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EFFECT OF SORGHUM ON METABOLIC PROFILE OF MUSCOVY AND COMMON DUCKS (*CAIRINA MOSCHATA* L. AND *ANAS PLATYRHYNCHOS* L.)

EFFETTO DELL'INTRODUZIONE DELLA FARINA DI SORGO NEL MANGIME SUL PROFILO METABOLICO DELLE ANATRE MUSCHIATE (*CAIRINA MOSCHATA* L.) E COMUNI (*ANAS PLATYRHYNCHOS* L.)

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SUMMARY

Metabolic profiles were monitored in 24 muscovy duck males and 24 common duck females at 35 days and at the characteristic slaughtering age for each species (57 days and 78 days for common duck and muscovy duck, respectively). Both species of ducks were differently fed (diet C: a commercial diet, maize-soya based; diet A: maize replaced by low tannin sorghum; diet B: maize replaced by a mixture of low and high tannin sorghum, 50%+50%). Results show that glucose, tryglicerides, and albumine are higher while total proteins are lower in common ducks fed the diets containing sorghum. Glucose level, cholesterol, and free fatty acids are lower in muscovy ducks fed the diets containing sorghum. The different trend observed confirms the big differences between the digestive ability of muscovy and common ducks.

Key words: Metabolic profiles, duck, sorghum, plasma

RIASSUNTO

È stato rilevato il profilo metabolico di 24 maschi di anatra muschiata e 24 femmine di anatra comune a 35 giorni e alla caratteristica età di macellazione delle due specie (57 giorni per le anatre comuni e 78 giorni per le anatre muschiate). Entrambe le specie di anatra sono state alimentate *ad libitum* con tre diverse diete, un controllo, nel quale il cereale base era rappresentato da mais e due trattati, nei quali il mais era sostituito completamente da una varietà bianca di sorgo (**lts** - a basso contenuto di tannino) o da una miscela (50%+50%) di sorgo rosso (**hts** - ad alto contenuto di tannino) e sorgo bianco (**lts** - a basso contenuto di tannino).

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I risultati hanno mostrato che, nelle anatre comuni, la glicemia, la trigliceridemia e l'albuminemia sono significativamente più alte nei soggetti alimentati con le diete contenenti sorgo rispetto ai soggetti alimentati con la dieta di controllo mentre, nelle anatre muschiate, la glicemia, la colesterolemia e il livello degli acidi grassi liberi sono più bassi nelle anatre alimentate con sorgo rispetto ai soggetti alimentati con la dieta di controllo. La differenziazione fra i parametri ematici nonchè il differente andamento fatto osservare nelle due specie ha confermato la notevole diversità delle due anatre in termini di capacità digestivo metaboliche.

Parole chiave: anatre, profilo metabolico, plasma, sorgo, alimentazione

INTRODUCTION

Sorghum is the most resisting cereal to fault of water, it grows during the hot season and it can survive to dry periods giving good productions. For these reasons sorghum is one of the most important cereal for the semi-arid areas of the tropics and sub-tropics. A great number of researchers studied the nutritional features of the different cultivars of sorghum as a possible substitute of corn in poultry and, particularly, in duck feeding (Gualtieri and Rapaccini, 1990; Lucbert and Castaing, 1986; Elkin et al., 1978, 1990; Rostagno et al., 1973). Low tannin sorghum cultivars can be used in poultry feeding giving similar results to corn but diets with high tannin sorghum cultivars (bird resistant sorghum varieties) give comparable growth rates and feed conversion efficiencies to the corn based diets only if the sorghum based diets are supplemented with synthetic aminoacids to reduce the anti-nutritional effects related to the tannin content of the bird resistant sorghum varieties (Paci et al., 1995).

Since the metabolic profile is one of the most accurate technique to test the fitness of diets (Bagliacca et al., 1994), the purpose of present study was to evaluate the metabolic profiles of ducks (muscovy and common) fed, in the starter-grower period and in the finisher period, with diets based on corn or on low tannin sorghum or on a mixture of low and high tannin sorghum supplemented with synthetic amino acids.

