EFFECTS OF *SAUROPUSANDROGYNUS* (KATUK) LEAF EXTRACT ON GROWTH, FAT ACCUMULATION AND FECAL MICROORGANISMS IN BROILER CHICKENS

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(Diterima dewan redaksi 1 Juli 2001)

ABSTRACT

SANTOSO, U. E. HANDAYANI and SUHARYANTO. 2001. Effects of *Sallropus androgynus* (katuk) leaf extract on growth, fat accumulation and fecal microorganisms in broiler chickens. *Jurnal Ilmu Ternak don Veteriner* 6(4): 220-226.

A study was conducted to determine the effects of *Sauropus androgynus* leaf extract on growth, carcass quality and the number of fecal microorganisms in broiler chickens. Forty-eight male Arbor Acres broiler chickens (21-d-old) obtained from a commercial hatchery were used in the present study. Experiment consisted of four treatment groups with four pen replicates of three broilers allotted randomly to each dietary treatment from day 21-42 old. One group was the control with no additional *Sauropus androgynus* leaf extract (SAE) (P0), and other three groups were given drinking water supplemented with 1.5 g (PI), 3.0 g (P2) or 4.5 g SAE/l water (P3). The diet used was a commercial mix (Crude protein: 19% and Metabolizable Energy 3200 kcal/kg). Feed intake significantly reduced in P2 or P3 as compared with the control ($P<0.05$). A decrease in feed conversion ratio was observed in treatment groups as compared with Po ($P<0.05$). Abdominal fat, neck fat and liver fat content were significantly reduced by SAE ($P<0.05$), while carcass fat content was not significantly different. Number of fecal *Escherichia coli* in P1 or P3 ($P<0,01$) and fecal *Streptococcus sp* and *Salmonella sp.* were significantly ($P<0,01$) reduced by SAE supplementation as compared with the control, while fecal *Bacillus subtilis* in P2 and *Lactobacillus sp.* in P1 ($P<0,01$) were significantly higher as compared with other groups. SAE (P2 or P3) also significantly improved meat taste, shank color but lowered meat color ($P<0.05$) as compared with the control group. It was found that the number of fecal *Streptococcus sp* was suitable to predict abdominal fat. In conclusion, the inclusion of SAE at 4.5 g/l drinking water resulted in the best performance and carcass quality.

Key words: *Sauropus androgynus* leaf extract, fat accumulation, broilers

ABSTRAK

SANTOSO, U. E. HANDAYANI and SUHARYANTO. 2001. Pengaruh ekstrak daun katuk terhadap pertumbuhan, akumulasi lemak dan jumlah mikroba dalam feses pada broiler. *Jurnal Ilmu Ternak don Veteriner* 6(4): 220-226.

Penelitian ini bertujuan untuk mengevaluasi pengaruh ekstrak daun katuk terhadap pertumbuhan, akumulasi lemak, kualitas karkas dan jumlah mikroba dalam feses pada ayam broiler. Empat puluh delapan broiler jantan strain Arbor Acres (umur 21 hari) yang digunakan pada penelitian ini diperoleh dari penetasan komersial. Penelitian ini dirancang dengan Rancangan Acak Lengkap yang terdiri dari empat kelompok perlakuan. Masing-masing perlakuan terdiri dari empat ulangan, yang setiap ulangan berisi tiga ekor broiler. Satu kelompok sebagai kontrol yang tidak diberi ekstrak daun katuk (EDK) (Po), dan tiga kelompok lainnya diberi air minum yang disuplementasi EDK sebanyak 1,5 g (P1), 3,0 g (P2) atau 4,5 g/liter air (P3). Pakan yang digunakan dalam penelitian ini adalah pakan komersial dengan protein kasar 19% dan ME 3200 kkal/kg. Konsumsi pakan secara nyata lebih rendah pada P2 dan P3 jika dibandingkan dengan P1 ($P<0,05$). Konversi pakan pada kelompok perlakuan lebih rendah jika dibandingkan dengan Po ($P<0,05$). Lemak perut, lemak leher dan lemak hati secara nyata lebih rendah pada broiler yang diberi EDK ($P<0,05$), sementara lemak karkas tidak berbeda nyata. lumlah *Escherichia coli* feses pada P1 atau P3 ($P<0,01$) dan jumlah *Streptococcus sp* dan *Salmonella sp.* pada broiler yang diberi EDK ($P<0,01$) secara sangat nyata lebih rendah jika dibandingkan dengan kontrol. Jumlah *Bacillus subtilis* pada P2 dan *Lactobacillus sp.* pada P1 ($P<0,01$) sangat nyata lebih tinggi jika dibandingkan dengan kontrol. Suplementasi EDK (P2 atau P3) secara nyata memperbaiki rasa daging, warna shank tetapi memperburuk warna daging ($P<0,05$). Ditemukan bahwa jumlah *Streptococcus sp* feses cukup baik untuk memprediksi kadar lemak perut. Dapat disimpulkan bahwa suplementasi EDK sebesar 4,5 g/l air minum memberikan performans dan mutu karkas terbaik.

