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# Review on the protein content of different wheat varieties

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### ABSTRACT

In the world wheat varieties are grown over a wide agro-climatic range and as such are anticipated to exhibit quality differences. Pakistan and Ethiopia are best examples of wheat producers found in different agro-climatic ranges. Grain protein percentage is an important component of grain quality. Protein contents measured by standard Kjeldahl method show a higher level than protein contents calculated from NIRS. Generally grain protein contents in wheat varies between 8% and 17%, depending on genetic make-up and on external factors associated with the crop. The Pakistan's results regarding standard Kjeldahl analysis of protein reveals highest level of 11.2% protein in variety Bakhtawar-92, while Tatara, Watan, Bhakkar-01, Wafaq-01, Gandam-2002 and Chudry-97 contain 11.0% protein. The lowest value is present in Saleem-2000 (9.0%).

Wheat grain quality of three bread wheat varieties namely Pavon 76, HAR 2501 and HAR 2536 grown in Arsi and Bale areas of Ethiopia were determined. The wheat varieties had a protein content of 10.60, 11.53 and 10.70%, respectively. Relatively, the wheat varieties collected from Ethiopia has higher amount of protein content compared to those of Pakistan wheat varieties. This variation may be due to method differences but not significant at 95% confidence level. This study is significant to further improve their nutritional excellence.

**Keywords:** Bread Wheat; Grain Quality; Wheat varieties; Protein content

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## Introduction

Global wheat production is concentrated mainly in Australia, Canada, China, European Union, India, Pakistan, Russia, Turkey, Ukraine and the United States, accounting for over 80% of world wheat production. Pakistan is the 8<sup>th</sup> largest wheat producer, contributing about 3.17% of the world wheat production from 3.72% of the wheat growing area. Wheat in Pakistan is a leading food grain and occupies a central position in agriculture and its economy (Shuaib *et al.*, 2007).

Wheat is a grass of the gramineae family and of the genus *Triticum*. It is believed to be the first cereal crop grown by man and widely cultivated food crop in the world today. There are several thousand varieties known so far but three main types include *Triticum durum* (Durum wheat) largely used for pasta production, *Triticum vulgare* or *aestivum* mainly used for bread production and *Triticum compactum* (soft wheat) used for biscuit, pastry and cakes (Lapades, 1977; Bender and Bender, 1995). The grain is composed of branny husk 13%, germ 2% and endosperm 85%.

In Ethiopia, both the bread and durum wheat are widely cultivated in the highlands of the country largely in the areas like South East, Central and North West parts. According to Ministry of Agriculture and Rural Development (MoARD, 2005), it is estimated that 1.4 million hectare of land is covered with wheat and more than 2.18 million tons are produced annually. Some of the hard wheat varieties include Pavon 76, HAR 2536 (Simba), HAR 1407 (Tuse), HAR 604 (Galema) and HAR 2501 (Hawi). Both HAR 2501 and HAR 2536 were released in 1999/2000 by the Ethiopian Agricultural Research Organization, Kulumsa Agricultural Research Center while the variety Pavon 76 was released in 1982 by the same Research Center (MoARD, 2005).

## Materials and methods

Wheat grains of twelve varieties were collected from different ecological regions of Pakistan

during August to December 2005. The samples were stored in labeled glass bottle to ensure preserve integrity. The analysis was carried out at the Department of Biotechnology, University of Malakand Pakistan during February to June 2006. Kjeldahl method was used to determine percent nitrogen (%N) as described by American Association of Cereal Chemists (AACC, 1995). The calculated %N was multiplied by a protein factor of 5.70. Wheat samples of different varieties were placed in cuvettes (3 cm diameter) sealed with aluminum and plastic foils. The absorbance spectra [ $\log(1/R)$ ] were recorded on a near infrared spectrometer model 6500 (NIR System Inc., Silver Springs, MD, USA) equipped with computer.

From Ethiopia, three bread wheat varieties, Pavon 76, HAR 2536 and HAR 2501 were collected from Arsi and Bale Agricultural Development Enterprises. All the wheat samples were collected from the two locations (Arsi and Bale) merely because the two areas are most known in high quality wheat production. ARDU (Arsi Rural Development Unit) and CADU (Chilallo Agricultural Development Unit), Kulumsa wheat breeding research center, state farms and seed production enterprise which are located in the nearby areas have performed extension and popularization activities to farmers on agricultural technologies in wheat production. Moreover, wheat flour producing factories prefer the wheat varieties produced in these areas. Thus, the samples from the two locations represent the varieties. The samples were collected using random sampling system. They were then packed in polypropylene bags and brought to the laboratory. The bags were well tightened to avoid contamination and spillage. Each wheat variety was then thoroughly cleaned using 2 mm slot width laboratory sieve. Coarse impurities were handpicked. They were then packed in polypropylene bags again and stored at room temperature for analyses. The protein content of wheat samples was measured by grain analyzer (Minifra-2000T, Hungary) where clean wheat

samples were placed in a sample cell (cuvette) and inserted in to the grain analyzer. The protein content of the samples was read from the analyzer and recorded.