MATERIAL AND METHODS

The experiment was carried out during spring: 132 Muscovy ducks

males and 225 Common ducks females were reared in small pens. All the ducks, belonging from Italian strains not selected for growth speed, were reared inside a window-less poultry house from hatch to 28 days old (day-light: 23L:1D) then transferred to open air pens for the finisher period. Three experimental diets were used. The diets, always distributed *ad libitum*, were characterised by the different cereal base as follows:

	Starter grower period	Finisher period
diet C	corn 70%	corn 76%
diet A	low tannin sorghum 69%	low tannin sorghum 75%
diet B	36% l.t.s. + 36% high t.s. with synthetic aminoacids	38% l.t.s. + 38% high t.s. with synthetic aminoacids

36 muscovy ducks males and 36 Common ducks females were randomly chosen within the rearing groups and wing and leg tagged, to be recognisable for blood drawing. Plasma samples (Li-eparine), were drawn at 28, 57 and 78 days and analysis of glucose, cholesterol, triglycerides, free fatty acids, total protein, albumine, uric acid, alkaline phosphatase, ALT, AST, Ca, P, and Mg were performed according to the standard methods within 1-6 hours from collection (Bagliacca et al., 1996). Data were analysed by variance analysis to test the effect of diets within the different category of ducks (Wilkinson, 1988).

RESULTS

No significative lack of growth with the diets containing low tannin sorghum or the mixture of low and high tannin sorghum was observed in respect to the corn based diets, as control. The avg. productive performances of all the ducks reared (both muscovy or common) were the follows (Paci et al., 1995):

	Muscovy ducks			Common ducks		
diet C =	LW 3453	FC 152	FCE 3.5	LW 1962	FC 125	FCE 3.7
diet A =	LW 3414	FC 149	FCE 3.4	LW 1976	FC 121	FCE 3.5
diet B =	LW 3354	FC 148	FCE 3.5	LW 2076	FC 121	FCE 3.3

LW = live weight(g); FC = feed cons.(g/day); FCE = feed conv. eff.

The best performance were reached by common ducks fed the diets containing the mixture of low and high tannin sorghum supplemented with synthetic amino acids.

The serum levels of the different metabolites (Avg±St.d.), measured at 28 days and at the slaughtering ages, are shown in table 1 and 2 for common and muscovy ducks, respectively.

Results show that at 28 days of age, cholesterol, albumine, calcium and AST levels are lower while triglycerides, and phosphorus levels are higher in common ducks fed with the diets containing sorghum. The lowest value of alkaline phosphatase and magnesium were observed in the ducks fed with the diet containing the low tannin content sorghum.

At slaughtering age (57 days), total protein and alkaline phosphatase level were lower while glucose, triglycerides, albumine, calcium, and AST levels were higher in ducks fed with the diets containing sorghum. The highest value for free fatty acids and phosphorus and the lowest value for ALT were observed in the ducks fed with the diet containing the low tannin content sorghum. Glucose, cholesterol, free fatty acids, albumine and ALT showed a tendency to decrease with age while triglycerides, total protein, uric acid, calcium, and phosphorus levels showed a tendency to increase with age.

In muscovy ducks the chemical analysis carried out on plasma samples drawn from 28 days old ducklings showed higher values of albumine, ALT, and AST, and lower values of cholesterol and calcium, in plasma samples obtained from the ducks fed with the diets containing sorghum. The highest value of alkaline phosphatase was observed in the ducks fed with the diet containing sorghum with the low tannin content. At slaughtering age (78 days), glucose and magnesium levels were lower while free fatty acids and phosphorus levels were higher in ducks fed with the diets containing sorghum. The lowest value for cholesterol was observed in the ducks fed with the diet containing the low tannin sorghum. Glucose, cholesterol, free fatty acids, albumine, and AST showed a tendency to decrease with age while uric acid, phosphorus, magnesium, and alkaline phosphatase showed a tendency to increase with age.

CONCLUSIONS

The trial carried out give an experimental contribution to the knowledge of the metabolic profiles of ducks fed maize or sorghum based diets. As regards the effect of the diets on metabolic profiles, the different trend of the results observed in muscovy and common ducks do not allow

to reject the hypothesis obtained in the performance test, which showed the equivalence of the nutritive value in the diets based on corn, low tannin sorghum, or low + high tannin sorghum supplemented with synthetic aminoacids. The dietary addition of aminoacids, linked with the use of the mixture of low and high tannin sorghum, reduced the gap due to the anti nutritional factors contained in sorghum. For this reason the hematic metabolites in the ducks fed the mixture of sorghum were more similar to that one in the ducks fed with the control diets than that one in the ducks fed with the diets containing low tannin sorghum. The dietary addition of aminoacids seems to improve the productive efficiency of common ducks.

Neverthless the use of high tannin sorghum should be limited on account of the anti-nutritional effects related to its tannin content and can be used on condition that aminoacids integration is carried out.