Kata kunci: Ekstrak daun katuk, akumulasi lemak, motu karkas, broiler

INTRODUCTION

Recently, some investigators have investigated traditional drugs to evaluate their effects on livestock production. These were promoted by the fact that commercial drugs are expensive, and may also have side effects that influence the health of either livestock or human. It was also known that medical herbs and their various extracts used as traditional drugs have emerged as potent natural hypocholesteremic and hypolipidemic agents, and posses insecticidal, antibacterial, anti tumor, hypoglycemia and antiatherosclerotic properties (QURESHI *et aI.,* 1983a,b; MUWALLA and N .ABUIRMEILEH, 1990*).* Many substances such as propyl-disulfide and diallyl disulfide (JAIN and VY AS, 1974), soluble and insoluble fibers (HORIGOME *et al.,* 1992), antioxidant such as catechin (MURAMATSU *et aI.,* 1986), flavonoids *(*KATO *et al.,* 1983), ascorbic acid (TURLEY *et al.,* 1976) and magnesium (RENAND *et al.,* 1983) were well documented to be a potential natural substances for preventing some abnormalities.

SATIE (1995) stated that medical herbs supplementation to the diet could improve growth characteristic of broilers, because they contain antibacterial compounds that had ability to kill destructive microorganisms in gastrointestinal tract. The improvement of microbial balance in gastrointestinal tract would improve nutrient digestion and absorption. SANTOSO and SARTINI (2001) found that S. *androgynus* leaf supplementation at 3% level resulted in lower fat accumulation with better feed efficiency but had no effect to body weight gain SANTOSO *et al.* (I 999a) found that the inclusion of S. *androgynus* extract to the diet at level of 18 g/kg diet slightly increased body weight gain with better feed efficiency. It was known that poultry would response in different manner to feed additive when it was given through diet or drinking water. Therefore, the present study was designed to evaluate effects of S. *androgynus* leaf extract (SAE) inclusion through drinking water on growth, meat quality, body temperature and fat accumulation in broiler chickens. AGUSTAL *et al.* (1997) found that the main chemical compounds in S *androgynus* leaf were monomethyl succinate, cis-2-methyl cyclopentanol acetate (ester), benzoic acid, phenyl maloic acid (carboxilic acid), 2-pyrolion, methylpyroglutamate (alkaloid). ANONYMOUS (1992) found that boiled katuk contained *9000* μg β-carotene and 66 mg vitamin C per 100 g katuk leaf. ANONYMOUS (1994) stated that katuk leaf contained saponin, flavonoid and tannin. Monomethyl succinate and cis-2-methyl acetate might be converted to succinate and acetate in gastrointestinal tract. The exogenous succinate and acetate are found as intermediate substrates in the citric acid cycle, and therefore produce more ATP and more efficient metabolism.

