



THE USE OF SELECTED TRITICALE AND RYE VARIETIES IN RABBIT DIETS: EFFECT ON GROWTH PERFORMANCE, DIGESTIBILITY AND BALANCE OF NUTRIENTS

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ABSTRACT

Objective of this work was to compare the quality of two types of cereals. Grains of rye (*Secale cereale L.*) variety Fernando, and triticale (*Tritico secale*) variety Kendo were tested for their suitability for nutrition of monogastric animals. The subjects of biological testing were complete feed mixtures with 22.5% portion of those cereals. The tests were performed with broiler rabbits. Other components in the feed mixture had the same quality. Both complete feed mixtures were different in average content of individual nutrients. Higher content of crude protein, crude fibre and lower content of fat and nitrogen free extract in triticale variety Kendo increased the value of digestible and metabolizable energy in the mixture. Significant differences were in digestibility of dry matter, fat, organic matter ($P < 0.05$) and neutral detergent fibre ($P < 0.01$) in mixture with rye. Results of balance experiment for nitrogen, calcium and phosphorus were similar for both tested cereals (% of retention for rye N 68.12%; Ca 81.6%; P 60.1%, and for triticale N 68.12%; Ca 81.9%; P 69.7%, resp.). With regard to average content of nutrients. There is recommend for practical utilization of mixture containing triticale and rye for the finishing phase of fattening in broiler rabbits. The nutrients composition of mixture with rye or triticale (crude protein 170 - 175 g,

fat 18 - 26 g, fibre 154 - 158 g, starch 161 g and metabolizable energy 9.4 – 9.7 MJ. kg⁻¹) are also preferable from a physiological point of view of rabbits.

Keywords: Rabbits, rye, triticale, feed mixtures, digestibility of nutrients

INTRODUCTION

Nowadays this problem is quite urgent, as in the diets of non-ruminant animals the portion of such raw materials as wheat, rye, triticale i.e. crops, which have along with their good nutrient qualities some negative factors, is going on to increase. Potential of triticale in feeding of non-ruminant animals is noticed by the organism in full, due to the presence of non-starch polysaccharides, to which, first of all, belong pentosans, most part of which from arabinoxylans (**Draganov et al., 2010; Kairov et al., 2010; Kuprijanov et al., 2007**). This limits the utilization of these crops in feeding, and especially during intensive growth and fattening period (**Semenov et al., 2009**). Rye is second only to wheat for flour production. As feed, rye is not relished by livestock, so rye grain is usually fed in mixtures with other cereals. The negative effects of the NSPs on the utilization of rye-based diets can be overcome to a considerable degree by adding crude-enzyme preparations with endo-xylanase activity (**Chrenková et al., 2004; Rakowska et al., 1992; Rakowska, 1994; Petterson and Aman, 1988; Tor-Agbidye et al., 1992**).

The aim of the study was to determine selected chemical parameters and compare the quality of two grains rye (*Secale cereale L.*) variety Fernando, and triticale (*Triticum secale*) variety Kendo from the viewpoint of their suitability for nutrition of monogastric animals.

MATERIAL AND METHODS

A total of 56 weaned rabbits (35th day of age, male sex, Hycole hybrid, housed individually in cages) were divided into 2 experimental groups.

The rabbits in the 1st group were fed granulated mixture including 22.5 % triticale variety Kendo. The rabbits in the 2nd group were fed granulated mixture including 22.5 % rye variety Fernando.

The experiment lasted for 32 days. Rabbits were kept in standard cages (0.61 m x 0.34 m x 0.33 m) 2 animals per cage. Body weight and feed consumption were registered

weekly. In fattening experiment were studied the growth of live weight and consumption of feed mixtures per unit of live weight growth. Between 65 and 70 days of age, 5 rabbits from each group were selected for digestibility tests using the balance method. The digestibility test was performed in accordance with the recommended methodology (Meartens and Lebas, 1989). The samples of individual feeds were analyzed for content of nutrients according to procedures of the AOAC (1990), and starch according to the alpha-amylglucosidase method. Metabolizable energy content was calculated by the equation of Wiseman et al., (1992). Rabbits were fed *ad libitum* and they had free access to drinking water from nipple drinkers during the experiment. The diet formulation (complete granulated mixture, pellets of 3 mm diameter) for all groups is presented in Table 1. Data were treated by the one-way ANOVA. The means and standard deviation (SD) of the generated data per group were determined. For the subsequent statistical analysis the data were examined for significant differences using the Tukey-test.

