The Acorn's Tannin May Affect the Microbial Content of Broilers Ileum

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Abstract

In animal nutrition tannin is almost known as an anti-nutritive polyphenolic compound which is present in many parts of the plants and acorn as well. On the other hand polyphenolic compounds are considered as anti-bacterial substances which protect the plants and also affect the microbial growth. Oak fruit (acorn) contains 5-7% tannin and considerable amounts of carbohydrate and fat which could be used in animal nutrition. In a completely randomized design test (4 groups and 4 replicates) 640 one day old male broiler chicken received 0 (control), 1, 2 and 4% supplemented acorn with basal diet for 7 weeks. 1-2 gram of ileum contents of two chickens were collected weekly by central infusion of ketamine and immediate removal of ileum. Specific microbiological and biochemical experiments on these specimens revealed that microbial content is significantly ($p<0.05$) affected by age and concentration of acorn diet. Concluding that tannin content might be responsible for these adaptation and changes.

Introduction

Oak fruit (acorn) as a suitable source of energy for animal nutrition contains 3.7±0.5% condensed and 1.8±0.3% hydrolysable tannins, which introduces this material as a toxic food substance (Reed, 1995; Smith et al., 2001; Smith et al., 2003). In dry tropical regions the sources of nutrients for animals are limited and some native plants grow in different regions that one of them in Iran is oak tree which produces considerable amounts of acorn. This product is a good source of energy containing carbohydrates and fat. But its tannin content is a limiting factor. Our earlier studies (Abarghoui and Rahmani, 2001) showed supplementing the broiler diet up to 3 percent with acorn not only does not have disadvantages, but also improves performance traits in this species implying the effect on microbial content of gastrointestinal tract (GIT). Because some studies have shown tannins affect microbial population of GIT in human (Okubo et al., 1992), pig (Hara et al., 1995) chicken (Hara, 1997), and ruminants (McSweeney et al., 2000). On the other hand adaptation to high tannin nutrients has also been reported (Odenyo et al., 1997) and believing this adaptation is transferable by inoculation of microbial content from adapted animal (Miller et al., 1995; Miller et al., 1997). The present study was conducted to evaluate these effects in broilers.

Materials and Methods

In a completely randomized design test 640 one day old male Ross (308) chicken were divided into 4 groups receiving 0 (control), 1, 2 and 4% acorn supplement in corn-soybean meal basal diet (isocaloric) with 4 replicates and 40 chicken per replicate. Chicken were kept under Ross recommended conditions and immunized with Newcastle, Bronchitis and Gumboro vaccines routinely, and no antibiotics were used at all over 7 weeks of production. Every week 2 chicken of each replicate were sacrificed with central injection of ketamine and immediately 1-2 gram content of ileum were collected, and kept in the ice were taken to microbiology laboratory. General and specific microbial and biochemical experiment were done on specimens and recorded data were analyzed by GLM procedure and mean±SE compared with Duncan's range test.

Results and Discussion

The results are shown in Table1. Total microorganism population starts growing from first week and gradually increases up to 4×10^{13}cfu/gr in control group. But in acorn receiving groups the growing rates are significantly ($p<0.05$) slower for total microorganism population and clostridium population. The clostridium population grows more slowly ($p<0.05$) from 2nd week, but at 7th week they are at equivalent levels. The Escherichia coli and lactobacillus population are not affected by acorn levels. In this study only the tannin content of acorn was evaluated and this phenolic compound might have affected these conditions. As earlier studies have confirmed that microbial content of different species is influenced by tannins (Okubo et al., 1992; Hara et al., 1995; Hara, 1997; McSweeney et al., 2000), and also there are reasonable evidences which have shown tannin is able to grow resistant bacteria over a short period (Odenyo et al., 1997; Miller et al., 1995; Miller et al., 1997). Now one question which seems interesting is the possibility of using natural additives such as acorn for a short period to control the microbial circumstances in the broilers GIT.

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Table 1. Effect of different levels (0, 1, 2 and 4%) of acorn on ileum microbial content (Log No/gr; Total count, T; E. coli, Ec; Lactobacillus, L; and Clostridium, Cl) of broilers at different ages (1-7 week).

Acorn (Percent)	Ileum microbial content (Log No/gr)	Week						
		1	2	3	4	5	6	7
0								
	T	6.5±0.7	8.2±2.3	9.7±2.5	12.4±2.4^{a}	12.2±3.3^{a}	12.2±2.5^{a}	12.4±2.3^{a}
	Ec	2.5±1.1	3.5±0.7	3.6±0.5	3.9±0.7	4.2±0.5	4.4±0.6	5.8±1.2
	L	3.3±0.7	3.2±0.5	3.3±0.3	3.4±0.7	5.1±0.8	4.2±0.6	3.7±0.5
	Cl	0	1.2±0.3^{a}	1.3±0.4^{a}	1.2±0.2^{a}	1.1±0.5^{a}	1.3±0.4^{a}	1.3±0.5
1								
	T	5.7±08	7.9±2.3	8.6±2.3	9.7±1.5^{ab}	8.8±2.3^{ab}	9.2±1.2^{ab}	10.3±1.6^{ab}
	Ec	2.3±0.9	2.7±0.8	3.3±0.7	3.4±0.6	4.5±0.3	4.3±0.7	4.8±0.7
	L	3.2±0.8	2.8±0.6	3.6±0.5	3.6±0.5	4.6±0.7	3.9±0.8	4.1±0.7
	Cl	0	1.1±0.2^{a}	1.1±0.2^{a}	0.9±0.2^{ab}	0.7±0.3^{ab}	1.1±0.1^{a}	1.2±0.4
2								
	T	5.8±1.2	7.2±0.8	7.6±2.5	8.3±1.2^{b}	7.6±0.6^{b}	8.2±0.5^{b}	9.5±0.4^{b}
	Ec	2.5±0.7	3.2±0.5	2.8±0.8	3.5±0.6	3.9±0.5	3.9±0.6	4.1±0.8
	L	3.5±0.6	3.1±0.3	3.4±0.5	2.9±0.6	4.2±0.7	3.7±0.7	3.5±0.6
	Cl	0	0.7±0.3^{ab}	0.5±0.3^{b}	0.6±0.2^{b}	0.6±0.2^{ab}	0.9±0.2^{a}	0.8±0.3
4								
	T	6.2±0.9	7.5±0.7	8.1±1.6	7.5±0.7^{b}	7.2±0.4^{b}	7.4±0.5^{b}	8.5±0.6^{b}
	Ec	2.6±0.3	2.1±0.6	3.1±0.4	3.1±0.4	3.4±0.6	3.5±0.4	4.2±0.5
	L	3.5±0.5	2.8±0.6	3.1±0.6	3.2±0.4	4.3±0.5	3.4±0.7	3.3±0.5
	Cl	0	0.4±0.2^{b}	0.3±0.2^{b}	0.4±0.2^{b}	0.3±0.1^{b}	0.4±0.1^{b}	0.7±0.3

Means±SEM within a column for equivalent parameters (T, Ec, L and Cl) with no common superscript differ significantly ($p<0.05$)