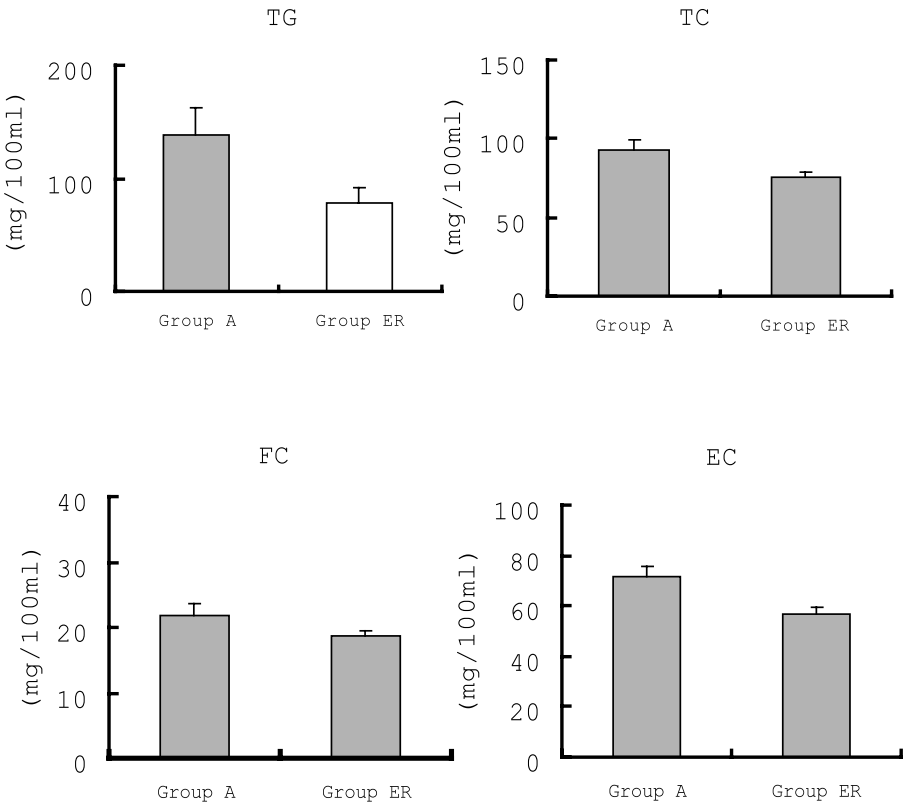

Fig. 2 A comparison of serum triglycerides (TG), total cholesterol (TC), esterified cholesterol (EC) and free cholesterol (FC) levels after partial hepatectomy between the ad libitum group (n=12) and energy-restricted group (n=10). Values are expressed as means±SEM.

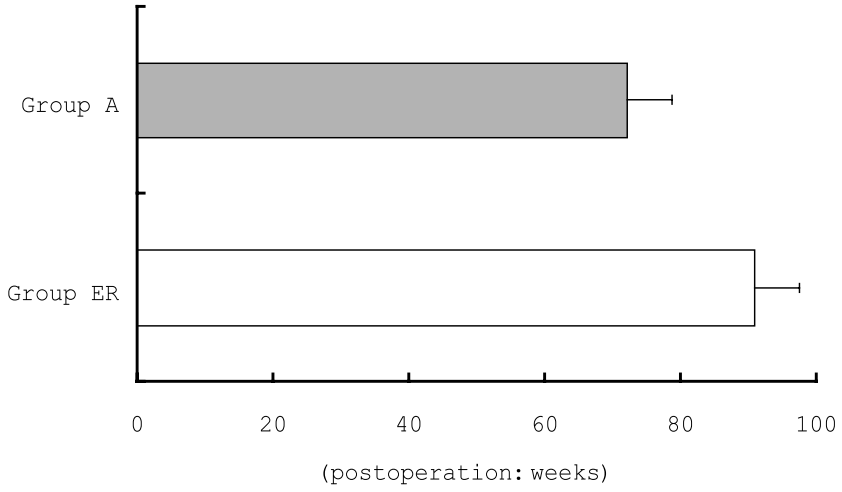

Fig. 3 Comparison of average longevity after partial hepatectomy between the ad libitum group (n=12) and energy-restricted group (n=10). Values are expressed as means±SEM.

Discussion

Cholesterol and triglycerides levels were slightly lower in group ER than in group A at 24 weeks. Liepa et al. [10] have demonstrated that serum cholesterol concentration increases with increasing age in ad libitum-fed rats, and that dietary restriction depresses the increase. Group A rapidly gained more weight

than group ER, as shown in fig1. In addition the survival rate of the energy-restricted was higher than that of the ad libitum group. Energy restriction has a beneficial effect on longevity in experimental animals [11–13]. This prolonging of life, has been considered to be the result of delaying the onset of some age-related diseases and retarding several physiological aging processes [11,12]. Therefore, in energy-restricted rats, attenuation of body weight increase is considered to be a primary factor prolonging the life span. These results suggest that the life span in these hepatectomized rats depends on post operative body weight. For that reason it was deduced that minimizing increase in body weight after adulthood is essential to lengthening the life span of the rat.

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