Note on the Effect of Vital Gluten on Some Rheological Properties of Dough[1]

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Hydrated gluten forms the three-dimensional network of flour-water doughs, and thereby plays a major role in their rheological properties. This note presents results of a study designed to measure the contribution of vital gluten to some rheological properties of dough.

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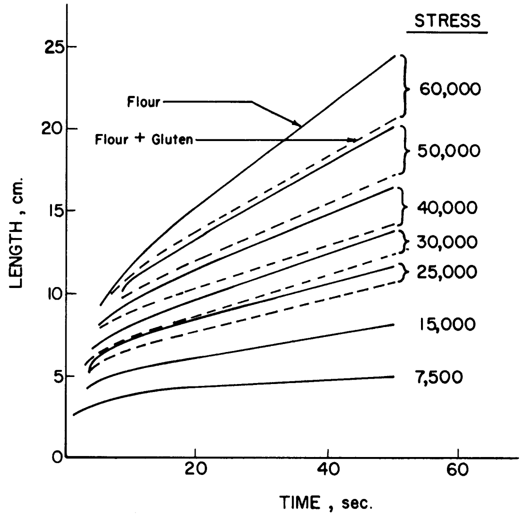

Fig. 1. Deformation curves for the doughs from flour and from flour-gluten blend. For stresses of 25,000 g.cm.$^{-1}$sec.$^{-2}$ and higher, the curve for the flour dough is above the analogous curve for the flour-gluten dough.

The flour was straight grade, milled commercially from a grist of Canadian hard red spring wheat. It was untreated, and its ash and protein contents on a 14% moisture basis were 0.42 and 13.1%, respectively. Commercial vital gluten was obtained from Industrial Grain Products Ltd., Thunder Bay, Ontario. Its protein and moisture contents were 76.5 and 5.5%, respectively (protein expressed on an as-is basis). The flour and gluten were blended together to give an artificial flour containing 2% vital gluten.

The farinograph absorption of the flour was 65.5%, 67.8% for the flour-gluten blend immediately after blending and 67.0% 3 days after blending. The latter value remained constant throughout the period of the experiments. Addition of 2% gluten did not affect the shape of the farinogram.

For the extensigraph tests, the doughs were mixed in air for 9 min. in the 300-g. farinograph mixer and shaped immediately after mixing. The test pieces were allowed to relax for 5 min. before stretching. Three identical doughs were stretched at each hook speed, and the average curve was used in the rheological calculations.

The stress-strain curves were constructed as described previously (1). Data derived from these curves were then used to derive the deformation curves shown in Fig. 1. The curves for the doughs from flour-gluten blends have a shape similar to that of curves for normal doughs; the former doughs are somewhat less extensible under stresses above 20,000 g.cm.$^{-1}$sec.$^{-2}$. The flow curves (Fig. 2) showed slight differences in the viscous properties of the two doughs for stresses above 20,000 g.cm.$^{-1}$sec.$^{-2}$. Values for the coefficient of viscous traction for different stress (Table I) led to the same conclusions.

When the differences between the length of the strand of the dough from flour and flour-plus-gluten (read off the deformation curve for constant time) were