RESULTS AND DISCUSSION

Differences in average content of individual nutrients were noticed not only in varieties of rye and triticale but also in complete feed mixtures. Higher content of crude protein, crude fibre and lower content of fat and nitrogen free extract in triticale variety Kendo increased the value of digestible and metabolizable energy in mixture (Tab 1).

Table 1 Content of nutrients and energy value in experimental mixtures, and triticale and rye in original matter (in g)

Item	Chemical analysis (g.kg ⁻¹)		Chemical analysis (g.kg ⁻¹)	
	mixture with included 22.5 % of triticale variety Kendo	mixture with included 22.5 % of rye Fernando	of the grain Triticale variety Kendo	of the grain Rye variety Fernando
(n=4)	\bar{x}	\bar{x}	\bar{x}	\bar{x}
Dry matter	906.32	897.85	866.18	869.49
Crude protein	174.8	170.45	130.35	104.81
Fat	21.42	18.10	14.28	19.18
Crude fibre	154.37	157.68	31.54	24.55
Nitrogen-free extract	488.86	485.33	669.82	702.02
Ash	66.86	66.29	20.18	18.93
Organic matter	839.46	831.56	846.00	850.56
Calcium	11.11	10.51	0.73	0.49

Phosphorus	3.67	4.25	2.72	2.17
¹ ADF	172.42	169.65	3.75	2.75
² NDF	304.74	293.4	1.15	3.13
³ DE (MJ.kg ⁻¹)	10.24	9.92	12.03	12.08
⁴ ME (MJ.kg ⁻¹)	9.73	9.43	11.43	11.47

¹Acid-detergent fibre, ² Neutral-detergent fibre, ³ Digestible energy, ⁴Metabolizable energy

Significant differences were in digestibility of dry matter, fat, organic matter (P<0.05) and neutral detergent fibre (P<0.01) in mixture containing rye (Tab 2). Results of balance for nitrogen, calcium and phosphorus (% of retention N 68.12%; Ca 81.6%; P 60.1%; Mg 82.8%; Na 87.3% with feeding the feed mixture containing triticale compared with N 68.12%; Ca 81.9%; P 69.7%; Mg 78.7%; Na 88.87% retained at feeding the feed mixture with rye) confirmed the efficiency in nutrition of rabbits up to 56th day of age (Tab 3a and Tab 3b). With regard to average content of nutrients (crude protein 170 - 175 g, fat 18 - 26 g, fibre 154 - 158 g, starch 161 g and metabolizable energy 9.4 – 9.7 MJ. kg⁻¹) we recommend practical utilization of mixture containing triticale and rye for the finishing phase of fattening in broiler rabbits. This composition of nutrients in mixture suits better also the physiological demands of breeding rabbits.

Table 2 Digestibility of nutrients in feed mixtures in %

Nutrients	Mixture with included 22.5 % of triticale variety Kendo	Mixture with included 22.5 % of rye variety Fernando
(n=4)	$\bar{x} \pm SD$	$\bar{x} \pm SD$
Dry matter	61.01 ± 0.76	63.33 ± 1.49 +
Crude protein	68.12 ± 2.16	72.60 ± 2.34+
Fat	64.04 ± 3.71	70.27 ± 2.74+
Crude fibre	19.64 ± 0.76	19.35 ± 2.21
Nitrogen-free extract	73.07 ± 1.11	74.76 ± 1.42
Ash	51.94 ± 3.66	54.85 ± 1.67
Organic matter	61.73 ± 0.94	64.01 ± 1.56+
Calcium	81.63 ± 3.12	81.92 ± 2.35
Phosphorus	60.08 ± 2.81	69.67 ± 3.20+
¹ ADF	13.31 ± 1.12	20.92 ± 3.96++
² NDF	28.52 ± 1.57	32.39 ± 1.71+

