EVALUATION OF TEN WHEAT VARIETIES FOR TME_n, CRUDE PROTEIN AND AMINO ACID CONTENT

C.W. Mittelstaedt[1] and R.G. Teeter[2]

Story in Brief

One study utilizing 8-week old Vantress x Arbor Acre male broilers was conducted to estimate the nitrogen corrected true metabolizable energy (TME_n), crude protein and amino acid content of five soft red winter wheat varieties and five hard red winter wheat varieties. Mean TME_n values for the hard and soft wheat classifications were similar at 1513.7 and 1506.1 Kcal/lb, respectively. However, there were significant TME_n differences among individual varieties. Crude protein content was higher, with the exception of Chisholm, for the hard red winter wheats. Amino acid content expressed as a percent of total protein was similar for the two classifications.

(Key Words: Wheat, TME_n, Broiler, Protein, Amino Acids.)

Introduction

Wheat is commonly produced in Oklahoma as a cash crop for human consumption, but can also be utilized as a livestock feed. Wheat is higher in crude protein than corn or milo, possesses a higher dry matter content and contains more pounds per bushel. In addition, the lysine and methionine content of wheat averages .35 and .17% respectively, which is higher than other feed grains.

Least cost ration formulation requires feed composition data describing bioavailable nutrient content. Metabolizable energy (ME) can be expressed as either apparent (AME) or true (TME) metabolizable energy (Harris, 1966). Since Sibbald (1976) developed the TME bioassay, considerable amount of research has been conducted to determine feed TME_n values as these have the advantage of being corrected for endogenous loss.

The number of wheat varieties available for production increases each year as more are developed. In order for this increasing number of wheat varieties to be utilized efficiently as livestock feeds, they must be evaluated

[1]Graduate Assistant [2]Professor

for nutrient content. The objective of this study was to determine the bioavailable energy, crude protein and amino acid content of five wheat varieties within the hard and soft wheats.

Materials and Methods

Eighty eight 8-week post hatching Vantress x Arbor Acre male broilers were utilized in a two-period study. All birds were individually housed in 10 x 18 x 17-inch wire cages within a thermostatically controlled room maintained at 75°F under constant florescent lighting. Water was provided ad libitum throughout the assay period.

Wheat varieties (Table 1) utilized in this study classified as either soft red winter or hard red winter, were provided by the Oklahoma Wheat Commission Company. Varieties classified as soft red winter included Hart, Caldwell, Arthur, Pike and Delange while the hard red winter wheat varieties included Triumph, Chisholm, Mustang, Payne and Tam 101.

The TME_n assay was conducted according to the method of Sibbald (1986), with modifications. As suggested by Sibbald, feed was withheld for 24 hr prior to initiating the assay. However, precision feeding was performed according to Teeter et al. (1984). Feed was administered on an air dry basis at 1.5% of initial body weight. Following feed administration a harness fitted with polyethylene bag was placed on the bird to commonly collect fecal and urine excretion for 48 hr (Sibbald et al., 1986). All excreta were frozen till subsequent analysis. Several observations were discarded as result of feed regurgitation and/or bag leakage. Due to the number of discarded observations, a second period was performed in a similar fashion to increase the number of observations per treatment group.

Table 1. Nutrient composition of winter wheat varieties expressed as a percent dry matter of the feed.

Wheat variety	DM	Ash	CP	Fat	ADF
Soft Red Winter					
Hart	86.65	1.62	12.91	1.27	2.82
Caldwell	87.01	1.53	11.20	1.22	2.69
Arthur	86.46	1.60	13.87	1.53	2.37
Pike	86.81	1.71	13.32	1.16	2.68
Delange	87.87	1.62	14.19	1.04	2.72
Hard Red Winter					
Triumph	88.42	1.32	15.76	.99	3.04
Chisholm	88.38	1.49	14.07	1.17	1.19
Mustang	88.69	1.45	15.39	1.27	.67
Payne	88.44	1.90	19.13	1.33	2.74
Tam 101	88.66	1.39	15.62	1.14	.73

Wheat samples were analyzed for gross energy using a Parr 1261 calorimeter, dry matter, fat as ether extract, protein (N x 6.25), ash (Association of Official Analytical Chemists, 1970), and acid detergent fiber (Van Soest, 1962). Amino acid concentrations were determined from acid hydrolysates by ion exchange chromatography using an automatic amino acid analyzer according to the methods outlined in the manufacturer's instruction manual 121-1M-1A April 1970. All data were subjected to analysis of variance. Duncan's multiple range test was used to determine differences ($P<.05$) between means when a significant F statistic effect was indicated by the analysis of variance (Steel and Torrie, 1960).

Results and Discussion

Results of crude protein and amino acid analysis are reported in Tables 2 and 3, respectively. The hard red winter wheat varieties were higher ($P<.05$) in crude protein and amino acid content similar to Poultry NRC (1984) values. Significant variation in crude protein and amino acid content or amino acid content expressed as a percent of crude protein were evident among wheat varieties. Wheat has been reported to vary in crude protein from 9.0 to 19.3% (Biely et al., 1970). This wide variation in protein content has been ascribed to both cultivar and cultural factors. Results of this study concur with that conclusion.

True metabolizable energy values corrected to zero nitrogen balance (TME_n) for the 10 wheat varieties are presented in Table 4. No significant differences were detected due to period and values reported are therefore averaged over period. The TME_n energy values, averaged across varieties within the hard and soft classification were similar ($P=.86$) at 1513.7 and 1506.1 Kcal/lb, respectively. However, variety differences within a wheat classification were detected ($P<.05$). Within the soft red winter wheat classification TME_n was depressed ($P<.05$) for the Delange and Hart varieties. Within the hard red winter wheat classification energy values were depressed ($P<.05$) for the Mustang variety and tended to be lower ($P<.1$) with the Chisholm and Tam 101 varieties. Reported values in the literature for TME_n (Sibbald, 1986; Salmon et al., 1987; Boldaji et al., 1986; Salmon, 1984) are similar range to the values obtained within this study. However, these values are for the spring and not the winter wheat classification.

