

Original Paper

## A Comparison of the Growth Rate of Rats on a Pellet Diet and a Semi Synthetic Diet.

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### Abstract

In the present study, the long-term effects of a pellet diet and a semi synthetic diet on the biochemical parameters of serum were investigated. After acclimation for one week, the 8-week-old rats were divided into two groups and given either a pellet diet or a semi synthetic diet (20% casein diet). Blood was collected prior to and after 4, 12, 24 and 48 weeks on the diets. Body weights were higher in the semi synthetic diet group throughout their lifespan. The median survival rate of the semi synthetic diet group was 72 weeks, while that of the pellet diet group was 94 weeks. The serum AST concentration in the two groups was similar, though ALT was higher in the semi synthetic diet group. Total cholesterol in the serum increased in both groups but was higher in the semi synthetic diet group during the experimental period. The results obtained from this study suggest that the differences in the aging process in the rats fed the experimental diets might be related to cellulose and vitamins.

### Introduction

In many animal experiments, the pellet diet and the semi synthetic diet are the best treatment option<sup>1)2)3)4)</sup>. Moreover, many studies have used 20% casein in the semi synthetic

diets. In the present study, the long-term effects of the pellet diet and the semi synthetic diet (20% casein) on longevity and the biochemical parameters of serum were investigated.

Table 1 Composition of the diets

	Pellet diet*	Semi synthetic diet*
Protein	25.81 g/100 g diet	20 g/100 g diet
Fat	5.53 g	5 g
Ash	6.62 g	5.15 g
Cellulose	3.47 g	1.85 g
Nitrogen-free extract	58.57 g	68 g
Vitamine consists of the following components per 100 g diet		
Vitamin A	3424 IU	500 IU
Vitamin D <sub>3</sub>	140 IU	100 IU
Vitamin E	11.45 mg	5 mg
Vitamin B <sub>1</sub>	2.06 mg	1.2 mg
Vitamin B <sub>2</sub>	1.3 mg	4.2 mg
Vitamin C	5 mg	30 mg
Vitamin B <sub>6</sub>	0.83 mg	0.8 mg
Vitamin B <sub>12</sub>	5.3 $\mu$ g	0.5 $\mu$ g
Inositol	450 mg	6 mg
Biotin	22.2 $\mu$ g	20 $\mu$ g
Pantothenate acid	3.2 mg	5 mg
Nicotinic acid	10.2 mg	6 mg
Choline bitartrate	0.24 g	0.15 g
Folic acid	0.15 mg	0.2 mg

\* On a dry weight basis.

## Materials and Method

### 1. Animals and diets

Nineteen-male Sprague-Dawley rats (Clea Japan Inc., Tokyo, Japan) were given a commercial diet (MF, Oriental Yeast Co., Tokyo) for one week. After the acclimation period, the 8-week-old rats were divided into two groups and given either the pellet diet (MF, Oriental Yeast Co., Tokyo) or the semi synthetic diet (20% casein diet) (Oriental Yeast Industrial Co., Ltd, Japan). There were 10 rats in the pellet diet group and 9 rats in the semi synthetic diet group. The composition of the experimental diets is shown in Table 1. The rats were allowed free access to food and deionized water. They were housed in a temperature-controlled room with a 12hour light-12hour dark cycle. During the study,

body weights were measured weekly.

### 2. Blood samples

The blood was collected prior to and after 4, 12, 24 and 48 weeks on the diet. Serum samples were obtained by refrigerated centrifugation (3,000 rpm for 15 min) (Himac CT12D Hitachi Koki Co., Tokyo) and stored at  $-40^{\circ}\text{C}$  until analyses could be performed. Cholesterol, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in the serum were determined by the following methods: total cholesterol, the enzymic method of Richmond (1973)<sup>5)</sup>; AST and ALT, the method of Bergmeyer (1978)<sup>6)</sup>.

### 3. Statistical analysis

Statistical significance was determined by Student's t-test. The values were expressed as mean  $\pm$  SEM.

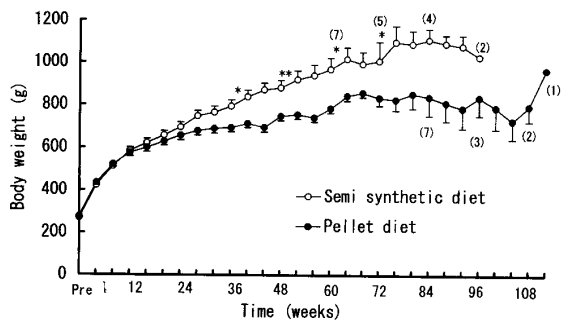


Fig. 1 Effect of the semi synthetic and pellet diets on the body weight of the experimental animals. Values are mean  $\pm$  SEM. Numbers in parentheses indicate the number of animals remaining in the groups.

