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Effect of Chemical Content and Physical Characteristics on Nutritional Value of Wheat Varieties Collected from Thrace Region

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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 on its nutritional composition as well as on the content of antinutritional factors. The importance of these factors may vary not only depending on variety of wheat but also on the geographic location where the grain produced. The aim of the present study was to compare the nutritional values of wheat varieties collected from Thrace region (Kirklareli, Edirne, Tekirdag) with respect to poultry nutrition. The present study demonstrated that crude protein content of the wheat varieties from 12.39, 13.68, and 15.83%, respectively and the difference, in this respect, among the three province were significant ($P < 0.01$). Crude fiber values were found to be significantly ($P < 0.05$) different either, being to 2.93, 2.88, and 3.27%, respectively. Physical characteristics such as one thousand grain weight and hectoliter weight were significantly different ($P < 0.01$). Viscosity values of wheat varieties obtained from Thrace region (Kirklareli, Edirne, Tekirdag) were measured to be 2.52, 2.34 and 2.32 cPs, respectively. However, viscosity values were not significantly different ($P > 0.05$). pH values were found to be significantly ($P < 0.05$) different either, being to 5.51, 5.67, and 5.90, respectively. Significant negative correlations were found between crude fiber and thousand grain weight ($r = -0.76$), crude ash and hectoliter weight ($r = -0.51$), whereas significant positive correlations dry matter and crude fiber ($r = 0.56$) from Kirklareli. Significant negative correlations were found between dry matter and pH ($r = -0.82$), crude fiber and viscosity ($r = -0.57$), whereas significant positive correlations dry matter and viscosity ($r = 0.62$) from Edirne. Significant negative correlations were found between dry matter and thousand grain weight ($r = -0.79$), dry matter and hectoliter weight ($r = -0.67$), whereas significant positive correlations thousand grain weight and hectoliter weight ($r = 0.87$) from Tekirdag. In addition to chemical composition, Physical characteristics such as thousand weight and hectoliter weight might be important in the usage of grains as feedstuffs for poultry.

Key words: Wheat, thrace region, poultry feeds

Introduction

Wheat is the main cereal which 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 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 to 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 last years.

In poultry feed industry wheat is 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 region (Kirklareli, Edirne, Tekirdag) for poultry nutrition.

Materials and Methods

Eighteen wheat varieties used in this study were obtained from Thrace regions. All wheat varieties of the study were harvested the same year and analyzed in Namik Kemal University, Agricultural Faculty of Tekirdag, Dept. of Animal Science Labs.

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Table 1: Nutrient compositions and physical characteristics of wheat varieties obtained from Thrace region (Kirkclareli, Edirne, Tekirdag)*

Parameters	Wheat varieties						p
	Kirkclareli		Edirne		Tekirdag		
	Mean	S.E	Mean	S.E	Mean	S.E	
Dry matter, %	91.4	0.16	91.35	0.24	91.3	0.22	
Crude Ash, %	1.82	0.04	1.84	0.04	1.88	0.05	
Crude protein, %	12.39 ^a	0.79	13.68 ^a	0.22	15.83 ^b	0.25	0.01
Crude Fiber, %	2.93 ^a		2.88 ^a		3.27 ^b		0.05
Thousand grain weight, g	40.25 ^b	0.01	40.57 ^b	0.02	35.50 ^a	0.05	0.01
Hectoliter weight, kg/hl	826.15 ^c	1.28	804.59 ^b	2.83 ^b	782.25 ^a	12.98	0.01
Viscosity, cPs	2.52	0.36	2.34	0.28	2.32	0.11	
pH	5.51 ^a	0.72	5.67 ^{ab}	0.72	5.90 ^b	0.37	0.05

a,b: Means in each line with different superscripts differ significantly

Table 2: Correlations between some parameters of wheat varieties from Kirkclareli

Parameters	Dry matter, %	Crude protein, %	Crude Fiber, %	Crude Ash, %	Thousand grain weight	Hectoliter weight, kg/hl	Viscosity, cPs	pH
Dry matter, %	1	0.34	0.56*	-0.01	-0.31	0.09	-0.38	0.22
Crude protein, %		1	0.27	-0.25	-0.16	0.41	0.1	0.03
Crude Fiber, %			1	0.22	-0.76*	-0.11	0.11	0.19
Crude Ash, %				1	-0.39	-0.51*	-0.09	-0.15
Thousand grain weight					1	0.29	-0.32	-0.12
Hectoliter weight, kg/hl						1	-0.24	0.41
Viscosity, cPs							1	-0.11
pH								1

*Correlation coefficient significant at p<0.05

In vitro viscosity: The samples of wheat varieties were fine ground (0.5 mm) through a hammer mill for *in vitro* viscosity of ground grains was determined according to Kluge *et al.* (1996) as 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 minutes and viscosity of supernatants was measured in a digital, cone-plate viscometre (model SV-O Viscometer, AND and A Company /Limited), 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.