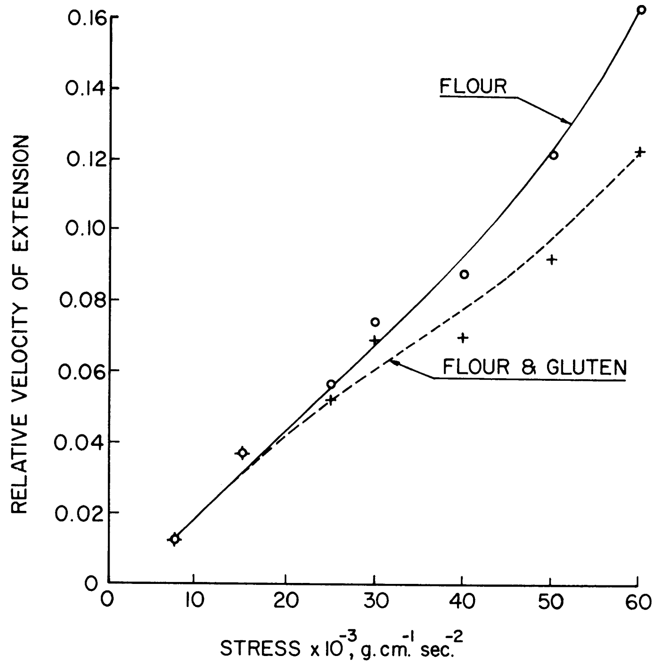

Fig. 2. Flow curves for doughs from flour and flour-gluten blend.

plotted against stress, linear relationships were obtained for the stresses above 20,000 g.cm.$^{-1}$ sec.$^{-2}$ (Fig. 3). The slopes of the lines increased with the time of extension. The increase was not proportional to time. The differences for stress of about 3,000 g.cm.$^{-1}$ sec.$^{-2}$ are independent of time, and for decreasing stress should extrapolate to zero (Fig. 3).

TABLE I. COEFFICIENTS OF VISCOUS TRACTION FOR DOUGHS FROM FLOUR WITH AND WITHOUT ADDED GLUTEN

	Coefficient of Viscous Traction X 10^{-5}	
Stress g.cm.$^{-1}$ sec.$^{-2}$	Flour	Flour and gluten g.cm.$^{-1}$ sec.$^{-1}$
7,500	6.08	6.08
15,000	4.07	4.07
25,000	4.40	4.78
30,000	4.05	4.36
40,000	4.58	5.77
50,000	4.11	5.42
60,000	3.67	4.87

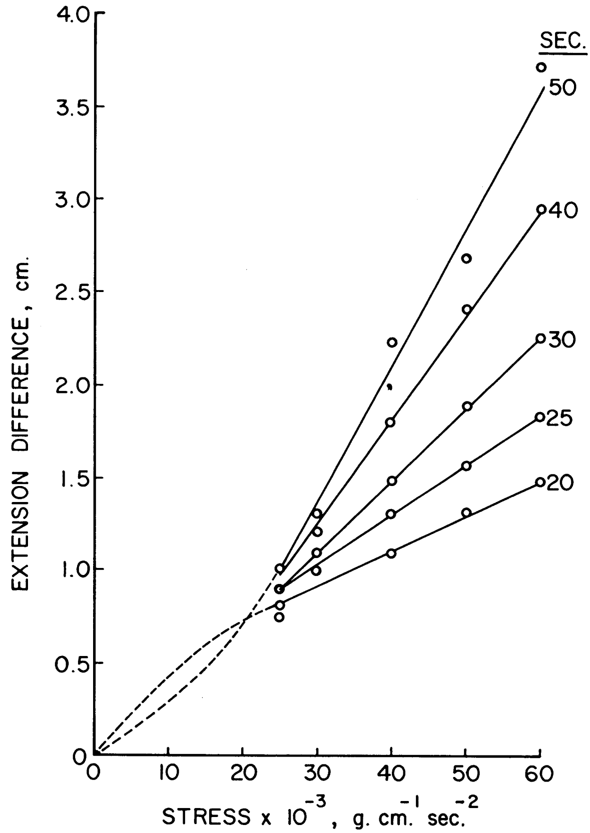

Fig. 3. Differences between extensions of flour and flour-gluten doughs as a function of stress for different extension times.

A definite effect of gluten on the rheological properties of dough was observed only for deformations by stresses above 20,000 g.cm.$^{-1}$ sec.$^{-2}$. For the slower deformations using low stresses, addition of 2% gluten had no effect.

Literature Cited

1. PŘÍHODA, J., and BUSHUK, W. Application of Muller's method to extensigraph measurements with various hook speeds. Cereal Chem. 48: (1971).

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