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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Study of Pentosans (Non Starch Polysaccharides), in Durum Wheat and its Relation to the Quality of Protein and Grain Hardness Index (H.I.)

A. Mohammadkhani

Cereal Research Department, Seed and Plant Improvement Institute, Karaj, Iran

Abstract: Total pentosan content of 119 durum wheat lines from collection of Cereal Dept. were estimated in whole wheat and laboratory-milled products by the orcinol-HCl method (5). The lowest total pentosan (2.6%) was related to the line of 43583 and the highest of the total pentosans (12.2%) was related to the line of IDYN39. In addition, the grain hardness index (H.I.) and protein quality (S.T.) of above mentioned 119 durum lines were investigated which the lowest grain HI (53) was related to 43696 and the highest one (80) was related to the line of IDYN28. Also the lowest (17) protein quality (S.T. zeleny number) was belonged to line of 43559 and the highest one (44) was related to the IDYN 30. All possible correlations among total pentosans, grain hardness index and protein content statistically were found significant at the highest level (0.01).

Key words: Grain hardness index, protein quality, durum wheat, total pentosans

Introduction

Pentosan is one of the important fiber components of the non-starch polysaccharides in cereal, which dominantly are consisted of pentosan sugar of L-arabinose and D-xylose. These non-starch polysaccharides normally are called flour gum or hemicelluloses. In terms of dietary fiber components of human nutritional aspect pentosan is not only has effect on food absorption but has also effect on decreasing absorption of lipid and cholesterol, therefore pentosan is very useful in human diet. Because of its important effect on quality of bread, macaroni and animal nutrition considerable research work have been done in the world, specially development countries, as example, from the research work has been found (Menger, 1976) that amounts of pentosan has positive effect on dough rheological characteristics and macaroni production processing. Also in durum wheat has been reported that by increasing pentosan, dough extensibility were increased (Jelaca and Hlynka, 1971) and also time of dough development and dough viscosity increased (Jelaca and Ylynka, 1972). In cereal among the different variety of rye, wheat and different lines of 6 IB/IR, all varieties of rye have the higher amounts of pentosan (Englyst *et al.*, 1983; Dhabwal *et al.*, 1988). These differences in pentosan are related to the genetic components of those varieties (Lehtonen and Alkasalo, 1987). About 23% of water absorption of dough is duo to the pentosan (Bushuk, 1966).

Materials and Methods

In current experiment standard chemical materials and equipments were used as follow: 1N and 2N HCl, 2N Na₂CO₃, 0.2N Na₂PO₃, yeast, FeCl₃ and Orcinol. NIR 1800, Spectrophotometer (Jenway 6105 U.V./V.S), Water bath, Ependorf micro tube, test tube, Vortex and micro

Centrifuge (Eppendorf 5415C).

For extraction and determination of total pentosan about 10 mg of whole grain flour from each line of durum wheat was weighted and according micro method of (Hashimoto *et al.*, 1987) 2ml of 2N HCl was added, in to the sealed tube then was put in to the boiling water bath at 100°C for 2.5HR. After cooling test tubes, 2ml of 2N Na₂CO₃ and 2ml of yeast (25 mg/ml in 0.2 N Naphosphate Buffer pH7.0) were added and put them into the water bath at 30°C for 2HR to ferment. In the first step of this stage all samples were vortexed and centrifuged then 2ml from supernatant of each sample were taken, put into another test tube and respectively one ml distilled water, 3ml FeCl₃ solution (0.1% FeCl₃ in 1N HCl) and 0.3 ml orcinol solution (1% orcinol in EtOH) were added, after vortexing again were put in the boiling water bath for 30 minutes at the 100°C then cooling them by cold water, with Spectrophotometer at the 670 nm total pentosan of all samples were detected. At the final stage grain hardness index and protein quality (zeleny number) according to the ICC standard method were determined by NIR (Informatic 8600).