Data reported therein suggest that greater variation occurs within a wheat classification than between the overall groups. Therefore, the producer must possess nutritional information specific for the variety utilized in order to maximize its utility as a livestock feed.

Table 2. Crude protein and amino acid composition of soft red winter wheat varieties.

	Hart	Caldwell	Arthur	Pike	Delange
% Protein (DM)	12.91	11.19	13.86	13.32	14.20
AA Composition as a % of feed					
Lysine	.37(2.86)[a]	.35(3.13)	.38(2.74)	.35(2.63)	---[b]
Histidine	.28(2.17)	.24(2.14)	.28(2.02)	.25(1.88)	.31(2.18)
Arginine	.63(4.88)	.61(5.45)	.65(4.69)	.59(4.43)	.69(4.86)
Aspartic Acid	.63(4.88)	.59(5.27)	.65(4.69)	.65(4.88)	.68(4.79)
Threonine	.33(2.57)	.31(2.77)	.36(2.59)	.34(2.55)	.39(2.75)
Serine	.53(4.10)	.48(4.29)	.57(4.11)	.53(3.98)	.62(4.37)
Glutamic Acid	3.49(27.0)	2.97(26.5)	3 85(27.8)	3.67(27.5)	4.15(29.2)
Proline	1.01(7.82)	.85(7.59)	1.11(8.01)	1.02(7.66)	1.22(8.59)
Glycine	.52(4.03)	.48(4.28)	.52(3.75)	.53(3.98)	.58(4.08)
Alanine	.45(3.48)	.39(3.48)	.45(3.25)	.43(3.23)	.48(3.38)
Valine	.55(4.26)	.50(4.47)	.57(4.11)	.53(3.98)	.51(4.01)
Methionine	.21(1.63)	.19(1.69)	.22(1.59)	.11(.83)	.22(1.55)
Isoleucine	.41(3.17)	.36(3.22)	.44(3.17)	.41(3.08)	.47(3.31)
Leucine	.82(6.35)	.72(6.43)	.86(6.20)	.82(6.16)	.92(6.48)
Tyrosine	.40(3.10)	.34(3.04)	.40(2.89)	.39(2.93)	.42(2.96)
Phenylalanine	.52(4.03)	.46(4.11)	.58(4.18)	.56(4.10)	.64(4.51)

[a]Numbers in parentheses represent amino acid concentrations as a % of the feed protein (DM basis).
[b]Value was not detected.

Table 3. Crude protein and amino acid composition of hard red winter wheat varieties.

	Triumph	Chisholm	Mustang	Payne	Tam
% Protein (DM)	15.76	14.07	15.39	19.13	15.63
AA Composition as a % of feed					
Lysine	.41(2.60)[a]	.40(2.84)	.36(2.34)	.49(2.56)	.34(2.17)
Histidine	.34(2.16)	.31(2.20)	.31(2.01)	.42(2.20)	.34(2.17)
Arginine	.75(4.76)	.70(4.97)	.64(4.16)	.92(4.81)	.74(4.73)
Aspartic Acid	.79(5.01)	.70(4.97)	.77(5.00)	.94(4.92)	.70(4.48)
Threonine	.41(2.60)	.35(2.49)	.40(2.60)	.47(2.46)	.37(2.37)
Serine	.65(4.12)	.60(4.26)	.65(4.22)	.89(4.65)	.62(3.97)
Glutamic Acid	4.65(29.5)	4.14(29.4)	5 08(33.0)	6.36(33.3)	4.50(28.8)
Proline	1.41(8.95)	1.12(7.96)	1.51(9.81)	1.67(8.73)	1.19(7.61)
Glycine	.62(3.93)	.54(3.84)	.58(3.77)	.75(3.92)	.58(3.71)
Alanine	.51(3.24)	.45(3.20)	.45(2.92)	.61(3.19)	.44(2.81)
Valine	.61(3.87)	.55(3.91)	.52(3.38)	.79(4.13)	.58(3.71)
Methionine	.25(1.59)	.20(1.42)	.18(1.17)	.27(1.41)	.20(1.28)
Isoleucine	.51(3.24)	.48(3.41)	.48(3.12)	.66(3.45)	.50(3.20)
Leucine	1.01(6.41)	.93(6.61)	.93(6.04)	1.30(6.80)	.98(6.27)
Tyrosine	.47(2.98)	.42(2.98)	.45(2.92)	.65(3.46)	.47(3.01)
Phenylalanine	.69(4.38)	.62(4.41)	.63(4.09)	.92(4.81)	.66(4.22)

[a]Numbers in parentheses represent amino acid concentrations as a % of the feed protein (DM basis).

Table 4. True metabolizable energy (TME) and N-corrected true metabolizable energy (TMEn) of different varieties of wheat.

Wheat variety	TME_n (Kcal/lb)	Standard Error[a] LMS
<u>Soft Red Winter</u>		
Caldwell	1595.1	56.4
Pike	1595.1	57.5
Arthur	1551.7	61.8
Hart	1388.9	48.8
Delange	1334.6	86.8
Mean value of Soft Red Winter	1506.1	29.5
<u>Hard Red Winter</u>		
Payne	1616.8	67.3
Triumph	1551.7	64.0
Tam 101	1508.3	90.1
Chisholm	1497.4	57.5
Mustang	1388.9	67.3
Mean value of Hard Red Winter	1513.7	32.7

[a]Standard error least squares means.

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