MATERIALS AND METHODS

S. *androgynus* leaf (waste leaf which is not consumable) was collected from the field, dried under the sun, and mixed with water. The mixture was boiled at 90°C for 20 minutes (WIJAYAKUSUMA *et aI.,* 1996), filtered, and the supernatant obtained was then dried in an oven at 55°C for 36 hours. The dried extract (Brownish and salty) was then stored in a sealed plastic bag. From one kilogram fresh katuk leaf was obtained 200 gram of extract. Katuk extract contained of *3700* kcal/kg energy, 0.28% Ca, 0.28% P and 0.58% K and 19.8% crude protein.

Forty-eight male Arbor Acres broiler chickens (21d-old) were obtained from a commercial hatchery. Broilers were housed in stainless steel battery brooders with wire-mesh floors; temperature was maintained at 32.5 C in the first week. Every 2 d, the temperature was decreased by 2 C. Additional heat was stopped at the 2nd week of age. Lighting was continuous, and feed and water were provided *ad libitum.* The experimental design consisted of four treatment groups with four pen replicates of three broilers allotted randomly to each dietary treatment from day 21-42. One group was a control with no additional *Sauropus androgynus* extract (SAE) (Po), and other three groups were given drinking water supplemented with 1.5 g (PI), 3.0 g (P2) or 4.5 g SAE/l water (P3). The diet used in this study was a commercial mix (moisture 13%, crude protein 19%, crude fat 4.5%, ash 6.5%, calcium 0.9%, phosphor 0.7%, BETN *52.0%,* ME *3200* kcal/kg and Zinc Bacitrazin). Feed intake was measured daily, whereas body weight was measured weekly. Performance data were collected for the 21-days experimental period.

At the end of the experiment, chickens were weighed individually, and feed intake was determined for each pen. On day 42, the chickens were killed by cervical dislocation. Whole intestine, abdominal fat, neck fat, liver, heart, spleen and gizzard were carefully removed, and then weighed. Carcasses (the body without head, neck, blood, feather, shank, internal organs except kidney and lungs) were determined. The fat content of carcass and liver were determined by the methods of AOAC (1980). Each sample was analyzed three times. Breast meat color was scored from white (I) to redness (5) by ID-DLO reference scale, whereas shank color was scored from less yellow (I) to very yellow (5). Leg abnormality was scored from normal (I) to very abnormal leg (5). Three days before experimental period ended, feces from each pen was collected and stored at -30nC before analysis of microorganism *(Bacillus subtilis, Streptococcus sp.,* *Escherichia coli, Salmonella sp.* and *Lactobacillus sp.)* by the methods of COLLIN *et al.* (1989).

Ten-trained sensory panelists were employed to compare the relative palatability of the meat. The leg muscles of broilers at 42 days of age were taken as soon as possible after slaughter and boiled for 15 minutes in water of 5 times meat weight. A professional cook prepared every meat for sensory evaluation. The panelists were asked to rank the taste of meat using a 5-point scale from dislike to like. The sensory evaluation was performed at room temperature.

Treatment effects were analysed for all response variables using by one-way ANOVA in which the differences between control and treatment group was represented by orthogonal contrasts single df (SHINJO, 1990). Differences were considered as statistically significant at the 5% level. Where appropriate, regression analysis was used to assess the statistical significance of the correlation between variables.

RESULTS AND DISCUSSION

As shown in Table I statistically significant differences were not seen in the weight gains and carcass weight (P>0.05) of broiler. A decrease in FCR was observed in the treatment groups as compared with control chickens (P<0.05). Feed intake was significantly lower in P2 or P3 group as compared with the control (P<0.05). Protein, calcium and phosphor intakes were not significantly different (P<0.05), whereas energy intake was significantly lower in P2 or P3 group as compared with the control (P<0.05). SAE inclusion at 3.0 or 4.5 g significantly reduced leg abnormality of broiler chickens at 42 days of age (P<0.05). No toxicity was observed.

