SENSORIAL CHARACTERISTICS OF MEAT OF JAPANESE QUAILS, *COTURNIX COTURNIX JAPONICA* FED WITH RATION CONTAINING SNAIL MEAL

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ABSTRACT

Seven hundreds of day old Japanese quails (*Coturnix coturnix japonica*) were obtained from a quail hatchery and breeding farm in Taiping, Perak State to be placed in wire mesh battery cages and fed with varying content of snail meal (*Pomacea insularis)* ranging from 0 (control), 2.5, 5, and 7.5% diet. All the rations contained 26% crude protein (CP) and approximately 2.800 kcal/kg of ME. For comparison separate birds were fed with commercial feed. Drinking water was provided *ad libitum*. All birds were reared up to six weeks old before being slaughtered to obtain their carcass for the sensorial test in the Department of Food Science, Universiti Putra Malaysia (UPM) to evaluate the flavor, juiciness, tenderness, colour, satisfaction and general appearance of the meat. Fourteen panelists, mostly students of UPM, were involved in the sensorial test. Cooked quail meat from breast part was served together with a form of palatability test with scoring system from 1 to 8. The results showed that the meat of bird that fed with ration containing snail meal were not significantly different from the meat fed with commercial diet except that the meat was less juicer. Since snail meal contained high crude protein (32.0%) and mineral especially calcium (26.3%), it could be used for animal feed as a source of protein and mineral. Level of snail meal in the ration (up to 7.5%) did not influence the sensorial characteristics of quail meat.

(Key words: Snail meal, Quail, Meat, Sensorial characteristics).

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KARAKTERISTIK SENSORIS DAGING BURUNG PUYUH, *COTURNIX COTURNIX JAPONICA* YANG DIBERI PAKAN DENGAN ARAS TEPUNG SIPUT YANG BERBEDA

INTISARI

Tujuh ratus ekor burung puyuh, *Coturnix coturnix japonica,* yang didapatkan dari sebuah peternakan dan pembibitan burung puyuh di Taiping, Perak, Malaysia ditempatkan dalam kandang bateri terbuat dari kawat dan diberi pakan dengan kandungan tepung keong, (*Pomacea insularis),* yang berbeda mulai dari 0 (kontrol), 2,5%, 5% dan 7.5%. Semua pakan mengandung CP 26% dan ME 2800 kcal/kg. Di samping itu, penelitian dengan pakan komersial burung puyuh juga dilakukan sebagai perbandingan. Burung puyuh dipelihara dari umur satu hari sampai umur 6 minggu dengan disediakan air minum secara *ad libitum.* Mereka dipotong untuk mendapatkan karkas dan kemudian diuji sensoris. Uji sensoris dilakukan di Jabatan Sains Makanan, Universiti Putra Malaysia untuk mengevaluasi terutama flavor, kesan jus, keempukan dan warna daging burung puyuh. Empat belas panelis, umumnya mahasiswa UPM turut terlibat dalam aktivitas uji sensoris ini. Daging burung puyuh masak dari bagian dada dihidangkan bersama dengan formulir uji palatabilitas dengan sistem penilaian mulai dari 1 sampai dengan 8. Hasil pengujian menunjukkan tidak ada perbedaan yang signifikan diantara daging hasil pakan keong dan daging dari burung puyuh yang diberi pakan komersial kecuali rasa jus yang lebih pada daging burung puyuh yang diberi pakan komersial. Tepung siput mengandung kadar protein kasar yang tinggi 32% dan mineral khususnya kalsium sebesar 26,3%. Oleh karena itu tepung siput dapat dimanfaatkan sebagai pakan ternak untuk sumber protein dan mineral. Aras tepung siput sebesar 7,5% dalam pakan tidak mempengaruhi karakteristik sensoris daging burung puyuh.

(Kata kunci: Tepung siput, Burung puyuh, Daging, Karakteristik sensoris)

Introduction

The utilization of golden apple snail, *Pomacea insularis,* for animal feed as part of the control measures of this rice pest has been carried out in several countries of South East Asia like Malaysia, Indonesia, Philippines and Thailand (Ulep and Buenafe, 1991; Pitojo, 1996; Sri-Anggraeni, 1998, Suryanto and Jambari, 1999). The snails can be given to ducks (Vinoba, 1998), chicken (Togatorop, 1998) and also quail (Suryanto and Jambari, 1999).

