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SHORT COMMUNICATIONS

Rate of muscle protein synthesis in rats fed raw and extruded pea diets

Peas (*Pisum sativum* L.) are legumes well accepted as relatively good protein, carbohydrates and mineral sources both in human and animal diets. However, the nutritional value of pea is limited by anti-nutritional factors (ANF), mainly proteolytic enzyme inhibitors together with tannins, phytates and sulphur amino acid deficiency (SAA). Growth inhibition, impaired intestinal transport of nutrients, increased N losses, decrease of both immunological competence and protein anabolism are some of the main effects caused by ANF. Many procedures have been developed to inactivate these factors. Extrusion is a thermic-mechanic single-stage continuous process which has recently been applied to raw legumes, its effects being apparently more efficient than other traditional methods (6). SAA deficiency may be corrected by supplementing the legume protein with methionine (5).

Skeletal muscle protein accretion is especially influenced by feeding raw legumes, which has an obvious relevance in farm animal nutrition. As it is well known, protein growth depends on the relative rates of synthesis and breakdown. However, there is little available information concerning the effects of feeding extruded legume on protein metabolism.

The aim of this communication is to report data on the rate of skeletal muscle protein turnover and nucleic acid composition in rats fed an extruded legume pea (*Pisum sativum* L.) diet. Male Wistar rats weighing about 60-70 g were divided into 3 dietary groups of ten animals each and housed in individual metabolic cages. Over a period of 15 d, animals were fed *ad libitum* diets (NRC recommendations) containing either casein (control, C), or raw or extruded pea (RP and EP groups, respectively) as the sole protein source. Methionine (0.25 %) was added to the three diets which contained 11.0 % protein and 1687 ± 46 kJ/100 g diet. Seeds were processed in a Clextral X-5 model BC 45 twin-screw extruder. The extrusion temperature was 150 ± 2 °C. Body weight changes and food intake were daily recorded. At the end of this period, gastrocnemius (G) muscle from rear limbs, a large mixed-fiber muscle taken as representative of the whole skeletal musculature, was excised and weighed. Protein synthesis was measured in G administering a flooding dose of [3H] phenylalanine (3). Muscle protein (1) DNA (2) and RNA (4), were assessed as well. One-way ANOVA test was used to determine the significant differences among means. The statistically significant difference was defined as $p < 0.05$.

Table I. *Body weight gain (g/d), food intake (g/100 g b.w.) and gastrocnemius muscle weight (mg/100 g b.w.), protein (mg/g), DNA (mg/g), RNA (mg/g) and ks (%/d) of rats fed a control (C) or pea diets either raw (RP) or extruded (EP).*

ks is the percentage of newly synthesized protein/24 h. Values are mean ± SEM of 10 animals. Values with different superscript within columns are different significantly ($p < 0.05$).

Group	Weight gain	Food intake	Gastrocnemius				
			Weight	Protein	RNA	DNA	ks
C	8.4±0.2^{c}	129.2±2.9^{a}	539±7^{ab}	229.2±0.3^{a}	1.52±0.02^{a}	0.98±0.05^{a}	15.2±0.6^{b}
RP	6.1±0.3^{a}	148.6±5.6^{b}	521±5^{a}	228.9±1.0^{a}	1.43±0.03^{a}	1.09±0.06^{a}	13.7±0.4^{a}
EP	7.4±0.2^{b}	135.1±3.3^{a}	552±6^{b}	232.3±0.5^{a}	1.59±0.05^{a}	1.01±0.04^{a}	14.8±0.3^{b}

Table I shows that as compared to group C rats, a significant weight gain reduction and food intake increase were found in RP rats. Extrusion significantly improved both weight gain and food intake. No differences were found in muscle weight, protein, RNA and DNA content between rats fed control and pea diets. However, G weight was significantly increased in EP with regard to RP group. Protein synthesis rate, significantly decreased in rats fed the raw legume, reached values similar to those of C animals fed the extruded legume.

These results show that growth and muscle protein synthesis in pea-fed rats are markedly improved by raw legume extrusion. Efficiency of this thermal processing in the inactivation of lectins, trypsin, chymotrypsin and α-amylase inhibitors (6) may explain the improvement of growth and development observed. Therefore, it can be suggested that this procedure is a valid one to remove ANF from raw legumes rendering them nutritionally adequate.

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Key words: Protein synthesis, Extrusion, Legumes, Rats.

Palabras clave: Síntesis de proteínas, Extrusión, Guisantes, Rata.

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