Broiler received 4.5 g SAE/I drinking water showed the tendency of higher weight gain, and lower feed intake and feed conversion ratio. Continuous supplementing of SAE might improve the balance of microorganism in digestive tract by lowering pathogenic microorganism such as *Escherichia coli, Salmonella sp* (the present study), *Salmonella typhosa* and *Staphylococcus aureus* (ANONYMOUS, 1995), and increasing effective microorganisms such as *Lactobacillus sp* and *Bacillus subtilis.* SANTOSO *et al.* (1995) showed that increasing number of *Bacillus subtilis* resulted in improved FCR and slightly higher body weight gain. In addition, some chemical substances of SAE such as monomethyl succinate and cyclopentanol, 2-methyl-acetate, cis might be converted to succinate and acetate in gastrointestinal tract. The exogenous succinate and acetate are found as intermediate substrates in the citric acid cycle, and therefore produce more ATP and more efficient metabolism.

Previous results (SANTOSO and SARTINI, 2001) found that S. *androgynus* leaf (SAL) meal slightly reduced body weight gain. It was possible that antinutrition (e.g. tannin and crude fiber) in SAL meal was lowered during the extraction. Tannin and crude fiber are known to be detrimental to poultry. These compounds were reduced during extraction. This occurrence resulted in the balance of microorganism in broiler received SAE became better than in broilers received SAL meal. Lower leg abnormality might be caused by better digestibility of calcium and phosphor in broilers received SAE, because those intakes were not different from the control group.

No toxicity was observed (Table 1). This was confirmed by the observation on the livers. All livers that were brownish in color and normal in shape, and no morphological abnormalities or spots of discoloration were observed.

As shown in Table 2, meat taste was significantly (P<0.05) improved in chickens given 3.0 or 4.5 g SAE. Meat color of breast was significantly lowered in P2 or P3 (P<0.05). Shank color was significantly improved in chickens given 3.0 or 4.5 g (P<0.05). SAE inclusion had no effect on rectal temperature of broiler chickens (P>0.05).

A more yellow of shank color might be caused by higher l3-carotene intake. ANONYMOUS (1995) showed that S. *androgynus* leaf was rich in l3-carotene. ANONYMOUS (1992) showed that boiled katuk leaf FUJIMURA *et al.* (1995) reported that IMP, free glutamic acid and K+ are taste-active compounds in chicken meat. Sodium ion (Na+) has been reported to be taste-active compound (HAYASHI *et al.,* 1981 cited by FUJIMURA *et al.,1995).* MOODY (1983) and FARMER (1994) stated that taste compounds are non-volatile or water-soluble compounds with taste or tactile properties including inorganic salts and sodium salts of certain acids (salty), hypo-xanthine, peptides and some amino acids (bitter), sugars and some amino acids (sweet) and acids (sour). It was shown that SAE contained high in kalium. Therefore, it was possible that this substance might cause better meat taste. In addition, methylpyroglutamate might be converted to amino acid in gastrointestinal tract which may improve the taste. A reduced breast color meat may relate to lower myoglobin content in breast as a result in reduced iron availability. Therefore, in general, SAE supplementation would improve the quality of broiler carcasses. An attempt should be conducted to improve the color of breast meat when broilers were given SAE.

DJOJOSOEBAGIO (1964) found that in rabbit, SAE lowered body temperature. However, the present study showed that in broilers, SAE had no effect on body temperature.

SAE supplementation at 4.5 g reduced fat accumulation in the neck (P<0,05), abdomen (P<0,05) and liver (P<0,05) (Table 3). Carcass fat content tended to lower intreatment groups, although it was not significantly different.

