Feasibility of Saudi wheat flour enriched with cottonseed flour for bread making

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Summary: Three samples of edible grade cottonseed flour (cosf) were utilized each in 5%, 10% and 15% mixtures with Saudi wheat flour for bread making. Addition of cosf increased water absorption of the dough. Times of dough mixing, stability and break-down were slightly increased at the low addition level, but adversely shortened at the higher levels, where mixing tolerance was doubled or tripled. Up to 5%-10% of cosf could be tolerated without deleterious effect on dough properties or bread quality, depending on the source of the additive and method of preparation. An increase of 25%-50% in protein content of bread was expected.

Zusammenfassung: Baumwollsaatmehl (eßbare Qualität) wurde in Anteilen von 5, 10 und 15% einem saudiarabischen Weizenmehl zur Brotbereitung zugemischt. Dies führte zu einem Anstieg der Wasserbindung des Teiges. Die Zeiten zur Teigbereitung, die Teigstabilität und das Abreißverhalten wurden mit niedrigen Zusatzmengen geringfügig erhöht; die höheren Zusatzmengen hatten umgekehrte Wirkung. Ein Zusatz von 5-10% Baumwollsaatmehl konnte bezüglich Teigeigenschaften und Brotqualität toleriert werden; die Qualität des zugesetzten Produktes war allerdings maßgebend. Auf diese Weise konnte eine Erhöhung des Proteingehaltes der Brote um 25-50% erreicht werden.

Key words: cottonseed flour, wheat flour, bread making

Introduction

Cottonseed forms the most important inedible oilseed produced in Arab countries (1), yet it is not well exploited, due to its inherent toxicity. Various methods have been presented to overcome the lysine and gossypol problems (2). Net edible cottonseed protein potentially produced in arab countries has been estimated to raise protein intake of the poorer sectors of the Arab population more than 50% (3).

Edible grade cottonseed flour (cosf) has successfully been used in a host of food products including cereal flours, noodles, breakfast cereals, sausages, cheese and baby foods (4, 5, 6). Bread, being widely consumed, forms a good medium for enrichment. Addition of cosf in bread-making enhances both protein content and protein quality (7) therefore widely studied (8–13). This product is permitted as a food additive without limitations (14).
Saudi Arabia was declared self-sufficient in wheat production (15), and recently a resulting surplus has been donated to needy countries that happen to be cotton producers. Integration would therefore be of economic and nutritional value. This investigation studies rheological behaviour of doughs of Saudi wheat flour mixed with different types of cosf and properties of bread baked therefrom.

Materials and Methods

Materials

Wheat flour of 75 % extraction (Saudi Mills Co. Dammam) was obtained from a local market.

Two food grades of cottonseed flour (cosf) samples were obtained from the Ministry of Agriculture, U.S.A. One (AAC) was prepared by the air classification method, whereas the other (ALC) by the liquid cyclone process (16). A third sample (ILC) was provided by the Regional Research Lab, Hyderabad, India, and produced by the LCP (17).

Sugar, salt, yeast, glycerol monostearate and ascorbic acid were also used for bread making.

Methods

Moisture, crude protein, fat, fibre and ash content were determined, as given in approved methods of the AACC (18).

Mixing properties of the dough were determined in triplicate in a Farinograph (Brabender, Duisburg; West Germany) by the AACC method (18).

Bread was prepared and baked as described earlier (19). All ingredients, including cottonseed flour in 5 %, 10 % and 15 % were well mixed with Saudi wheat flour in the Farinograph mixer where the amount of water to be added was also predetermined. Dough was left to ferment at 32 °C in a Fermentor (Natl. Mfg. Co. Lincoln, Nebr.) for 15 min, moulded in Al-moulds, then replaced in a fermenter to prove for 45 min, then baked at 218 °C. Specific loaf volume was computed from loaf weight (g) and loaf volume (ml) (19). Each result was an average determination of three loaves.

Organoleptic quality was assessed at two levels: firstly a panel of 15 members evaluated appearance, flavour and texture on a scale of nine points for each. Secondly, volume, colour, grain, symmetry, texture, break and shred were evaluated on a centigrade basis (19).

Results and Discussion

Analysis of cosf samples (Table 1) shows that American cosfs, AAC and ALC, enjoy a much higher protein and fiber content, but a significantly lower content of moisture and oil, properties which would indicate better nutritive value and keeping qualities. Addition of 10 % cosf would thus raise protein content of the resulting bread by approximately 1.5 times.

The higher protein and much lower ash content of ALC compared to AAC flour must be in favour of the former. Analytical difference between the three samples attributed to preparation technique is evidently smaller than that due to seed derivation and variety.

Mixing properties of wheat-cosf mixtures are shown in Table 2. Cottonseed flour thus increases water absorption of the dough. This coincides