Short Communication

Gelation of Porcine Plasma
by Glutathione

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Blood plasma and red cell proteins have been considered as a food ingredient and a potential source of high-quality proteins.^{1~4)} The plasma has been studied for its functionality, including gelation.^{5~10)} In most studies, the gelation of plasma or serum albumin has been induced by heating. Recently, we have reported that ovotransferrin can form a protein gel by incubating with thiols under mild temperature and pH conditions.^{11~13)} Since blood plasma contains another transferrin, serum transferrin, we examined the thiol-dependent gelation of blood plasma using porcine plasma.

Porcine plasma was supplied by Nippon Meat Packers Inc., and porcine serum albumin was obtained from Wako Pure Chemical Co.

Fig. 1. Gelation of Porcine Plasma and Porcine Serum Albumin.

Porcine plasma (A) and porcine serum albumin (B) were incubated in the presence (1 and 3) or absence (2 and 4) of 70 mM GSH at 37°C for 16 hr.

The pH of the porcine plasma was adjusted to 8.2 by the addition of 0.06 volume of 1 M sodium phosphate (pH 8), and 0.0043 volume of 1 M NaOH. To the mixture, 0.39 volume of 0.25 M glutathione, which had been adjusted to pH 8.2, was added and incubated at 37°C for 16 hr. As shown in Fig. 1A, porcine plasma formed an opaque gel in the presence of glutathione, while no gelation was induced in the absence of the thiol. To determine which component of porcine plasma was involved in the thiol-dependent gelation, we separated the gel sap (supernatant) and gel matrix (precipitate) by centrifugation (3,000 × *g*, 30 min) after crushing the porcine plasma gel. The proteins in whole plasma, the gel sap and the gel matrix were analyzed by sodium dodecyl

Fig. 2. Protein Analyses in the Glutathione-induced Gel of Porcine Plasma.

Three micrograms of porcine serum albumin (lane 1), 0.5 μ l of porcine plasma (lane 2), and the gel sap (lane 3) and the gel matrix fractions (lane 4), the amounts of which corresponded to the same 0.5 μ l of plasma, were run on a 10%-polyacrylamide slab gel (8 cm long) at a constant voltage of 100 V for 3 hr. The proteins were stained with Coomassie blue. The arrows on the left side represent the molecular weights of marker proteins (cross-linked cytochrome *c*, Oriental Yest Co.), and those on the right side, serum transferrin (Tf) and serum albumin (SA).

sulfate polyacrylamide gel electrophoresis.¹⁴⁾ As shown in Fig. 2, serum transferrin with a molecular mass of 76,000 dalton¹⁵⁾ was indeed detected in the gel matrix fraction, but a higher amount of serum albumin (68,000 dalton molecular mass¹⁵⁾) was detected in this fraction. On the other hand, albumin was significantly less in the gel sap fraction, suggesting that the gel matrix was mainly composed of albumin. To confirm this, we examined the thiol-dependent gelation of porcine serum albumin (30 mg/ml) under the same conditions as those for the porcine plasma gelation. As shown in Fig. 1B, porcine serum albumin formed an opaque gel in the presence of, but not in the absence of the thiol.

In the present study, we have demonstrated that serum albumin is a major factor in the thiol-dependent gelation of porcine plasma. Serum albumin has similar molecular properties to ovotransferrin, since they consist of multidomain structures, which are made up by single polypeptide chains with similar molecular weights.^{16,17)} Both the proteins contain many intramolecular disulfides: 17 disulfides in serum albumin and 15 disulfides in ovotransferrin.^{16,17)} The thiol-dependent gelation of serum albumin may proceed *via* a similar mechanism to that of ovotransferrin.

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