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An *in vitro* Assessment of Nutritional and Physical Characteristics of Wheat Varieties Obtained from Thrace and Aegean Regions for Poultry

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Abstract: In poultry feed industry, wheat ranks as the second most important grain after maize. The inclusion level of wheat in poultry diets depends upon its nutritional composition as well as on the content of anti-nutritional factors. The importance of these factors may vary not only depending on variety of wheat but also on the geographic location where the grain is produced. The aim of the present study was to compare the nutritional values of wheat varieties obtained from Thrace and Aegean regions with respect to poultry nutrition. The present study demonstrated that crude protein content of the wheat varieties from Thrace and Aegean regions were 15.07 and 14.54%, respectively and the difference, in this respect, between the two regions was significant ($P < 0.05$). Crude fiber values were found to be significantly ($P < 0.05$) different either, being 3.61 to 3.25%, respectively. Physical characteristics such as one thousand grain weight and hectoliter weight were not significantly different ($P > 0.05$). Viscosity values of wheat varieties obtained from Thrace and Aegean regions were measured to be 1.42 and 1.17 cPs, respectively. However, viscosity values were not significantly different ($P > 0.05$). Significant negative correlations were found between thousand grain weight and crude ash of wheat varieties from Thrace region, whereas significant positive correlations were found to be, respectively r=0.80 and 0.79, between thousand grain weight-density and crude ash-crude protein contents of Aegean regions ($P < 0.05$). In addition to chemical composition, physical characteristics such as thousand grain weight and hectoliter weight might be important in the usage of grains as feedstuffs for poultry.

Key words: Wheat, poultry feeds, Thrace and Aegean regions

Introduction

Wheat is the main cereal which is produced in Turkey for human and animal's diets. However, its structural and nutritional characteristics demonstrate important variations. Wheat production area in Turkey is approximately 9.5 million hectares, and important production regions are Thrace and Aegean. Furthermore, according to data from FAO (2004) wheat production of Turkey in 2004 was approximately 21 million metric tons. In this respect, if you compared with EU countries; Turkey came after France (21 million metric tons) and Germany (25.4 million metric tons). Although, production ratios are high, demand for good quality wheat could not be met. Therefore, wheat of good quality was not preferred for animal feed manufacturing. According to FAO (2004), Turkey's wheat import was 1,838,739 metric ton in 2003 and the importation tended to increase during the last years.

In poultry feed industry wheat is the second important grain after maize. When maize price increases, usage of wheat may be affected positively. Especially, increase of maize price might be positively effective on wheat utilization in poultry diets.

The major constituents of wheat grain are starch, fiber (non-starch polysaccharides-NSP, lignin) and protein. Wheat has 50% more lysine and three times more tryptophan compared with maize. Water soluble and insoluble NSP content of wheat varieties range from 75 to 166 g/kg DM. Wheat varieties, region and climate plays the major role in this variation (Kim *et al*., 2005). Wheat inclusion rate can be increased in poultry diets by supplementation of feed enzymes. These microbial enzymes have been shown to alleviate the negative effects of especially the soluble NSP fractions available in wheat cell walls by depolymerisation of these complex groups (Bedford and Morgan, 1996).

The present study was conducted to investigate the physical and nutritional values of wheat varieties obtained from Thrace and Aegean regions for poultry nutrition.

Materials and Methods

Twenty four wheat varieties used in this study were obtained from Thrace Agricultural Research Institute (in Edirne) and 13 varieties from Eagean Agricultural Research Institute (in Izmir). All wheat varieties of the study were harvested the same year and analyzed in Thrace University, Agricultural Faculty of Tekirdag, Dept. of Animal Science Labs.

In vitro viscosity: The samples of wheat varieties were fine ground (0.5 mm) through a hammer mill for *in vitro* viscosity measurement and various nutrient analyses. *In vitro* viscosity of ground grains was determined

Table 1: Nutrient compositions and physical characteristics of wheat varieties obtained from Thrace and Aegean region*

Parameters	Wheat varieties			
	Thrace region		Aegean region	
	Mean	Standard Error	Mean	Standard Error
Dry matter, %	92.34	0.329	91.45	0.232
Ash, %	1.89	0.063	1.90	0.058
Crude protein, %	15.07[a]	0.267	14.54[b]	0.246
Crude fiber, %	3.61[a]	0.142	3.25[b]	0.198
Ether extract, %	1.68	0.045	1.66	0.057
Thousand grain weight, g	42.04	0.936	43.63	2.367
Hectoliter weight, kg/hl	79.72	0.495	79.37	1.074
Viscosity, cPs	1.42	0.093	1.17	0.118

*a,b:Means in each line with different subscripts differ significantly ($P < 0.05$)

according to Kluge *et al.* (1996) as the following: 2 ml deionized water was added to 1 gram of sample and the placed in a rotatory incubation shaker at 38°C for 30 minutes. After incubation, samples were centrifuged at 10,000 g for 10 minutes and viscosity of supernatants was measured in a digital, cone-plate viscometer (model LVTD-CP-40, Brookfield Engineering Laboratories, Inc. Massachusetts, USA), at 25°C.

Thousand grain weight and hectoliter weight: Thousand grain weight and hectoliter weight was determined according to Sakin *et al.* (2004) as follows: 100 wheat grain were counted and weighed in electronic analytical balance for four times to determine thousand grain weight (g) of wheat varieties and then found values were averaged and multiplied by 10. To find out hectoliter weight (kg/hl), wheat varieties weighed in 250 ml baker for 4 times and averaged, then obtained values were multiplied by 400.