Results and Discussion

119 advanced lines of durum wheat from cereal research dept. of Seed and Plant Improvement Institute on the base of above mentioned standard methods were analyzed, the results of total pentosan content of whole grain flour of samples demonstrated in Fig. 1 which the lowest one was related to the line of 43583 with 2.6% of total pentosan and the highest one related to the line of IDYN39 with 12.2% of total pentosan the most frequency (50 line) were related to those lines with containing about 4% of total pentosan. It should be noted that with current method the total pentosan in whole wheat flour (8.95%) and wheat bran (22.53%) were reported (Hashimoto *et al.*, 1987).

Mohammadkhani: Pentosans in Durum Wheat

Table 1: Pearson correlation among 3 factors of pentosan content, protein quality and grain hardness index in 119 advanced lines of durum wheat

		Protein qual	Pentosan%	GrainH. index
Protein qual	Pearson correlation	1.000	0.408**	0.567**
	Sig (2 tailed)	0.000	0.000	0.000
Pentosan%	Pearson correlation	0.408**	1.000	0.266**
	Sig (2 tailed)	0.000	0.000	0.003
GrainH.index	Pearson correlation	0.567**	0.266**	1.000
	Sig (2 tailed)	0.000	0.003	0.000

**Correlation is significant at the 0.01 level (2-tailed).

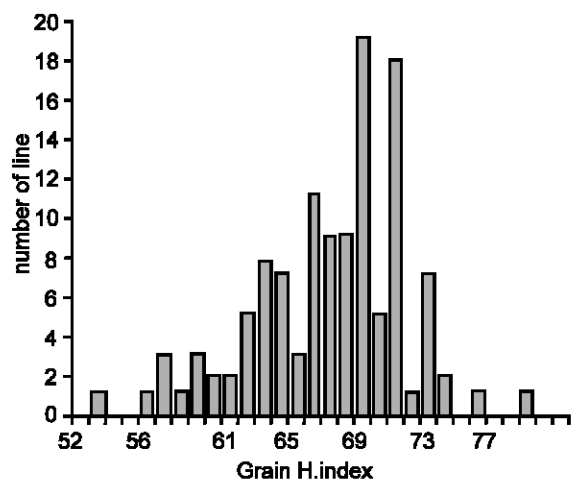


Fig 1: Frequency distribution of total pentosan in advanced lines of durum wheat

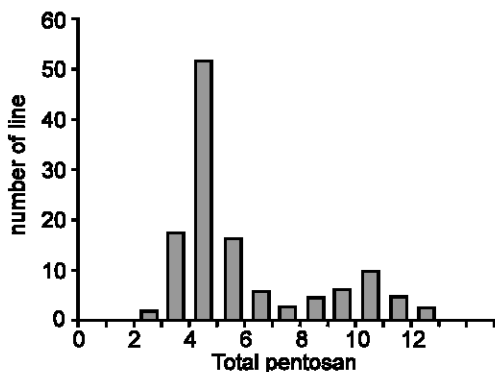


Fig 2: Frequency distributions of grain Hardness index in durum wheat

In terms of grain hardness index (HI) and protein quality (ST) of all the lines were analyzed. As the results shown in Fig. 2 the lowest grain hardness index was 53 (medium class), which was related to the line of 43696, and the highest grain hardness index was 80 (super class), which was related to the line of IDYN28. In the case of protein quality (zeleny number) as the Fig. 3 was demonstrated that the lowest amount was 17 (very weak class), belonged to the line of 43559 and the highest protein quality was 44 (super class), belonged to the line of IDYN30. On the based of the test of Pearson, the

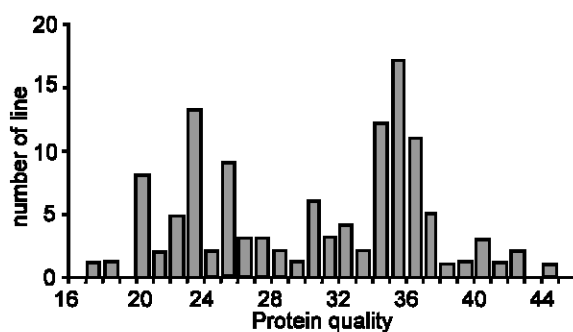


Fig 3: Frequency distribution of protein Quality in advanced lines of durum wheat

correlation among the total pentosan, grain hardness index and protein quality were shown in Table 1 all correlation were statistically high significant (0.01).

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