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Effect of Dried Tomato Meal (*Solanum lycopersicum*) in Diet on Performance and Egg Quality of Native Chickens

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INTRODUCTION

Native chickens contribute a lot to household nutrition and income in rural areas of the tropics (Norris et al. 2007). But, improving nutrition for increasing egg and meat production in native chickens in Indonesia is critical. It was harder than imported breeds on free range when little or no food is supplied by the owner (Henuk and Riley, 2014).

Productivity of native chicken breeds may be doubled with improved diets and management conditions (Chowdhury et al., 2006). But, the native chickens have not attained their full production potential due to exposure to risks that influence against their survival and productivity under extensive management conditions. (Faruque et al., 2013).

Tomato pomace was a good source of protein, vitamins and minerals but may be limited in energy due to the high non-starch polysaccharides content. The wet tomato pomace contains 33% seed, 27% skin and 40% pulp, while the dried pomace contains 44% seed and 56% pulp plus skin (Sogi and Bawa, 1998). Dried tomato pomace (DTP) contains 10% moisture, 20.77% crude protein, 1760 Kcal/kg ME, 39.8% crude fiber, 7.3% ether extract, 4.24% ash, 0.5% calcium and 0.45% phosphorus (Jafari et al., 2006). The limiting factors of DTP in poultry diets are low energy and high fiber contents (Squires, et al., 1992). DTP contain remarkable amounts of α -tocopherol (Bordowski and Geisman, 1980), lutein, β -carotene, and lycopene, which could contribute to a darker yolk color that is desirable for the consumers (Mlodowski and Kuchta, 1998).

Habanabashaka et al. (2014) reported that up to 6% tomato waste meal can be added in laying hen diets without any adverse effect on egg quality and compromising egg production rate. This inclusion level also showed to be beneficial via enhancing yolk colour score and lycopene concentration and reducing egg yolk cholesterol content. The degree of yolk color is an important criterion in table eggs for consumption as well as manufacturing of egg-containing market food products (De-Groote, 1970). The color of egg yolks is produced by oxycarotenoids, as xanthophylls pigments, derived from the feed ingredients (Zahroojian et al., 2011). Vasupen et al. (2013) reported that feeding laying hens diets containing tomato pomace at inclusion 10% did not affect egg production, egg weight, feed consumption and efficiency of the hens. There are limited studies on the effects of dried tomato meal supplementation in birds, especially native chickens. It is therefore, the experiment was conducted to evaluate the effect of dried tomato meal in diet on performance and egg quality of native chickens.

MATERIALS AND METHODS

One hundred of native chickens (36 weeks of age) were allocated into five experimental diets and each was divided into four replications using a completely randomized design. Based diet was formulated to contain 53% corn, 10% rice bran, 10% fish meal, 6% CaCO₃, Top Mix 0.5%, NaCl 0.5% and 20% commercial diet. Tomato meal was included in four experimental diets at levels of 2, 4, 6, 8% to substitute based diet. Treatments were: R0 = 100% based diet (BD) + 0% tomato meal (TM); R1 = 98% BD + 2% TM; R2 = 96% BD + 4% TM; R3 = 94% BD + 6% TM; and R4 = 92% BD + 8% TM. Chemical composition of tomato meal were: 16.73% crude protein, 1.53% fat, 30.94% crude fiber, 0.98% Ca, 1.20% P, and 2416 Kcal/kg ME. Feed and water were provided *ad libitum*. Chemical composition of the diets were shown in Table 1.

The study was conducted over a period of 8 weeks. Data were collected on feed intake (FI), egg weight (EW), Hen-day egg production (HDP), egg number (EM), FCR, egg shell weight ESW, egg shell thickness (EST), egg yolk weight (EYW) and egg yolk color (EYC). Hen-day egg production was calculated as: (number of eggs-produced \times 100) / (number of hens \times number of hens in production). Yolk colour was determined using the yolk colour chart. Egg shell membrane was removed carefully and manually from the broken egg shell and the thickness of the shell measured using a micro-meter screw gauge (An et al. 2010). Data collected were subjected to one-way analysis of variance Treatment means were compared using Duncan's multiple range test (Snedecor and Cochran, 1967) using software IBM SPSS 22.

RESULTS AND DISCUSSION

The results of performance and egg quality of native chickens fed dried tomato meal in diets were shown in Table 2. Results showed that tomato meal could be used with inclusion levels up to 8% to native chicken diets having no detrimental effect on egg weight and egg shell thickness. Moreover, it was found that tomato meal had effects on the feed intake, Hen-day egg production, egg mass, FCR, egg shell weight, egg yolk weight and egg yolk color of native chickens.