Mean values for the two groups were significantly different : \* $P < 0.05$ , \*\* $P < 0.01$ .

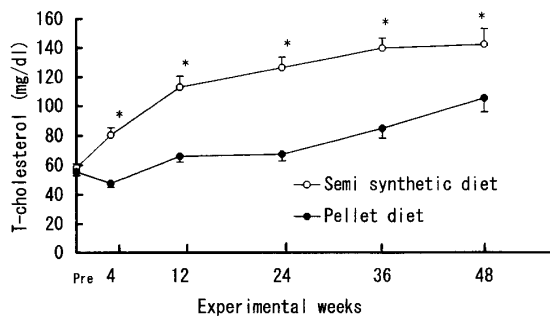


Fig. 2 Effect of the semi synthetic and pellet diets on serum total-cholesterol in rats. Results are expressed as mean  $\pm$  SEM. Mean values for the two groups were significantly different : \* $P < 0.05$ .

### Experimental results and discussion

Rats were monitored by two variables : weight gain and mortality. For the first 48 weeks on the diets, there was a steady gain in body weight in the pellet diet group, from  $275 \pm 3$  gm to  $727 \pm 20$  gm (mean  $\pm$  SEM), and in the semi synthetic diet group, from  $270 \pm 1$  gm to  $878 \pm 35$  gm (Fig. 1). The body weights were higher in the semi synthetic diet group throughout the experiment.

The median survival rate in the semi syn-

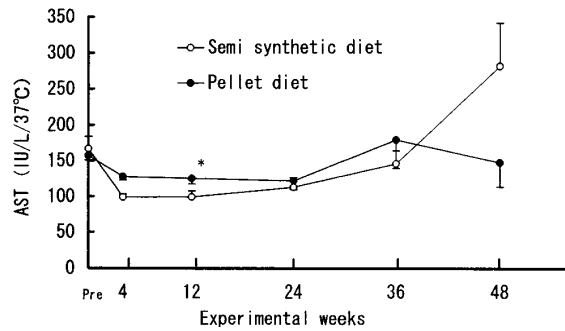


Fig. 3 Effect of the semi synthetic and pellet diets on serum AST in rats. Results are expressed as mean  $\pm$  SEM. Mean values for the two groups were significantly different : \* $P < 0.05$ .

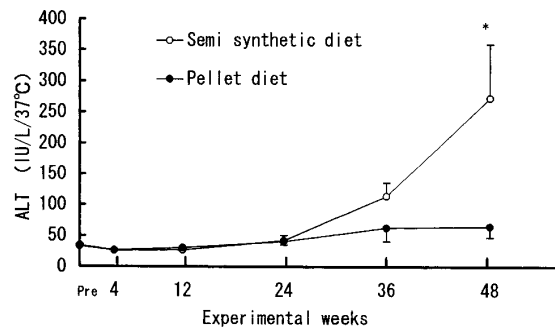


Fig. 4 Effect of the semi synthetic and pellet diets on serum ALT in rats. Results are expressed as mean  $\pm$  SEM. Mean values for the two groups were significantly different : \* $P < 0.05$ .

thetic diet group was 72 weeks, as compared with 94 weeks for the pellet diet group. Half of the rats in the semi synthetic diet group were dead by 72 weeks, when all the rats in the pellet diet group were still alive.

The total cholesterol concentration in the serum of both groups increased, but the concentrations in the semi synthetic diet group were higher than those of the pellet diet group (Fig. 2).

The serum AST concentrations of the two groups were similar, though the value of ALT at 48 weeks in the semi synthetic diet group was higher than that of the pellet diet group (Fig. 3, 4).

AST and ALT were chosen as the biochemical parameters of this study. Food intake was not one of the parameters because food was offered *ad libitum*. However, the pellet diet contained more vitamins than the semi synthetic diet. In particular, the pellet diet contained about 10 times more vitamin B<sub>12</sub>, about 6 times more vitamin A and about 2 times more vitamin E than the semi synthetic diet. Many antioxidants, such as carotenoids, ascorbate and tocopherol et al, were reported to be involved in aging. These reports suggested that oxidative damage affected various organs in the process of aging. The ratio of macronutrients, such as fat and protein, were similar in the two experimental diets.

These facts suggest that the aging process may be affected, not by macronutrients, but by micronutrients, such as vitamins. Furthermore, there was 3.47 mg/100 g and 1.85 mg/100 g of cellulose in the pellet and semi synthetic diets, respectively. Sundaravalli reported that increased levels of cellulose decreased serum cholesterol. If this is true, the dietary levels of cellulose may explain the decreased serum cholesterol and body weight of the pellet diet group. The results of this study suggest that the difference in longevity in rats fed the two experimental diets might be related to cellulose and vitamins. The effects of dietary composition should be examined, as well.

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