Table 1 - Hematic parameters of common ducks fed different diets

Hematic parameters	Age days	Common duck female diet C		diet A		diet B	
Glucose	28	10.2	± .76	10.8	± 1.87	10.5	± 1.36
mmol/l	57	9.1 b	± .66	9.5 a	± .48	9.9 a	± .83
Cholesterol	28	7.0 a	± 1.61	6.1 b	± .60	6.6 ab	± 1.23
mmol/l	57	5.1	± .82	4.9	± .57	4.9	± .59
Triglycerides	28	1.1 b	± .62	1.6 a	± .79	1.8 a	± .58
mmol/l	57	1.8 b	± .58	2.6 a	± .77	2.0 b	± .56
NEFA	28	1057	± 271	1131	± 252	1198	± 359
µEq/l	57	843 b	± 234	994 a	± 227	647 c	± 167
Total protein	28	43.0	± 6.21	41.2	± 5.71	40.3	± 6.44
g/l	57	48.5 a	± 4.81	46.6 ab	± 5.98	44.1 b	± 4.04
Albumine	28	380 a	± 69	360 ab	± 75	328 b	± 47
µmol/l	57	178 b	± 18	192 a	± 18	182 ab	± 26
Uric Acid	28	287	± 131	293	± 191	304	± 147
µmol/l	57	312	± 119	338	± 128	309	± 100
Ca	28	2.61 a	± .184	2.48 b	± .247	2.46 b	± .187
mmol/l	57	2.75 b	± .145	2.79 b	± .158	2.84 a	± .132
P	28	2.19 b	± .206	2.53 a	± .275	2.24 b	± .223
mmol/l	57	2.58 b	± .302	2.85 a	± .293	2.59 b	± .246
Mg	28	.37 b	± .068	.34 c	± .039	.42 a	± .072
mEq/l	57	.41	± .022	.40	± .040	.41	± .021
Alc.Phosphatase	28	655 b	± 88	597 c	± 91	720 a	± 76
m/ml	57	696 a	± 85	680 ab	± 80	645 b	± 84
ALT	28	26.8	±13.75	22.8	± 8.92	24.5	± 7.78
mU/ml	57	16.1 ab	± 2.82	14.8 b	± 3.18	17.9 a	± 6.84
AST	28	22.5 a	± 6.10	20.2 ab	± 9.31	15.9 b	± 5.07
mU/ml	57	15.0 b	± 2.30	15.9 ab	± 2.29	16.8 a	± 3.58

Means bearing different letters differ (P<.05)

Table 2 Hematic parameters of muscovy ducks fed different diets

Hematic parameters	Age days	Muscovy duck males					
		diet C		diet A		diet B	
Glucose	28	12.3	± 1.74	12.2	± 1.05	12.2	± 1.67
mmol/l	78	11.5 a	± .59	11.3 ab	± 1.55	11.0 b	± .63
Cholesterol	28	5.5 b	± 1.12	5.6 b	± 136	6.6 a	± 1.40
mmol/l	78	4.1 a	± .67	3.4 b	± .46	4.0 a	± .81
Triglycerides	28	1.7	± 1.08	1.7	± .69	2.1	± 1.00
mmol/l	78	1.7	± .64	1.9	± .63	1.6	± .50
NEFA	28	996	± 308	965	± 257	1084	± 251
µEq/l	78	515 a	± 61	465 b	± 72	496 ab	± 125
Total protein	28	37.5	± 6.65	36.2	± 3.33	34.8	± 5.74
g/l	78	36.8	± 3.41	37.2	± 4.67	36.5	± 5.30
Albumine	28	293 b	± 43	308 ab	± 50	325 a	± 55
µmol/l	78	192	± 40	189	± 26	196	± 26
Uric Acid	28	155	± 79	164	± 58	169	± 65
µmol/l	78	184	± 58	198	± 44	192	± 82
Ca	28	2.30 a	± .200	2.19 b	± .128	2.17 b	± .183
mmol/l	78	2.27	± .255	2.36	± .236	2.27	± .280
P	28	2.73	± .240	2.75	± .215	2.70	± .227
mmol/l	78	2.76 b	± .228	2.88 a	± .160	2.78 ab	± .179
Mg	28	.35	± .046	.37	± .070	.34	± .048
mEq/l	78	.44 a	± .044	.38 b	± .023	.39 b	± .041
Alc.Phosphatase	28	490 ab	± 108	522 a	± 81	478 b	± 58
m/ml	78	597	± 73	609	± 94	616	± 106
ALT	28	16.4 b	± 4.72	23.1 a	±10.81	21.1 a	± 9.29
mU/ml	78	17.0	± 1.50	16.3	± 2.51	16.1	± 2.25
AST	28	13.4 b	± 3.63	17.8 a	±15.42	17.6 a	± 8.56
m/ml	78	11.7	± 1.07	11.5	± .82	11.6	± 1.19

Means bearing different letters differ (P<.05)

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