



CAHARACTERIZATION OF DURUM WHEAT (*Triticum durum desf*) CULTIVARS IN TERMS OF GLIADIN AND GLUTENIN PROTEIN COMPOSITION

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ABSTRACT: In these days, the quality has become the most important topic in durum wheat in the World. For this purpose, the study was on quality of durum wheat conducted using *electrophoresis*. In the study, ten durum wheat (commonly cultivated in the region) samples were evaluated for high molecular weight (HGMW-GS) and low molecular weight glutenin subunit(LGMW-GS) composition using SDS-PAGE with Kyle cultivar as a reference. In terms of LMW, data indicated that all cultivar had LMW-2 similar to Kyle cultivar, except Sarıçanak 98. On the basis of *elektrophoretic seperation* of gliadin fraction it was found that 9 cultivar contained γ -45, While Sarıçanak 98 had γ -42. On the other hand, in terms of HMW, all cultivar were similar in four location except Güneyyıldızı. Cultivars with glutenin allele LMW-2 (or gliadin band γ -45) generally give stronger gluten than cultivars with allele LMW-1 (or gliadin band γ - 42).

Keywords: Durum wheat, electrophoresis. SDS-PAGE

INTRODUCTION

Wheat is the basic food material around the world, including Turkey. *Triticum aestivum* (common or bread wheat) and *Triticum durum* (durum or pasta wheat) are the commercially produced wheat species in the world and Turkey [16]. Durum wheat (*Triticum turgidum L. durum*) is an important food crop in the world because of its great importance in the human diet [14]. It is also most appropriate cereal for the production of high quality pasta products [13]. Wheat gluten proteins are classified into two broad groups on the basis of their aggregation and functional properties. These are the gliadins which are present as monomers which interact by mono-covalent forces and the glutenins which form polymers stabilized by interchain disulphide bonds. Glutenins are divided into two basic classes according to the molecular weight of their subunits: HMW (High Molecular Weight) and LMW (Low Molecular Weight)glutenin subunits (GS) [9]. Two different LMW glutenin patterns,LMW-1 and LMW-2, linked to γ -42 and γ -45 respectively, were described by [11]. The aim of this study was to investigate 10 durum wheat cultivars, which are cultivating in South-eastern Anatolia Region of Turkey, with respect to γ -gliadin 45 and LMW-2 glutenin that were associated with pasta-cooking quality by means of protein markers. Another aim of the study to check the uniformity of varieties and to determine if there is any change in gluten-band patterns as depend on locations.

MATERIALS AND METHODS

A total of 10 *Triticum durum* accessions of Turkey and Italy origin obtained from different Institutes of Turkey were used as a research material to determine the presence or absence of γ -gliadin 45 and LMW-2 glutenin proteins (Table 1).

Table 1. Name and registration year of cultivars used in the research.

Cultivar name	Registered from	Registration year
Artuklu	GIARTC	2008
Aydın 93	GIARTC	1993
Eyyubi	GIARTC	2008
Güneyyıldızı	GIARTC	2010
Harran 95	GIARTC	1995
Sarıçanak 98	GIARTC	1998
Svevo	TAICL	2001
Şahinbey	GIARTC	2008
Zenit	TAICL	2001
Zühre	GIARTC	2010