Table 1. Effects *of Sauropus andro^ynus* (Katuk) leaf extract on performance characteristics of broiler chickens

Variables .	0 g SAE	1.5gSAE	3.0g SAE	4.5 g SAE	Pooled SD
Feed intake, g/bird	2.331.6	2.260.0	2.2.5	2.238.1	50.0
Protein intake, g/bird	443.0	431.0	422.0	429.4	15.1
Energy intake, kcal/bird	7.461.1	7.237.9	7.070.0*	7.178.3*	100.5
Calcium intake, g/bird	20.98	20.34	19.85	20.14	0.5
Phosphor intake, g/bird	16.32	15,82	15.44	15.67	0.4
SAE intake, g/bird 0 8.15**	0	8,15**	15.51**	22.68**	0.3
FCR	1.86	1.73*	1.72**	1.66	0.08
Water intake, ml/bird	5.658.0	5.433.6	5.170.9	5.039.6	389.9
Weight gain, g/bird[1]	1.252.5	1.306.0	1.285.5	1.353.8	40.0
Carcass weight, g/bird[2]	1235.0	1231.1	1171.9	1247.3	53.1
Leg abnormality[1]	1.3	1.2*	1.0*	1.0*	0.1
Toxicity(%)[2]	4.0	4.0	4.9	4.1	0.3

* p<0,05; ** p<0,01 between treatment group and the control
Toxicity = Spleen + liver weights/live body weight x 100%
Values reported represent for 12 chickens. Leg was scored from normal (l)tovi
Values reported represent for 6 chickens

Table 2. Effects of *Sauropus androgynus* (K-atuk) leaf extract on me chickens

Variables .	0. g SAE	1.5 g SAE	3.0 g SAE	4.5 g SAE	Pooled SD
Meal color'	3.5	3.0	2.8*	2.5*	0.5
Meat taste	1.2	1.4	2.0*	2.3*	0.3
Shank color	2.0	2.2	2.5*	3.5*	0.4
Body temperature (°C)	41.3	41.2	41.3	41.2	0.03

p<0.05: ** p<0,01 between treatment group and the control.
1 Values reported represent tor 6 chickens

Table 3. Effects *of Sauropus androgynus* (Katuk) leaf extract on fat accumulation

Site of fat accumulation	0 g SAE	1..5 g SAE	3.0 g SAE	4.5 g SAE	Pooled SD
Abdomen (%BW)'	3.10	2.40*	2.56*	2.32*	0.43
Neck(%BW)	1.02	0.83*	0.70*	0.62*	0.43
Liver (%)	4.33	3.28*	3.00*	3,11*	0,44
Carcass (%)	19.3	16.7		16.5	0.41

p<0.05: ** p0.01 between treatment group and the control.
1 Values reported represent tor 6 chickens

Table 4. Effects of *Sauropus androgynus* (Katuk) leaf extract on the number of microorganism in feces (x 109 CFU/g feces)[1]

Variables	0 g SAE	1.5 g SAE	3.0 g SAE	4.5 g SAE	Pooled SD
Escherichia coli	182.5	109.3**	170.0	119.0**	38.7
Bacillus subtilis	146.3	162.0	212.0**	143.3	29.5
Lactobacillus sp.	135.3	281.5**	171.5	178.5	56.6
Streptococcus sp.	68.3	46.3**	38.5**	31.0**	15.1
Salmonella sp.	21.8	17.0*	11.3**	10.8**	4.9

* p< 0,05; ** p< 0,01 between treatment group and the control
[1] Values reported represent for cages

Table 5. Correlation of fat accumulation and the number of microorganism in feces (Probability of ANOVA)

	E. coli	B. subtilis	Lactobacillus sp.	Streptococcus sp.	Salmonella sp.	Regression
Abdomi-nal fat	0.946ns	0.742ns	0.858ns	0.027*	0.145ns	0.068ns
r^2 partial	0.00015	0.008	0.0024	0.3024	0.1453	
Liver fat	0.22605ns	0.027*	0.767ns	0.544ns	0.99ns	0.049*
r^2 partial	0.103	0.85	0.0065	0.0269	0.0000105	

