DIGESTIBILITY TEST OF PROTEIN BODY FRACTION FROM RAPESEED

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ABSTRACT

An in vitro digestibility test of the extracted protein body (PB) from Canola rapeseed was carried out as a link in the nutritional evaluation study of rapeseed meal protein for food use. It was showed that few types of PB might be existed in the rapeseed and the differences of PB type would be connected to a digestibility for rapeseed meal protein.

INTRODUCTION

Recently, rapeseed meal (RM) has been increasing as a by-product of a food oil in Japan. Although, the utilization of RM is still limited to a fertilizer and livestock feed, largely on account of high content of glucosinolates present as an anti-nutrient factor (Irvin, 1980). The use of RM is also restricted because of its less digestibility of protein than that of soybean meal protein (Finley & Hopkins,1985). However,"Canola" rapeseed with glucosinolates content less than 1% which recently developed in Canada shows more possibility for food use. The final goal of our study was to evaluate the nutritional value of the RM for food use.

Concerning with the factors that lowering the digestibility of RM, two main factors were considered. One is fiber amount in RM and the other is the protein itself. In relation to protein digestibility, Tanaka (1980) and Sato (1990) reported that some types of protein body (PB) in rice showed resistance against the enzymic digestion of human. Our present results also suggest that one of the cause for the low digestibility of RM lies on the digestibility of the rapeseed protein itself. Then, we were attempted to clarify the protein digestibility of rapeseed. As a first step, the extraction method of PB from rapeseed was studied since it is known that most of the protein in rapeseed exists mainly as PB for storage in the cotyledon. And next, the

extracted PB fractions were used as a sample for protein analysis. Finally, in vitro digestibility test with pepsin was carried out.

EXPERIMENTAL Extraction method and chemical analysis of PB fraction

Canola rapeseed were originally taken from Canada and it was imported by Toyo Seiyu Co.Ltd. in 1992. After imported, the rapeseed were used for the extraction of PB by using the modified method of Saio and Watanabe (1966). And finally, D-1, D-2,and D-3 fractions according to the difference of density were separated. The existence of PB in the three fractions was examined by using scanning electron microscope (JEOL Co.Ltd.,JSM-120) and the total protein content was analyzed by the micro Kjeldahl method. The protein was then fractionated based on its solubility. Fig.1 shows the photographs of PB in D-1 (1.34 ~1.39), D-2 (1.39~1.42), and D-3 (> 1.42 of density), respectively.

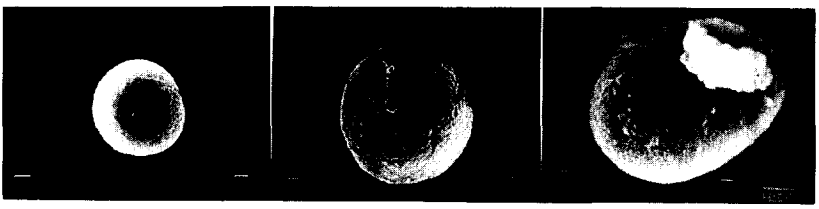

Fig. 1. Scanning electron microscopy of D-1 (1.34 ~1.39), D-2 (1.39 ~1.42), and D-3 (> 1.42 of density)

PB was recognized in those three fractions and each fraction has approximately diameter size of 4 μm, 6μm, and 10 μm for D-1, D-2, and D-3, respectively. Table 1 shows the total protein content and its protein fractions according to the solubility in each fraction.

TABLE 1. Total protein content (% dry basis) and its protein fractions (% of total protein) in the three fractions

Fractions	Protein	Albumin	Globulin	Prolamin	Glutelin
D − 1	64.9	8.5	69.9	18.1	3.5
D − 2	64.2	7.5	64.8	21.1	6.4
D − 3	38.9	3.0	48.1	33.1	15.8

Total protein content in each fraction was 64.9%, 64.2%, and 38.9%, respectively. The main protein in all the fractions was globulin and its content in D-1 fraction was higher than in D-3 fraction. On the contrary, the contents of prolamin and glutelin in D-3 fraction were higher than in D-1 fraction and its content varies from 33.1 to 18.1% for prolamin and from 15.8 to 3.5% for glutelin. These results indicated that the digestibility of D-3 fraction was different from the D-1 fraction.

In Vitro Digestibility Test

The method of Kametaka et al. (1985) was used to evaluate the in vitro protein digestibility. Table 2 shows the results of the pepsin digestion.

Table 2. In vitro protein digestibility test with pepsin for the three fractions (%)

Fraction	30 min.	60 min.	120 min.	180 min.
D − 1	39.5	55.3	61.5	61.5
D − 2	42.5	47.5	57.9	57.9
D − 3	41.2	44.9	44.9	44.9

The differences of the digestion rates among the three fractions that observed in D-3 and D-1 fractions were 44.9% and 61.5% after 120min.. Based on this results, in order to obtain more information about the protein in PB fractions, the techniques of SDS-PAGE and isoelectric focusing were used. The results of SDS-PAGE and two dimensional isoelectric focusing indicated the D-1 and D-3 fractions had different patterns. In this system, some of proteins in D-1 fraction migrated from neutral to alkaline area, but some of proteins in D-3 fraction migrated toward acidic electrode pool.

However, our present data are still not enough to answer the question why the protein in RM has digestibility lower than in soybean meal. More analysis of amino acid , peptide and protein in PB fraction are needed to complete this study.

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