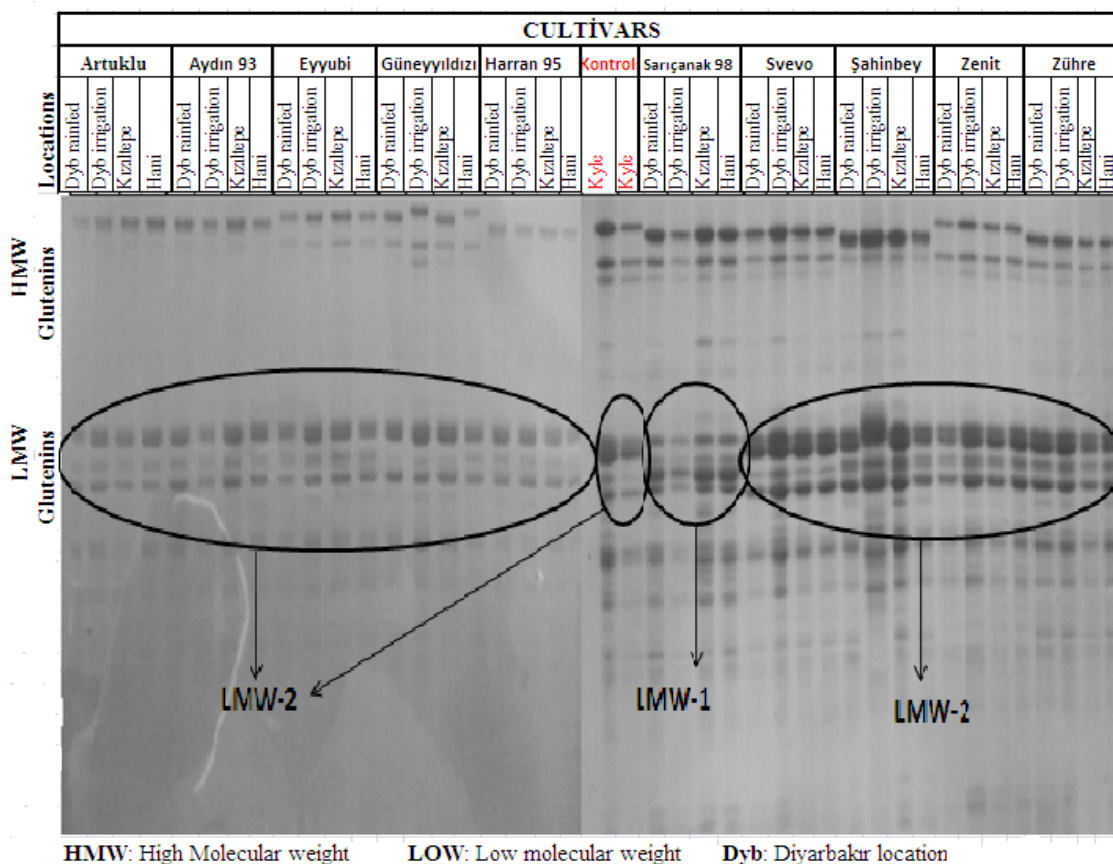
TAICL: Tasaco Agricultural Industrial Company Limited, GIARTC: Gap International Agricultural Research and Training Center

Kyle, the most commonly grown cultivar in Canada carrying γ - gliadin 45 and LMW-2 glutenin proteins, was used as a reference. Total seed storage proteins were extracted and fractionated by PAGE in sodium dodecyl sulphate (SDS-PAGE) according to the procedure described by [1].

RESULTS AND DISCUSSION

Storage protein samples of varieties of protein were transferred into gel, in alphabetical order from left side, also protein samples taken from different locations of the same variety were arranged side by side. Kyle variety was used in the research as a reference and was placed in the middle of varieties (Fig. 1). Low molecular weight glutenin subunits (LMW-1, LMW-2) were compared with Kyle as this control variety had LMW-2 glutenin protein. Each of the four distinct samples of varieties lined up side by side to easily observe uniformity samples of diverse locations. There were not differences on protein banding patterns of samples taken from four locations, except Güneyyıldızı. Examined HMW protein bands of Güneyyıldızı cultivar were divided into two different groups. The protein bands of samples brought from irrigated Diyarbakır and Hani, samples from rainfed locations, other two location(rainfed Diyarbakır and Kızıltepe) were similar between themselves.

This confusion which happened in Güneyyıldızı cultivar could be the result of selecting the wrong spike or incorrect cultivation. However, There was no any mixture samples of among other varieties from different among locations. So, the protein banding patterns of these varieties were similar. It has been found that all varieties used in this study contain LMW-2 glutenin proteins, except Sarıçanak 98 cultivars (LMW-1).



Figur 1. The gel samples of ten durum wheat belong to four location.

In other researches, it has shown that γ -gliadin-42 and γ -gliadin-45 proteins which are effective in quality of pasta cooking, produced from wheat semolina, genetically are related to LMW-1 LMW-2 glutenin proteins respectively. γ -gliadin 45 protein is recognized as an indicator of high cooking quality and the optimal gluten strength in pasta, on the contrary, γ -gliadin-42 protein is responsible for low cooking quality and weak gluten [2,3,4,5,8].

Consequently, it was determined in the study that Kyle standard variety and other varieties used in the study, had LMW-2 gluten proteins, and so these varieties were related with γ -gliadin 45 band, except Sarıçanak 98 (LMW 1 gluten protein related with γ -gliadin 42). Some studies on the quality of durum wheat in the region showed that Sarıçanak 98 cultivar had sensitive to rotation seed and low quality criteria [6,7].

CONCLUSIONS

As far as can be understood from these results, only Sariçanak 98 cultivar related with y-gliadin 42 band, other cultivars used in the study related with y-gliadin 45 band. Therefore, Sariçanak 98 shows weak cooking quality, other varieties show high cooking quality. Sariçanak 98 showed weak gluten, relating with pasta cooking quality, other varieties showed strong gluten, relating with quality pasta cooking.