Leke et al. (2015) in previous study reported that tomato meal can be used as an alternative feedstuff in laying hen diets to substitute based diet, at inclusion levels up to 8% without negative effects on egg quality. Studies by Nobakht and Safamehr (2007) indicated that feeding of dried tomato pomace increased feed intake, egg production, egg weight and eggshell weight. Feed conversion ratio of reference diet, dried tomato pulp were better than other treatments. Some authors have found that supplementing dried tomato pomace in laying hens diet did not influence performance parameters but increase yolk color value (Mansoori et al., 2008). In a study by Calislar and Uygur (2010), dried tomato pulp had a significant effect on the egg shape index and egg yolk index, whereas, dried tomato pulp had no significant effect on the albumen index and Haugh unit. This result is similar to those reported by Mitsuhiro et al. (1994) who found a significant increase in egg mass was observed with reference diet, 2% red pepper and 5% dried tomato pulp compare to the control diet. In current study, egg shell thickness was not affected by dietary treatment.

Jafari et al. (2006) reported no significant differences in egg shell thickness and Haugh unit of laying hens fed on diets containing dried tomato pulp compared to hens fed on a control diet. This result is similar to those reported by Yannakopoulos et al. (1992), Nobakht and Safamehr (2007) and Mansoori et al. (2008), that the dietary addition of dried tomato pomace did not have any significant effect on FI. However, Jafari et al. (2006) and Calislar and Uygur (2010) found that DTP resulted in greater FCR. It has been shown that feeding hen diets containing DTP at inclusion rates up to 17% increased EP (Nobakht and Safamehr, 2007). EW was not affected by dietary treatments, a finding which is in agreement with the previously reported data (Jafari et al., 2006; Mansoori et al., 2008). It was observed that the dried tomato meal used in this study did not exhibit any negative effects on the egg quality. These discrepancies in results may be attributed to tomato variety, levels of dietary supplementation with tomato by-product, tomato processing conditions, and breed of native chickens.

CONCLUSION

It can be concluded that tomato meal can be used in native chicken diets up to 8% without negative effects on performance and egg quality.

KEYWORD : Egg, Chicken, Native, Performance, Tomato

Table 1. Chemical Composition of the Diets

Nutrients	Diets				
	R0 (0% TM)	R1 (2% TM)	R2 (4% TM)	R3 (6% TM)	R4 (8% TM)
Crude protein (%)	17.34	17.30	17.29	17.27	17.26
Fat (%)	5.35	5.12	5.04	4.96	4.89
Crude fiber (%)	3.76	5.39	5.93	6.47	7.03
Ca (%)	2.93	2.81	2.77	2.73	2.69
P (%)	0.62	0.65	0.66	0.67	0.68
ME (Kcal/kg)	2742	2722	2715	2709	2702

Table 2. Effect of Dried Tomato Meal in Diet on Performance and Egg Quality of Native Chickens

Variable	Treatments					SEM	P Value
	R0	R1	R2	R3	R4		
Feed Intake	75.93 ^a	75.90 ^a	76.91 ^{ab}	77.85 ^{bc}	78.18 ^c	0.235	.000
Egg Weight (g)	39.88	40.08	40.01	41.11	41.51	0.228	.059
HDP (%)	57.76 ^a	64.01 ^c	62.49 ^b	62.44 ^b	62.31 ^b	0.476	.000
Egg Mass (g/hen/day)	40.10 ^a	44.66 ^b	43.40 ^b	44.15 ^b	44.94 ^b	0.414	.000
FCR	1.89 ^b	1.70 ^a	1.77 ^a	1.76 ^a	1.74 ^a	0.016	.000
Egg Shell Weight (g)	3.62 ^b	3.35 ^a	3.38 ^a	3.62 ^b	3.73 ^b	0.041	.002
Egg Shell Thickness (mm)	0.35	0.35	0.35	0.34	0.36	.001	.268
Egg Yolk Weight (g)	11.43 ^a	11.52 ^a	11.98 ^{ab}	12.46 ^b	11.88 ^{ab}	0.119	.031
Egg Yolk Color	10.75 ^a	11.56 ^b	11.58 ^b	11.90 ^b	12.38 ^c	0.121	.000

Notes: **Means in a row with different superscripts are significantly different at the P-value shown

¹SEM = pooled standard error of mean (n=5)

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