The advantage of using the snails as animal feed is due to its high protein content (Ulep and Buenafe, 1991; Pitojo, 1996; Sri-Anggraeni, 1998) and mineral content especially calcium (Suryanto, 2000). Duck can be used to control the snail directly by herding them into rice field as suggested by Halwart (1994). Other studies have been focussing on the utilization of snail flesh and/or whole snail meal as a substitute of fish meal, meat bone meal or soybean meal for poultry. In these studies, evaluation on the performances of the animals such as feed intake, body weight, ADG, FCR and carcass percentages were emphasized. Thus, in the present study, the chemical composition of snail meat was analysed and subsequently the sensorial characteristics of the meat would be evaluated

Materials and Methods

Feeding trials of quails

Adult snail of mixed sex collected from rice field and canals in Chenderong Balai, Perak State, Malaysia were oven dried at temperature ± 65 ^{0}C for 3-5 days. The dried snails were ground into fine powder for chemical analysis prior to feeding trials. Chemical composition of snail meal was analysed in the Department of Biochemistry

and Nutrition, Faculty of Animal Science, Gadjah Mada University, Yogyakarta, Indonesia to obtain the nutrient contents.

Rations of quail with different levels of snail meal were formulated as shown in Table 1. An agricultural supplier company in Serdang provided main feed ingredients such as corn, fishmeal, soybean meal, and rice bran. Feeding trial of quails was conducted in Chenderong Balai.

Day-old Japanese quails, *Coturnix coturnix japonica*, obtained from a quail hatchery and breeder in Taiping, Perak State were put into wire mesh battery cages of 50 x 80 cm^2. Cages containing 35 birds each were heated using 40-watt bulb to generate temperature up to about 39 ^{0}C. Feed of 4 different levels of snail meal as shown in Table 1 was given to the birds *ad libitum*. At 3 weeks old the birds were transferred to grower cages and provided with lighting during the night (the first feeding trials). Drinking water was provided continuously during the trial. The second feeding trial using commercial feed was conducted for comparison. Feed consumption or feed intake was measured every week. Individually bird was weighed weekly over 6 weeks before they were slaughtered. Carcasses of birds from the two feeding trials were kept separately in each plastic bag for sensorial characteristic evaluation.

Sensory test

Carcasses of each treatment were separately cooked by steaming in a pan for about 30 minutes. Breasts were separated from carcass and would be used in sensory test with the guidance of scoring for palatability test (Table 2). Sensory test was conducted in Food Science Department, UPM since all facilities for doing such test is compliance with the standard requirement. Fourteen untrained panelists (mostly students of UPM) were involved in the testing of quail meat. They were individually placed in a small cubicle with provided drinking water. Pieces of quail meat samples of breast part were served through a small window in front of panelists together with forms (Table 2) containing questions to be answered. The data collected were analysed statistically using SAS method. Any differences among the treatment were further tested.

Results and Discussion

Chemical composition of snail meal

Snails were consisted of muscular foot part, shell, operculum and the rests containing stomach, digestive glands and reproductive organs. The whole snails contained 25.69% ± 4.88% dry matter (DM). The shell was the most various parts of the snail. Chemical composition of snail meal was as follows: dry matter (DM) 96.7%, ash 32.4%, crude protein (CP) 32.0%, crude fibre (CF) 3.17%, fat 1.77%, Calcium (Ca) 26.3%, Phosphor (P) 0.289%. Shell was composed of mainly calcium and trace of protein.

Table 1. Composition of rations used for feeding trial of quails

Ingredients used	Level of snail meal in the rations (%)			
	0 (control)	2.5	5	7.5
Crude Protein (%)	26.08	26.11	26.07	26.00
Metabolised Energy (Kcal/kg)	2800.25	2808.31	2800.12	2800.10
Calcium (%)	0.65	0.85	1.50	2.15
Phosphor (%)	0.59	0.59	0.58	0.58

Table 2. Sample of palatability test card

PALATABILITY TEST CARD

Date
Type of samples : Meat of quails
Name
Score the coded samples for flavor, tenderness, juiciness, color, overall satisfaction and appearance according to the following scoring system

