REVISTA ESPAÑOLA DE FISIOLOGIA, 40, 123-124, 1984

CARTAS AL EDITOR

Rate of Muscle Protein Synthesis in Field Bean (*Vicia faba* L.) Fed Growing Rats

Although legumes are widely used as protein sources both in human and animal nutrition, it has long been recognized (7) that feeding growing animals on diets containing raw legumes as the main source of protein brings about a number of undesirable physiological and biochemical effects. These effects are basically characterized by a serious impairment in the rate of growth (3, 6), increased protein catabolism (2, 10), reduced intestinal absorption of sugars and amino acids (1, 9), negative nitrogen balances (11), enhanced liver and muscle proteolytic activity (12) and others. See review by LIENER (8).

The aim of this communication is to report data on the effects of the raw legume field bean (*Vicia faba* L. var. *minor*), extensively harvested in Spain, on the rate of skeletal muscle protein synthesis. Twelve Wistar male rats, weighing about 80-90 g were divided in two groups of six animals each and housed in individual metabolic cages. Groups were arranged as follows: one was fed a casein control diet, and the other was fed a diet containing raw field bean as the only source of protein. Both diets were isocaloric and contained about 20-21 % of protein. Composition of diets was as previously described (9). Legume-fed rats were pair-fed to the food intake of the casein-fed rats. Body weight changes and food intake were daily recorded. At the end of the experimental period, all

Table I. *Body weight gain, food intake, S_B/S_i ratio (specific radioactivities of tyrosine in bound protein and in the free intracellular pool, in dpm/μmol), and fractional synthetic rate, k_s (fraction of protein mass renewed each day, in % per day), of gastrocnemius muscle protein in young male rats fed over a period of 10 days on diets containing either casein or raw field bean (*Vicia faba* L.) as the main source of protein.*
Both diets were isocaloric and contained about 20-21 % of protein. Entries are mean values (±SEM) of six animals in each group.

Group	Body weight gain (g/day)	Food intake (g/100 g body weight)	S_B/S_i † ($\times 10^{-3}$)	K_s †
Casein	7.1 ± 0.4	11.2 ± 0.3	24.7 ± 2.4	14.2 ± 0.1
Vicia faba	4.6 ± 0.5*	11.7 ± 0.3	15.6 ± 1.5*	9.9 ± 0.1*

* $p < 0.01$, as compared to the control group (*t*-Student test).
† According to the method of GARLICK and MARSHALL (4) and GARLICK *et al.* (5).

rats were infused through the tail vein with L-[^{14}C]-tyrosine, as previously described by GARLICK and MARSHALL (4). Rate of muscle protein synthesis was determined according to the methodology established by GARLICK *et al.* (5), which involves separation of muscle protein from the supernatant (i. e., intracellular fraction) and determination of . the radiospecific activity of tyrosine in both bound (S_B) and free (S_i) fractions in the gastrocnemius muscle. The S_B/S_i ratio allows for the calculation of k_s, i.e., fractional rate of protein synthesis, expressed as percentage of newly synthesized protein per day. Statistical analysis was carried out by the student's *t* test.

Results of the experiment are summarized in table I. As compared to casein-fed rats, a significant reduction ($p < 0.01$) in the rate of growth was found in legume-fed animals. No significant differences were observed in the amount of food intake, expressed as g of diet consumed per 100 g of body weight. Gastrocnemius muscle S_B/S_i, and, consequently fractional synthetic rate were significantly reduced ($p < 0.01$) in field bean fed rats, as compared to control animals. Taking into account that skeletal muscle is normally the largest tissue in the body of the adult mammal, being about 45 % of body weight irrespective of species size (13), we can assume that the outstanding decrease in muscle protein synthesis shown by growing rats fed a raw field bean diet might be an important factor in order to explain the marked reduction of growth and the antinutritive effects caused by the raw legume. It is suggested that both sulphur-amino acid defficiency and the antinutritive compounds contained in field bean seeds (8) could account for the antianabolic effects reported in this communication.

Key words: *Vicia faba*, Muscle protein, Growing rats.

References

1. BIELORAI, R. R., TAMIR, R. and HURWYTZ, S.: *J. Nutr.*, 107, 1775-1778, 1977.
2. CENARRUZABEITIA, M. N., SANTIDRIÁN, S., BELLO, J. and LARRALDE, J.: *Nutr. Metab.*, 23, 203-210, 1979.
3. SANTIDRIÁN, S., LASHERAS, B., CENARRUZABEITIA, M. N., BOLUFER, J. and LARRALDE, J.: *Poult. Sci.*, 60, 887-890, 1980.
4. GARLICK, P. J. and MARSHALL, I.: *J. Neurochem.*, 19, 577-583, 1972.
5. GARLICK, P. J., MILLWARD, D. J. and JAMES, W. P. T.: *Biochem. J.*, 136, 935-948, 1973.
6. JAFFE, W. C. and VEGA, C. L.: *J. Nutr.*, 94, 175-184, 1968.
7. JIMÉNEZ DÍAZ, C. and VIVANCO, F.: *Rev. Clin. Esp.*, 40, 157-163, 1951.
8. LIENER, I. E.: In «Toxic Constituents of Plant Foodstuff» (Liener, I. E., ed.). Academic Press, New York, 1980, pp. 266-289.
9. SANTIDRIÁN, S.: *J. An. Sci.*, 53, 414-419, 1981.
10. SANTIDRIÁN, S., SOBRINI, F. J., BELLO, J. and LARRALDE, J.: *Enzyme*, 26, 103-106, 1981.
11. SANTIDRIÁN, S.: *Horm. Metab. Res.*, 13, 407-410, 1981.
12. SANTIDRIÁN, S., RODRÍGUEZ, M. L., CENARRUZABEITIA, M. N. and LARRALDE, J.: *Favis*, 5, 31-33, 1982.
13. YOUNG, V. R.: In «Mammalian Protein Metabolism» (Munro, H. N., ed.). Vol. 4. Academic Press, New York, 1970, pp. 585-674.

M. GOENA, S. SANTIDRIÁN*, F. CUEVILLAS and J. LARRALDE

Departamento de Fisiología (División de Nutrición)
Facultad de Farmacia
Universidad de Navarra
Pamplona (Spain)

(Received on September 15, 1983)

* Present address:
Departamento de Fisiología. Facultad de Farmacia.
Universidad de La Laguna/Tenerife (Spain).