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REFERENCES

- [1] Ciaffi, M., Lafiandra, D., Porceddu, E. and Benedettelli, S. (1993). Storage protein variation in wild emmer wheat (*Triticum turgidum* ssp. *dicoccoides*) from Jordan and Turkey. I. Electrophoretic characterization of genotypes. *Theor. Appl. Genet.*, 86: 474-480.
- [2] Clarke, J.M., Marchylo, B.A., Kovacs, M.I.P., Noll, J.S., McCaig, T.N., and Howes, N.K., 1998. Breeding durum wheat for pasta quality in Canada. *Wheat: Prospects for Global Improvement*, Eds: Braun, H.-J. ve ark., Kluwer Academic Publishers, New York, 229-236
- [3] Edwards, N.M., Gianibelli, M.C., McCaig, T.N., Clarke, J.M., Ames, N.P., Larroque, O.R., and Dexter, J.E., 2007. Relationships between dough strength, polymeric protein quantity and composition for diverse durum wheat genotypes. *Journal of Cereal Science*, 45, 140-149.
- [4] Feillet, R., Ait-Mouh, O., Kobrehel, K., and Autran, J.-C., 1989. The role of low molecular weight glutenin proteins in the determination of cooking quality of pasta products: An overview. *Cereal Chemistry*, 66, 26-30.
- [5] Gupta, R.B., Paul, J.G., Cornish, G.B., Palmer, G.A., Bekes, F., and Rathjen, A.J., 1994. Allelic variation at glutenin subunits and gliadin loci, Glu-1, Glu-3 and Gli-1, of common wheats. I. Its additive and interaction effects on dough properties. *Journal of Cereal Science*, 19, 9-17.
- [6] Kendal, E., Tekdal, S., Aktaş, H. ve Karaman M. 2012. Comparison of some Durum wheat varieties in terms of yield and quality parameters in irrigation conditions of Diyarbakir and Adiyaman, Uludağ. Ü. the Journal of Faculty Agriculture, 2012, Vol 26, N: 2, Pge: 1-14
- [7] Kılıç, H. 2003. The Studies of some agronomic and quality traits and stability on Durum Wheat (*Triticum turgidum* ssp *Status*) varieties in Southeastern Anatolia Region, Çukurova.Ü. Institute of Science.
- [8] Kovacs M.I.P., Howes N.K., Leslie D., and Zawistowski, J., 1995. Effect of two low molecular weight glutenin subunits on durum wheat pasta quality parameters. *Cereal Chemistry*, 72, 85-87.
- [9] Motalebi, M. – Keshavarzi, M. – Naghavi, M. R. 2007. Glutenin subunit composition in durum (*Triticum durum*) landraces and cultivars. In *Asian Journal of Plant Sciences*, vol. 6, p. 399-402.
- [10] Payne, P. I. – Nightingale, M. A. – Krattiger, A. F. – Holt, L. M. 1987. The relationship between HMW glutenin subunit composition and the bread-making quality of British-grown wheat varieties. In *J. Sci. Food. Agric.*, vol. 40, p. 51-65.
- [11] Payne, P.I., Holt, L.M., Lawrence, G.J., and Law, C.N., 1982. The genetic of gliadin and glutenin - The major storage proteins of the wheat endosperm. *Plant Foods for Human Nutrition*, 31, 229-241.
- [12] Pogna, N.E., Autran, J.C., Mellini, F., Lafiandra, D., and Feillet, P., 1990. Chromosome 1B-encoded gliadins and glutenin subunits in durum wheat: Genetics and relationship to gluten strength. *Journal of Cereal Science*, 11, 15-34.
- [13] Vansteelandt, J. – Delcour, J. A. 1999. Characterisation of starch from durum wheat (*Triticum durum*). In *Starch/Stärke*, vol. 51, p. 73-80.
- [14] Williams, P.C., J.P. Srivastav, M.M. Nachit, FJ. El-Haramein. 1984. Durum wheat quality evaluation at CARDIA. *Rachis* 3: 30-33.
- [15] Yüksel, F., 2009. Bazı Makarnalık Buğday İleri İslah Hatlarının Kalite Özellikleri ve Stabilite Yetenekleri (Yüksek Lisans Tezi). Gaziosmanpaşa Üniversitesi Fen Bilimleri Enstitüsü Gıda Mühendisliği Anabilim Dalı, Tokat.
- [16] Yüksel, F., Koyuncu M., Sayaslan A. 2011 Makarnalık Buğday (*Triticum durum*) Kalitesi, *Türk Bilimsel Derlemeler Dergisi* 4 (2):25-31, 2011 ISSN: 1308-0040, E-ISSN: 2146-0132, www.nobel.gen.tr