## Results and discussion

### Protein contents

Grain protein percentage is an important component of grain quality. Protein contents measured by standard Kjeldahl method show a higher level than protein contents calculated from NIRS as given in Table 1. However the highest mean value from both methods are (mean  $\pm$  SD): (10.27 $\pm$ 1.161)%, (10.25 $\pm$  1.061)% and (10.20 $\pm$ 1.414)% for varieties Gandam- 711, Watan and Bakhtawar-92 respectively. Low values were observed in Saleem-2000 (9.15 $\pm$  0.212)%, and Fakhre-Sarhad (9.57 $\pm$ 0.460)%. Generally grain protein contents in wheat varies between 8% and 17%, depending on genetic make-up and on external factors associated with the crop, however the protein contents in wheat measured by NIRS have been shown to be in the

range of 10%-19% (Hruschka and Norris, 1982). Thus our values for protein contents on both NIRS and Kjeldahl method are in this range, but mostly on the lower side of the scale.

Results regarding standard Kjeldahl analysis of protein reveals highest level of 11.2% protein in variety Bakhtawar-92, while Tatara, Watan, Bhakkar-01, Wafaq-01, Gandam-2002 and Chudry-97 contain 11.0% protein. The lowest value is present in Saleem-2000 (9.0%). This trend is close to the mean values from both methods. However this value correlates with the recently reported value of 8.6% for variety Inqilab-91 (Hussain *et al.*, 2006).

The Ethiopian wheat varieties showed differences in their protein content. Variety HAR 2501 had the highest protein while the variety Pavon 76 had the lowest protein content ranging between 10.60% and 11.53%. The protein content of the tested varieties was low and need supplementation of protein to be suitable for pasta and bread production (Table 2).

**Table 1: Protein content of different Pakistan wheat varieties determined by different methods**

Variety name	Protein (%)			
	Kjeldahl	NIRS	Mean $\pm$ SD	AOAC
Tatara	11.0	9.25	10.12 $\pm$ 1.237	2.7
Watan	11.0	9.50	10.25 $\pm$ 1.061	2.4
Gandam-711	10.9	9.25	10.27 $\pm$ 1.161	2.2
Bakhtawar-92	11.2	9.20	10.20 $\pm$ 1.414	2.8
Fakhre-Sarhad	9.90	9.25	9.57 $\pm$ 0.460	2.6
Bhakkar-01	11.0	9.30	10.15 $\pm$ 1.202	2.7
Ghaznawy	10.8	9.10	9.95 $\pm$ 1.202	2.2
Saleem-2000	9.00	9.30	9.15 $\pm$ 0.212	2.1
Wafaq-01	11.0	9.20	10.10 $\pm$ 1.271	2.9
Gandam-2002	11.0	9.20	10.10 $\pm$ 1.271	2.5
Chudry-97	11.0	9.30	10.15 $\pm$ 1.202	2.6
Inqilab-91	10.2	9.40	9.80 $\pm$ 0.565	2.4

Values are expressed as Mean  $\pm$  SD (n=3).

**Table 2. Grain quality characteristics of three wheat varieties determined by grain analyzer (Minifra-2000T, Hungary).**

Parameter	Wheat varieties		
	Pavon 76	HAR 2501	HAR 2536
Protein (%)	10.60 ± 0.10	11.53 ± 0.12	10.70 ± 0.17

All values are means of triplicates ± SD

## Conclusion

The crude protein content of the three wheat varieties collected from Pakistan was within the requirements of codex alimentarius in which vital gluten powder supposed to have a minimum of 80% protein on dry matter basis. It is concluded from the present study that wheat grains of different varieties in Pakistan contain total protein of 9.15%-10.27% and 10.60-11.53% for the wheat varieties collected from Ethiopia. Relatively, the wheat varieties collected from Ethiopia has higher amount of protein content compared to those of Pakistan wheat varieties. This variation may be due to method differences or other agro-ecology factors but the variation is not significant at 95% confidence level. This study is important in providing an opportunity to improve the nutritional quality of wheat and for setting up of nutritional and export regulations.

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