

The composition and nutritive value of naked oat grain (*Avena sativa* var. *nuda*)

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ABSTRACT

The chemical and amino acid composition and energy value of grain of the naked oat cultivars Akt and STH 296 were determined. Lysine was the amino acid limiting the nutritional value of protein (CS) in both cultivars. EAAI and the total amino acid content in protein were higher in cv. Akt than in STH 296. The concentration of metabolizable energy (for pigs) was high and equaled 17.4 and 17.8 MJ/kg DM in STH 296 and Akt, respectively.

KEY WORDS: naked oat, chemical composition, nutritive value, metabolizable energy

INTRODUCTION

Thanks to its high energy and protein concentration, naked oat can be used in diets for growing and fattening animals (Brand et al., 1996; Barneveld et al., 1998). It may even be possible that replacing imported maize with domestically grown naked oat is more economical.

The objective of this study was to determine the nutritive value of two cultivars of naked oat on the basis of their nutrient content and amino acid composition.

MATERIAL AND METHODS

Grain from two cultivars of naked oat, Akt and STH 296, obtained from the Experimental Station of Plant Breeding and Acclimatization Institute Strzelce from the 1998 harvest was studied. The chemical composition of the grain was deter-

mined using conventional methods (Skulmowski, 1974). The sugar content in the grain was determined according to Polish Standard PN-94-R-64784, starch, according to PN-94-R-64785. The amino acid composition of protein, with the exception of methionine and tryptophan, was assayed following hydrolysis of samples in 6 N HCl using a Czech AAAT 339M amino acid analyzer. In order to determine methionine and tryptophan, a feed sample was enzymatically hydrolyzed (papain). Methionine was determined using the colorimetric method given by Pawlik (1972), tryptophan was determined on the basis of a reaction with p-dimethylaminobenzaldehyde according to Lombard (Skibniewska et al., 1970). The amino acid composition of protein was used to assess its nutritive value by chemical means on the basis of the essential amino acid index (EAAI-Index) and the limiting amino acid index (CS-Chemical Score) in comparison with the FAO/WHO/UNU standard (1985).

Metabolizable energy was calculated using the equation given by Hoffmann and Schiemann with the modifications introduced by Müller and Kirchgessner (Nutrient Requirements of Pigs, 1993).

RESULTS

The results are presented in Tables 1 and 2. The grain of naked oat cv. Akt contained less crude fibre in comparison with STH 296 (21.4 vs 42.2 g/kg DM), more easily digestible carbohydrates, starch, (608 vs 593 g/kg DM) and sugar (31 vs 28 g/kg DM) and more crude protein (161 vs 145 g/kg DM). Cv. Akt grain also contained more crude ash and ether extract (25 vs 18.5 and 96.6 vs 88.5 g/kg DM). The nutritive value of protein based on the amino acid composition of

TABLE 1

Chemical composition of naked oat

Components	STH 296		Akt	
	g/kg grain	g/kg dry matter	g/kg grain	g/kg dry matter
Dry matter	912.3	1000	907.6	1000
Ash	16.9	18.5	22.6	24.9
Protein	132.7	145.5	146.5	161.4
Ether extract	80.7	88.5	87.7	96.6
Fibre	38.5	42.2	19.4	21.4
NFE	643.8	705.6	631.4	695.7
Carbohydrates	25.6	28.1	28.0	30.9
Starch	540.8	592.7	551.5	607.7
Metabolizable energy, MJ	15.83	17.4	16.2	17.8