ns=non significant; * significant different at P<0,05

SAE significantly reduced *Escherichia coli* in chickens given 1.5 or 4.5 g (P<0,01), whereas *Streptococcus sp.* and *Salmonella sp.* were significantly lower by SAE (P<0,01). It increased *Bacillus subtilis* in chickens fed 3.0 g (P<0,01), and *Lactobacillus sp* was significantly increased in chickens fed 1.5 g SAE (P<0,01) (Table 4). From analysis of multiple regression, it was obtained that the equation of abdominal fat and the number of microorganism in feces was as follows: Y = 2.421 - 0.00002 XI - 0.0016 X2 - 0.0005 X3 + 0.04 X4 - 0.088 Xs; $r^2 = 0.487$, where Y was abdominal fat, and X), X2, X3, X4 and Xs was *Escherichia coli, Bacillus subtilis, Lactobacillus sp., Streptococcus sp and Salmonella sp.* This multiple correlation was statistically not significant. As shown in Table 5, there was significant positive correlation between abdominal fat and *Streptococcus sp* (P<0.05; r^2 = 0.30). The correlation of liver fat and the number of microorganism in feces was as follows: $Y = 1.32 + 0.0055 X_1 - 0.0053X_2 + 0.00082 X_3 + 0.0103 X_4 - 0.00069 X_5$ ($P < 0.05$; r^2 = 0.507). There was negative correlation between liver fat and *Bacillus subtilis* (P<0,05; r^2 = 0.85).

It was known that higher protein intake and/or lower energy intake reduced fat accumulation in broiler chickens (SANTOSO *et al.,* 1995). In the present study, however, showed that protein intake was lower as a result of lower feed intake. Therefore, higher protein intake was not the mechanism affecting fat accumulation. In addition, although energy intake tended to be lower in broiler receiving SAE, its reduction was not sufficient to reduce fat accumulation.

The balance of microorganism may partly affect fat accumulation as shown by multiple regression.

An increase in *Bacillus subtilis* may partly reduced liver fat accumulation (Table 5). *Bacillus subtilis* (SANTOSO *et al.,* 1995) can reduce hepatic acetyl-CoA carboxylase activity, the rate limiting enzyme for fatty acid synthesis. Lower hepatic fatty acid would cause lower hepatic triglyceride synthesis leading to lower hepatic and serum triglyceride concentration. It was known that lower triglyceride concentration is one factor reducing abdominal fat content. It is unknown why carcass fat content was not significantly reduced by SAE. In addition to the hepatic fatty acid, it was known that extrahepatic fatty acid synthesis had significant contribution to carcass fat content in chickens.

In addition, katuk leaf might also contain an active substances which may affect fat accumulation. The possible substances were 2-pyrolidion, methylpyroglutamate (alkaloid) and flavonoid. It was known that some alkaloid, and flavonoid (KATO *et al.,* 1983) reduced fat accumulation in poultry. Methylpyroglutamate may be converted to amino acid in gastrointestinal tract which may stimulate lean growth rather than fat growth.

A reduced pathogenic microorganism such as *Escherichia coli* and *Salmonella sp.* in feces might result in reduced those pathogenic microorganism in carcass. SANTOSO *et af.* (1999a) found that SAE resulted in lower *Escherichia coli* and *Salmonella sp.* in meat. DARISE and SULAEMAN (1997) found that SAE had ability to inhibit *Staphylococcus aureus* and *Salmonella typhosa.* It is of interest to note that *Lactobacillus sp* and *Bacillus subtilis* were increased in broilers received

1.5 g SAE/ I water. Bacillus subtilis was known to improve growth performance and reduce fat accumulation (SANTOSO *et al*., 1995) and to reduce ammonia gas release from feces (SANTOSO *et al*., 1996b). Lactobacillus inclusion was also known to have similar effect. An increase Lactobacillus sp. In feces may inhibit microorganism degraded uric acid and therefore reducing ammonia gas release.

CONCLUSION

The current study showed that Saropus androgynus leaf axtract at 4,5 g/l dringking water had the best performance as indicated by lower FCR and lower leg abnormality with tendency of higher body weight gain, and had the best carcass quality as indicated by better meat taste and color shank, and lower fat accumulation. Saropus androgynus leaf axtract reduced fat accumulation in abodemen, neck and liver but not in carcass. The extract also changed the balance of microorganism in feces.

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