Score	Flavor description	Juiciness description	Tenderness description	Color Description	Overall satisfaction	Appearance description
8	Like extremely	Extremely juicy	Extremely tender	Extremely bright	Like extremely	Like extremely
7	Like very much	Very juicy	Very tender	Very bright	Like very much	Like very much
6	Like moderately	Moderately juicy	Moderately tender	Moderately bright	Like moderately	Like moderately
5	Like Slightly	Slightly juicy	Slightly tender	Slightly bright	Like slightly	Like slightly
4	Dislike Slightly	Slightly juicy	Slightly tough	Slightly dark	Dislike slightly	Dislike slightly
3	Dislike moderately	Moderately dry	Moderately tough	Moderately dark	Dislike moderately	Dislike moderately
2	Dislike very much	Very dry	Very tough	Very dark	Dislike very much	Dislike very much
1	Dislike Extremely	Extremely dry	Extremely tough	Extremely dark	Dislike Extremely	Dislike Extremely

PALATABILITY SCORE CARD

No.	Flavor	Juiciness	Tenderness	Color	Overall satisfaction	Appearance	Total

Results of the proximate analysis showed that the dried flesh or snail flesh meal was high in crude protein content (50.8%). Sri-Anggraeni (1998) reported slightly lower content of crude protein in the snail flesh meal (43.2%), whereas Ulep and Buenafe (1991) reported similar result as current analysis (51%). These values were less as compared to the giant snail meal that contained 64.1% (Pitojo, 1996). Nevertheless, compared with other sources of protein, such as soya bean that contained 44% CP, the snail meal was definitely higher. Fish meal was more superior with 63.6% CP (NRC, 1994). Tillman *et al.*, (1983) stated that any feed ingredients containing 20% CP or more were categorised as sources of protein. Therefore, flesh of snail could be categorised as source of protein for poultry. Besides the use of flesh part as a protein source, the shell of snail was a good source of mineral especially since it contained 51.5% calcium. This is higher than the limestone that contained only 38% calcium. Whole snail meal (WSM), thus, considered as good feed ingredient to provide protein and mineral for poultry.

Studies on the nutrient contents especially amino acid composition (profile) of giant snail meal (Pitojo, 1996) revealed that essential amino acids content of the snail meal was better than chicken eggs. Snail meal contained more lysine, isoleucine and leucine than chicken eggs. These amino acids are essential for poultry, in particular the lysine, which is the most critical amino acid in many feed ingredients. Snail meal of *Pomacea* may probably similar to the giant snail meal since both of them feed on vegetable. However, another study on the amino acid profile of snail meal of *Pomacea* should be carried out to verify this assumption.

Sensory characteristics of quail meat

Consumer acceptance upon the product was very important to be considered. Feed given to the bird might influence sensorial

properties of the meat, therefore, sensory test of the quail meat was carried out to determine whether the inclusion of snail meal would affect the sensorial properties of meat or not. Results of the test were presented in Table 3.

Sensory properties of quils meat such as flavor, juiciness, tenderness, color, satisfaction as well as general acceptance were generally not affected by the inclusion of snail meal in the ration given. The inclusion of snail meal up to 7.5% in the ration did not change the flavor, tenderness and color of the quail meat. Quails fed with snail meal produced slightly more juicy meat than the bird fed without snail meal.

Results of sensory test of meat from quails fed with commercial feed (second feeding trials) indicated that there was not any significant different upon the parameters observed (Table 4). However, quail fed with ration containing snail meal and commercial feed produced slightly more juicy meat than the bird fed without snail meal.

Sensory characteristics of meat from quails fed with various rations such as flavor, juiciness, tenderness and color were generally similar among the birds. Forrest *et al.* (1975) stated that the flavor quality of a muscle food is dependent upon several key antemortem and postmortem factors. These factors include, but are not limited to, the animal's age, breed, strain, sex and nutritional status (feed being given) as well as all of the postmortem handling and cooking protocols. However, level of snail meal in the ration as well as type of ration did not affect significantly sensory characteristics of quail meat.