TABLE 2

Composition of amino acids and nutritive value of naked oat

Item	Naked oat			
	STH 296		Akt	
	g/kg grain	g/16 g N	g/kg grain	g/16 g N
Lys	5.44	4.10	6.80	4.64
Met	2.07	1.56	2.12	1.45
Cys	3.12	2.35	2.90	1.98
Met + Cys	5.19	3.91	5.02	3.43
Thr	4.55	3.43	5.28	3.60
Ile	4.75	3.58	5.88	4.01
Trp	1.50	1.13	1.50	1.02
Val	6.83	5.15	8.18	5.58
Leu	8.53	6.43	10.51	7.17
His	3.16	2.38	3.82	2.61
Arg	8.32	6.27	10.54	7.19
Phe	6.43	4.85	7.78	5.31
Tyr	3.08	2.32	3.89	2.66
ΣEAA	46.30	34.89	54.84	37.43
ΣAA	118.39	89.22	139.88	95.48
CS	Lys		Lys	
	40.3		43.3	
EAAI	72.3		74.9	

amino acids ratio - lysine: methionine+ cystine: threonine: tryptophan

STH 296: 100: 95:84:28

Akt : 100: 74: 78:22

naked oat varieties is presented in Table 2. In both cultivars, the limiting amino acid was lysine, followed by isoleucine and methionine and cystine. The EAAI and CS for naked oats cv. Akt and STH 296 are 74.9 and 72.3 and 43.3 and 40.3 %, respectively.

When the lysine content was taken as 100, the ratios of methionine and cystine, threonine and tryptophan were 100:95:84:28, respectively, in STH 296 protein and 100:74:78:22 in protein from Akt, and were higher than required in diets for pigs (100:60:62:18). This comparison shows that the utilization of protein in feeds containing naked oat will depend mainly on lysine supplementation, which is the amino acid in which both cultivars are deficient.

The energy value of naked oat grain for pigs is high and equals 17.4 MJ/kg DM for cv. STH 296 and 17.8 MJ/kg DM for Akt (Table 1).

DISCUSSION

The determined chemical composition of both naked oat cultivars is similar to that given by Kosieradzka (1995) and Nita (1999). Eliminating the seed coat has led to substantial changes in the composition of the grain. The crude fibre content of both naked oat cultivars is much lower than in oats that have seed covers, which contain about 149 g fibre/kg DM (Maciejewicz-Ryś et al., 1985) and is similar to the values of this component in barley, wheat and maize (Petkov et al., 1999). Naked oat contains twice as much fat as oat varieties with seed coats, and maize, and 4-6 times more than other cereals. The protein content of naked oat is also higher than in the seed-coat varieties and other cereals.

Only small differences were found in the amino acid composition of protein between the compared cultivars, but in both the EAAI was substantially higher than that of barley, wheat, and maize, which is 66.1, 65.8, and 67.8, respectively (Maciejewicz-Ryś et al., 1985). Naked oat contains more lysine, threonine, phenylalanine, tyrosine, methionine and cystine than other cereals (Grela et al., 1998), and the nutritive value of its protein is higher than that of oat with seed coats, maize or wheat (Kosieradzka et al., 1995; Barneveld, 1998; Maciejewicz-Ryś and Sokół, 1999). The higher energy value of the two cultivars of naked oat than of oats with seed coats (17.4 and 17.8 vs 13.0 MJ EM/kg DM; Petkov et al., 1999) is mainly the result of their lower fibre and higher fat contents.

CONCLUSIONS

The chemical and amino acid composition of naked oat grain points to its high nutritive value for monogastric animals.

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STRESZCZENIE

Skład i wartość odżywcza ziarna owsa nagiego (*Avena sativa* var. *nuda*)

Oznaczono skład chemiczny i aminokwasowy oraz obliczono wartość energetyczną ziarna owsa nagiego odmian Akt i STH 296. Aminokwasem ograniczającym wartość odżywczą białka (CS) obydwóch odmian była lizyna. Wskaźnik EAAI oraz suma aminokwasów w białku były wyższe u odmiany Akt niż STH 296. Koncentracja energii metabolicznej (dla świń) była wysoka i wynosiła odpowiednio 17.4 i 17.8 MJ/kg s.m. u odmiany STH 296 i Akt.