+P < 0.05; ++P < 0.01- significant differences; ¹Acid-detergent fibre; ² Neutral-detergent fibre

Table 3a Balance of dry mater and nitrogen and mineral substances in growing rabbits

Parameter	Dry matter	N	Ca	P	Mg	Na
Intake of nutrients in g/day	149.41	4.60	1.75	0.71	0.42	0.29
Nutrients excreted by: (Mixture with included 22.5 % triticale variety Kendo)						
Droppings g/day	58.36	1.45	0.32	0.28	0.07	0.04
Urine g/day	9.60	1.70	0.06	0.09	0.02	0.01
Total g/day	67.96	3.15	0.38	0.37	0.09	0.05
Retained nutrients						
g out received	81.45	1.45	1.37	0.34	0.33	0.24
% out of received	54.51	32.0	78.0	48.0	79.0	83.0
% out of digested,	89.0	47.0	96.0	81.0	94.0	96.0
Digested nutrients g/day						
g/day	91.05	3.09	1.43	0.42	0.35	0.25
%	61.01	68.12	81.63	60.08	82.81	87.33

Table 3b Balance of dry mater and nitrogen and mineral substances in growing rabbits

Parameter	Dry matter	N	Ca	P	Mg	Na
Intake of nutrients in g/day	152.28	4.70	1.85	0.93	0.44	0.29
Nutrients excreted by: (Mixture with included 22.5 % of rye variety Fernando)						
Droppings g/day	55.93	1.29	0.33	0.28	0.09	0.03
Urine g/day	9.60	1.30	0.04	0.15	0.02	0.01
Total g/day	65.53	2.59	0.37	0.43	0.11	0.04
Retained nutrients						
g out received	86.75	2.11	1.48	0.50	0.33	0.25
% out of received	57.0	45.0	80.0	54.0	75.0	86.0
% out of digested,	90.0	62.0	98.0	77.0	94.0	96.0
Digested nutrients						
g/day	96.35	3.41	1.51	0.65	0.35	0.26
%	63.33	68.12	81.92	69.67	78.69	88.87

Table 4 Zootechnical parameters

Parameter (n=56)	Feed mixture with included of triticale variety Kendo		Feed mixture with included of rye variety Fernando	
	Live weight (g) $(\bar{x} \pm SD)$	Weight daily gain (g/d)	Live weight (g) $(\bar{x} \pm SD)$	Weight daily gain (g/d)
Day 45	1444±63	26.4	1454±57	24.8
Day 49	1556±124	26.8	1619±146	30.9
Day 56	1743±146	39.5	1835±144	32.9
Day 63	2020±174	38.7	2065±202	40.9
Day 70	2290±188	26.9	2352±215	30.4
Day 77	2436±185	32.9	2459±136	28.9
Daily food intake	125 (g/d)		151(g/d)	

Age after 2500g live weight	77.80 d	75.63 d
Mortality	(7 %)	(3.5 %)

Table 5 Microbiological parameters in feed and faeces of rabbits

Bacterial groups (CFU/g)	Bacterial counts	Bacterial counts in faeces of rabbits	
	in feed mixture	fed diet containing 22.5 % triticale	fed diet containing 22.5 % rye
Escherichia coli	3.0×10^2	0	10×10^4
Enterococci	1.0×10^4	7.0×10^2	2.4×10^3
CNS (coagulase-negative staphylococci)	2.0×10^4	2.0×10^5	2.0×10^5
Staphylococcus aureus	4.0×10^2	1.0×10^3	1.0×10^2
Pseudomonas sp.	100×10^1	0	0
Amylolytic streptococci	1.1×10^7	1.1×10^7	3.0×10^5

CONCLUSION

Feeding of triticale and rye to rabbits did not influence zootechnical parameters, as well as it had no negative effect on growth performance and did not influence negatively the health status of rabbits; summary of this efficiency improving is showed in Table 4. It had no negative effect on influence of body weight as well. Counts of amylolytic streptococci were high (Table 5).

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