Table 3. Sensory test of quail fed with different level of snail in its ration

Parameter	% of snail meal in the ration			
	0 (control)	2.5	5	7.5
Flavor	5.93 ± 0.62a	6.00 ± 0.96a	5.36 ± 1.15a	5.14 ± 1.46a
Juiciness	4.71 ± 1.33b	5.00 ± 1.41a	5.21 ± 1.12a	5.64 ± 1.01a
Tenderness	6.14 ± 1.03a	6.29 ± 1.14a	6.21 ± 0.58a	6.29 ± 0.99a
Color	5.43 ± 0.94a	5.57 ± 0.94a	5.43 ± 1.16a	5.07 ± 1.14a
Satisfaction	6.00 ± 0.68a	5.93 ± 1.00a	5.43 ± 1.28a	5.43 ± 1.40a
General appearance	5.64 ± 1.15a	6.00 ± 1.04a	5.71 ± 1.20a	5.57 ± 1.58a

Note: Values in the same row with different script showed significant different at P<0.01
Maximum score is 8

Table 4. Sensory test of quail fed with three different types of rations

Parameter	Type of ration		
	Without SM (control)	With SM	C. feed
Flavor	5.93 ± 0.62a	5.14 ± 1.46a	5.50 ± 1.16a
Juiciness	4.71 ± 1.33a	5.29 ± 1.20ab	5.71 ± 0.73b
Tenderness	6.14 ± 1.03a	6.26 ± 0.91a	5.71 ± 0.73a
Color	5.43 ± 0.94a	5.36 ± 1.08a	5.07 ± 0.83a
Satisfaction	6.00 ± 0.68a	5.60 ± 1.23a	5.50 ± 0.94a
General appearance	5.64 ± 1.15a	5.76 ± 1.16a	5.21 ± 0.89a

Note: values in the same row with different script showed significant different at P<0.01
C. feed : Commercial feed, SM: snail meal

Flavor of meat is closely related with taste, smell, texture, temperature and pH (Lawrie, 1983). There were many factors that influenced meat flavor such as age of animal, species, sex, type of feed, the length and temperature of cooking (Bratzler, 1971). Flavor will develop during cooking. Flavor intensity was the same for all rations used in the this study.

The juiciness of meat depends on two factors i.e. the juice of meat that release during chewing and also the release of intramuscular fat (Soeparno, 1992). The juiciness also had negative correlation with cooking loss. Meat with high cooking loss always had low juice in the meat. Feed given to animals had little effect on their juiciness. Juiciness was influenced more by species, age, sex of animals and pH of meat. In the present study, juiciness was not influenced by the rations given to unsexed and unselected birds. By selection, Caron *et al.* (1990) reported that after 20 generation of mass selection for body weight, there were 3 lines of birds; birds of line 3 were less juicy and less tender than the lines 1 and 2. Juiciness and tenderness were clearly associated with the relative proportions for fat and protein and line 3 had the leanest birds and overall produced acceptable meat; but this meat was slightly drier and tougher than that from the other lines. Besides selection, different scalding temperature (postmortem factor), reported by Arafa *et al.* (1978) significantly influenced the flavor, juiciness and tenderness of Bobwhite quails meat. The quail meat was less flavor, juicy and tender, as the scalding temperature increased. Singh and Panda (1987) evaluated quality characteristics of quail broiler and spent quail meat. They reported that age and type of meat influenced the quality characteristic of meat including tenderness. *Coturnix* quail aged 5 weeks had less shear force values than 58 weeks (spent layer quail), the less shear values indicated more tender meat.

Tenderness is the most important sensorial properties in the assessment of meat quality. Factors that influenced tenderness can be categorised into two factors namely ante-mortem factors like genetics (breed, species and physiology), age, management, sex and stress. The second postmortem factors are for example methods of chilling, refrigeration, aging and cooking (Soeparno, 1992). There was no difference in the meat tenderness of quail fed with different level of snail meal and different types of ration. Other than feed treatment, all birds were treated with equal regiments such as slaughtered at the same age (42 days), use of same part (breast meats) for the sensory tests.

Color of meat is influenced by many factors i.e. feed, species, breed, age, sex, stress, pH and oxygen (Soeparno, 1992). The color of meat is derived mainly from the meat pigment called myoglobin. Concentration of myoglobin in the muscle differed among the species, breed, age as well as location of muscle (Forrest *et al.*, 1975). In this study meat from quails fed with different level of snail meal and type of rations showed no significant differences.

The results of sensory test (with scoring system from 1 – 8) showed that quail meat received score between 5 – 7 indicating the moderate preference upon the quail meat. Therefore, quails fed ration with the inclusion of snail meal up to 7.5% were still acceptable to panelists or people in general.

Conclusions

The snail meal of *Pomacea insularis* contained nutrients with high content of crude protein and mineral. It could be used in the ration as a protein source without affecting the sensorial characteristics of the meat of Japanese quails. The sensorial characteristics of meat from birds fed with snail meal up to 7.5% were still acceptable.

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