

Muscle Protein Synthesis of Rats Fed a Kidney Bean (*Phaseolus vulgaris* L.) Diet

It is well known that legumes are of great importance in many aspects of human and animal nutrition (3). Previous studies carried out both in our laboratory and others have shown that feeding growing animals on diets containing the raw legume kidney bean (*Phaseolus vulgaris* L.) as the main or sole source of protein brings about a number of nutritional effects basically characterized by growth inhibition (4), reduced intestinal absorption of sugars and amino acids (10, 14), antivitaminic effects (6), increased protease inhibitors activity (17), increased endogenous nitrogen excretion (11), etc. The antinutritive substances contained in the raw legume seeds (7) along with the deficiency of some essential amino acids of the legume protein (16) are thought to be the main causes of these and other effects. However, there is little available information concerning the effects of this legume on protein metabolism. We have recently published increases in muscle and liver proteolytic activity in birds fed a raw kidney bean diet (15). The goal of this communication was to investigate the rate of skeletal muscle protein synthesis capacity in rats fed a *Ph. vulgaris* diet.

Twenty Wistar albino male rats, weighing about 80-90 g were randomly assigned into two dietary groups of 10 animals each and housed individually in cages with raised floors. One group (control) was fed a diet in which heated soybean (HSB) was used as the sole source of protein; the other group was fed a diet in which raw kidney bean (RKB) was taken as the sole source of protein. It was not possible to use higher protein diets since an increase of RKB above the percentage chosen in this study produced severe diarrhea, and, in some cases, death of the

animals (15). Diets were prepared according to the AOAC recommendations (1) and composition was as previously reported (15). Diets were isocaloric and contained about 12 % of protein. Both food and water were provided *ad libitum* to the experimental animals over an experimental period of 11 days. Body weight changes and food intake were individually recorded in each animal every day. At the end of the feeding period, rats were killed by decapitation. Immediately after bleeding, gastrocnemius muscle from rear limbs were carefully excised and weighed. Muscle protein content was assessed by the method of LOWRY *et al.* (8). Total DNA and RNA were determined according to the techniques described by GILES and MYERS (5) and MILLWARD *et al.* (9) respectively. These determinations allow for the calculation of the following parameters: *RNA/DNA ratio*, indicative of the intracellular concentration of RNA, that may be in direct correlation with the rate of muscle protein synthesis (2); *cell size*, indicative of the amount of protein in muscle cells, and that is determined by the ratio protein (mg)/DNA (mg) (12); and, *protein synthesis capacity* (PSC), which is the ratio between the two former parameters (RNA/DNA and cell size, and will, therefore, have mg of RNA/mg of protein as units) and represents the capacity of the total RNA to build up proteins (13). Statistical evaluations were carried out by conventional Student's *t* test.

Table I summarizes the results of this study. As compared to control HSB-fed rats, those fed the RKB diet exhibited a significant reduction in the rate of growth, food intake, gastrocnemius weight, protein content, RNA/DNA, cell size and

Table 1. Body weight gain, food intake and gastrocnemius muscle weight, protein content, RNA/DNA ratio, cell size and protein synthesis capacity (PSC) of male growing rats fed ad libitum over a period of 11 days on 12 % protein diets containing either heated soybean (HSB) (control) or raw kidney bean (*Phaseolus vulgaris* L.) as the sole sources of protein.

Entries are mean values ($\pm$ SEM) from 10 rats in each group.

	HSB	<i>Ph. vulgaris</i>
Body weight gain (g/day)	5.8 $\pm$ 0.2	-0.51 $\pm$ 0.05 ^b
Food intake (/100 g body weight)	13.9 $\pm$ 0.42	8.42 $\pm$ 0.77 ^a
Gastrocnemius muscle:		
Weight of single muscle (g/100 g b. w.)	0.49 $\pm$ 0.01	0.42 $\pm$ 0.01 ^b
Protein (mg/g of tissue)	207.8 $\pm$ 13.6	161.3 $\pm$ 4.7 ^a
RNA/DNA	1.09 $\pm$ 0.10	0.38 $\pm$ 0.04 ^b
Cell size [protein (mg)/ DNA (mg)]	221.7 $\pm$ 22.3	69.3 $\pm$ 10 ^b
PSC [RNA (mg)/protein (mg)]	59.5 $\pm$ 2.8	53.5 $\pm$ 2.7 ^a

^ap < 0.05, ^bp < 0.01 (Student's *t* test), as compared to control HSB-fed rats.

PSC. These findings do suggest that feeding growing rats a RKB diet brings about a marked reduction in the rate of skeletal muscle protein synthesis, this effect being an important contributing factor in order to explain the whole catabolic picture displayed by legume-fed animals.

Key Words: Legumes, Protein synthesis, DNA, RNA.

Palabras clave: Leguminosas, Síntesis proteica, DNA, RNA.

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