Weender analysis: Samples of wheat varieties were analyzed in the methods of Weender for the contents of dry matter, crude protein, ether extract, crude fiber and crude ash according to Akyildiz (1984).

Statistical analysis: The analyses of variance (ANOVA) and comparisons of mean differences between groups (Tukey HSD-Test; $P<0.05$) were performed using the Statistica for the Windows Operating System (1999).

Results and Discussion

Nutrient composition, viscosity, and physical characteristics of the wheat varieties collected from Thrace and Aegean Regions were presented in Table 1. Dry matter content of the wheat varieties of Thrace and Aegean regions were 92.3, 91.5%, respectively, whereas crude ash content was the same, 1.9% for the two regions. In this respect, however, the difference between the two regions was not found to be significant ($P > 0.05$). In the case of crude protein and crude fiber, significant ($P < 0.05$) differences were found between the two regions. Mean of the crude protein of Thrace varieties was 15.1% and crude fiber, 3.61%, while the same values for Aegean region were, 14.5% and 3.3% respectively. However, data concerning to crude oil, thousand grain weight, bushel weight and viscosity demonstrated that there was not any significant difference between the two regions ($P > 0.05$). Numerically higher values of viscosity found in Thrace region (1.41 cPs) compared to Aegean region (1.17 cPs), could be attributed to the higher crude fiber values detected in the former varieties.

Kluge *et al.* (1996) reported that lower thousand grain weight was related to smaller grain size and smaller starch cells, however associated with higher levels of cell wall constituents. Thousand grain weights of the varieties from Thrace region (42.04 g) were found to be lower than those of the Aegean region (43.63 g). Significant differences regarding the crude fiber between the two regions were also supported by the findings of other studies (Kluge *et al.*, 1996; Svihus and Gullord, 2002). On the other hand, especially significant effect of harvesting year on thousand grain weight, and significant effects of variety, region and harvesting year on crude protein and nitrogen free extract were reported recently by Kluge and Dusel (2004). However, in the same study no significant correlation (r=-0.13) between the metabolizable energy (ME) value of the wheat varieties and the thousand grain weight could be found. While solely effect of harvesting year on crude fiber, effects of variety and harvesting year on crude ash was reported.

Correlations between the nutrient compositions and physical characteristics of the wheat varieties of Thrace and Aegean regions were shown in Table 2 and 3, respectively.

Although they were not significant negative correlation (r=-0.53) were detected in Aegean wheat varieties,

Table 2: Correlations between some parameters of wheat varieties from Thrace region*

	Thousand grain weight	Hectoliter weight	Viscosity	Dry matter	Ash	Crude protein	Crude fiber	Ether Extract
Thousand grain weight	1	0.38	0.04	0.26	-0.58*	-0.50	0.21	0.45
Hectoliter weight		1	-0.22	-0.17	-0.24	-0.08	-0.32	0.19
Viscosity			1	0.23	0.05	0.03	0.09	-0.24
Dry matter				1	-0.44	-0.54	0.41	-0.04
Ash					1	0.34	-0.01	-0.34
Crude protein						1	-0.10	-0.07
Crude fiber							1	-0.22
Ether extract								1

*Correlation coefficients significant at P < 0.05

Table 3: Correlations between some parameters of wheat varieties from Aegean region*

	Thousand grain weight	Hectoliter weight	Viscosity	Dry matter	Ash	Crude protein	Crude fiber	Ether Extract
Thousand grain weight	1	0.80*	-0.40	0.33	-0.53	-0.39	-0.28	0.16
Hectoliter weight		1	-0.08	0.03	-0.43	-0.35	-0.35	0.16
Viscosity			1	-0.24	0.31	0.55	0.35	-0.58
Dry matter				1	-0.33	-0.37	-0.06	-0.05
Ash					1	0.79*	0.59	0.17
Crude protein						1	0.56	-0.01
Crude fiber							1	-0.02
Ether extract								1

*Correlation coefficients significant at P < 0.05

whereas significant (P < 0.05) negative correlation (r=-0.58) between crude ash and thousand grain weight of Thrace region wheat varieties were found. The highest positive correlation (r=0.80) was found to be between thousand grain weight and hectoliter weight in the wheat varieties of Aegean region while the same correlation of the Thrace region varieties were rather low (r=0.38) and insignificant. Similar relation between crude ash and crude fiber was also observed in the wheat varieties of the two regions. There were significant (P < 0.05) correlations (r=0.79) between crude ash and crude fiber of the Aegean varieties while insignificant (P > 0.05) and lower correlations could be found between the same parameters of Thrace region varieties.

Conclusion: The *in vitro* results of the present study indicated that there were significant differences with respect to nutrient composition of the wheat varieties of the two regions. Wheat varieties of Thrace and Aegean regions especially differed in their crude protein and crude protein contents which the two parameters are of prime importance in poultry feeding. Some of the physical characteristics of the wheat varieties such as crude fiber, thousand grain weight and hectoliter weight were found to be significantly correlated with their nutritional potential. Therefore, significant information may be obtained for poultry regarding the nutritional value of the wheat varieties obtained from different regions when some of the physical characteristics besides their nutrient compositions are examined.

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