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

Statistical analysis: The analysis of variance (ANOVA)

and comparisons of mean differences between groups (Duncan-Test; P<0.01) were performed using the Statistic for the Windows Operating System (1999).

Results and Discussion

Nutrient composition, viscosity, and physical characteristics of the wheat varieties collected from Thrace Region was presented in Table 1. Dry matter and crude ash content of the wheat varieties of Thrace region (Kirkclareli, Edirne, Tekirdag) was 91.40% and 1.82%; 91.35% and 1.84%; 91.30% and 1.88% respectively. In this respect, however the difference among the three province was not found to be significant (P>0.05). In the case of crude protein and crude fiber significant (P<0.05, P<0.01 respectively) differences were found among the three provinces. Mean of the crude protein Kirkclareli varieties was 12.39% and crude fiber 2.93%; Edirne varieties was 13.68% and 2.88%, while the same values for Tekirdag was 15.83% and 3.27% respectively. Data concerning thousand grain weight, bushel weight significant difference among the three province (P<0.01). Numerically higher values of viscosity found in Kirkclareli (2.52 cPs) compared to Edirne and Tekirdag (2.34-2.32 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

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Table 3: Correlations between some parameters of wheat varieties from Edirne

Parameters	Dry matter, %	Crude protein, %	Crude Fiber, %	Crude Ash, %	Thousand grain weight	Hectoliter weight, kg/hl	Viscosity, cPs	pH
Dry matter, %	1	0.14	-0.33	-0.11	-0.49	0.15	0.62*	-0.82*
Crude protein, %		1	0.07	-0.32	0.01	0.45	-0.26	-0.14
Crude Fiber, %			1	-0.12	-0.13	0.14	-0.57*	0.00
Crude Ash, %				1	0.02	0.02	0.16	0.45
Thousand grain weight					1	0.16	-0.03	0.46
Hectoliter weight, kg/hl						1	0.21	-0.33
Viscosity, cPs							1	0.07
pH								1

*Correlation coefficient significant at $p < 0.05$

Table 4: Correlations between some parameters of wheat varieties from Tekirdag

Parameters	Dry matter, %	Crude protein, %	Crude Fiber, %	Ash, %	Thousand grain weight	Hectoliter weight, kg/hl	Viscosity, cPs	pH
Dry matter, %	1	0.13	0.4	-0.2	-0.79*	-0.67*	-0.67	-0.02
Crude protein, %		1	-0.35	0.11	-0.14	-0.12	0.01	0.00
Crude Fiber, %			1	0.29	-0.26	-0.1	-0.12	0.34
Ash, %				1	0.02	0.25	0.32	0.14
Thousand grain weight					1	0.87*	-0.19	-0.15
Hectoliter weight, kg/hl						1	0.17	-0.37
Viscosity, cPs							1	-0.69
pH								1

*Correlation coefficient significant at $p < 0.05$

cell wall constituents. Thousand grain weights of the varieties from Kırklareli (40.25 g) and Edirne (40.57 g) were found to be higher than those of the Tekirdag (35.50 g). Significant differences regarding the crude fiber among the three provinces 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 Thrace region (Kırklareli, Edirne, Tekirdag) was shown in Table 2, 3 and 4 respectively.

The highest positive correlation ($r = 0.87$) was found to be between thousand grain weight and hectoliter weight in the wheat varieties of Tekirdag province, while the same correlation of Kırklareli and Edirne varieties were rather low ($r = 0.29$, $r = 0.16$) and insignificant. There were significant ($P < 0.05$) correlations ($r = 0.56$) between dry matter and crude fiber; crude fiber and thousand grain weight ($r = -0.76$), crude ash and hectoliter weight ($r = -0.51$) of the Kırklareli varieties, while insignificant ($P > 0.05$) and lower same parameters of Edirne and

Tekirdag province varieties. Dry matter and pH ($r = -0.82$), crude fiber and viscosity ($r = -0.57$) of the Edirne varieties. Significant negative correlations were found between crude fiber and thousand grain weight; crude ash and hectoliter weight of wheat varieties from Kırklareli, whereas significant positive correlations were found to be, dry matter and crude fiber. Significant negative correlations were found between dry matter and pH; crude fiber and viscosity of wheat varieties from Edirne, whereas significant positive correlations were found to be, dry matter and viscosity. Significant negative correlations were found between dry matter content and thousand grain weight; dry matter and hectoliter weight of wheat varieties from Tekirdag, whereas significant positive correlations were found to be, thousand grain weight and hectoliter weight.

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 Thrace region (Kırklareli, Edirne, Tekirdag) 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 from different province when some of the physical characteristics besides their nutrient compositions are examined.

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