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Carcass Composition of Jungle Fowl in Comparison with Broilers and Indigenous Chicken*

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Abstract: Carcass composition of three breed of chicken was compared: jungle fowl, broiler and Malaysian indigenous chicken. The chickens were sacrificed and were divided into forequarter and hindquarter. The forequarter was further divide into breast, wing and ribs. The muscle, bone, fat and skin of all different portions were separated, weighed and recorded. The results showed that broilers have significantly higher muscle weight compared to indigenous chicken and jungle fowl. The jungle fowl has significantly higher bone weight with least fat compared to the other two breeds The carcass composition of indigenous chicken is always in between the broiler and jungle fowl. Present results show that different habitat and feeding pattern of these chickens do contribute to these changes.

Key words: Broiler, indigenous chicken, jungle fowl, meat composition

INTRODUCTION

The chicken is a domesticated fowl that is believed to be descended from the wild Indian Jungle Fowl and South East Asia Red Jungle Fowl (Moiseyeva *et al*., 2003). It is one of the most common and wide-spread domestic animals with a population of more than 24 billion in 2003 and kept primarily as a source of food from both their meat and eggs.

There are many strains and breeds of chicken with different carcass characteristics such as broilers (*Gallus domesticus*), indigenous chicken (*Gallus gallus domesticus*) and jungle fowl (*Gallus gallus*). Broilers are very similar as the ancient jungle fowl, except it lays on muscle faster. Modern broilers are typically a third generation offspring (an F2 hybrid) and are fed with high quality formulated diet to increase muscle growth hence increase the body weight, while the jungle fowl, which is known to be the ancestor of all the domestic fowl, is considered as omnivorous (Klasing, 2005; Arshad *et al*., 2000). Their diet consists of arthropods together with tender leaves/shoots, seeds as well as fruits of numerous plant species. As for the indigenous chicken or ayam kampung (refers to the present Malaysian village chicken) are crossbred between red Jungle Fowl and mixed exotic domestic breed that has been brought by the Europeans, mainly British (Duguma, 2006). Feeding routine of this chicken are usually once or twice a day, with variety of left over food such as rice or used coconut pulp. The chickens are free roaming and studies have showed that rearing indigenous chicken is cost effective since very little financial input is needed (Ramlah, 1996).

Indigenous chicken and jungle fowl are always thought to be good in term of carcass composition compared to the broilers due to its low fat content. However, there is no quantitative information available to support the statement. To the best of our knowledge, no published information on the carcass evaluation of jungle fowl or indigenous chicken is available. Therefore, this study was carried out to evaluate the carcass composition and various tissue components of jungle fowl, broiler chicken and indigenous chicken.

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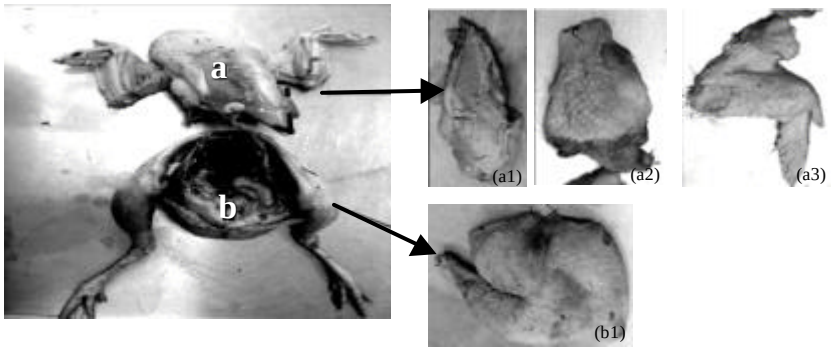

Fig. 1: The carcass was dissected into (a) forequarter and (b) hind quarter. The forequarter was further divided into (a1) breast, (a2) ribs and (a3) wing. The hind quarter were divided into (b1) right and left leg including the pelvis

MATERIALS AND METHODS

A total of 35 birds were used in this study consisting of 15 adult broiler chicken (8 female and 7 males), 10 adult free range indigenous chicken (8 female, 2 male) and 10 adult jungle fowl (2 female, 8 male). The broiler chicken was purchased from a supplier in Malaysia, while the free range chicken and the jungle fowl was caught from a small village in Dengkil and from the wild, respectively (by wildlife research team, Faculty of Veterinary Medicine, UPM-approved by the Wildlife ethics in the faculty). The study was conducted at the Faculty of Veterinary Medicine, University Putra Malaysia from 16th April 2007 to May 2008.

All birds were fasted for approximately 24 h before cervical dislocation and the live weight were recorded. Later all carcasses were frozen 24 h at 0°C. Prior to dissection, the carcasses were thawed and then separated according to different meat composition. First the carcass was de-feathered and dissected into two equal portions. The carcass was further divided into forequarter and hindquarter by cutting posterior to and parallel to the rib cage, posterior to the last thoracic vertebrae, last ribs and the sternum (Fig. 1a, b). The pelvis and legs makes the hindquarter (Fig. 1b). The forequarter was cut into two halves consisting of the right and left breast, wings and ribs, where as the hindquarter was divided into two equal portions consisting of the right and left legs including the pelvis (Fig. 1).

All the internal organs were weighed separately and the results were recorded. The skin, muscles, fat as well as the bones and connective tissue of each portion were also weighed and recorded.

Statistical analysis was done by using Analysis of Variance test (ANOVA).

RESULTS

The results are divided into mean live weight, mean ribs weight, mean of hind quarter weight, mean breast weight and mean wing weight.

Mean Live Weight

Mean live weight of adult broiler chicken was higher (2184.08 g) compared to adult indigenous chicken (1384.59 g), whereas jungle fowl has the lowest mean live weight (729.39 g) (Table 1).

Mean of Rib Weight

Among the three breeds of chicken studied the jungle fowl had the highest rib weight (74.3±18.05) followed by the broilers (47.70±1.55 g) and indigenous chicken (29.0±1.76 g). The

Table 1: Means of total body weight among three breeds of chicken

Breed	Weight (g)
Broiler	2184.1
Indigenous chicken	1384.6
Jungle fowl	729.4

Table 2: Means of ribs trait among three breeds of chicken

Source	Broiler (n = 15)	Indigenous chicken (n = 10)	Jungle fowl (n = 10)
Whole weight (g)	47.7±1.55^{ab}	29.0±1.76^{a}	74.3±18.05^{a}
Bone (g)	10.4±0.73^{b}	6.8±0.59^{b}	24.3±2.98^{a}
Skin (g)	7.5±0.51^{b}	3.6±0.49^{c}	18.8±1.84^{a}
Muscle (g)	24.8±0.62^{a}	14.6±0.64^{b}	2.7±0.22^{c}
Fat (g)	1.5±0.28^{a}	2.0±0.57^{a}	0.3±0.13^{b}
M:B ratio	2.8±0.20^{a}	2.4±0.18^{a}	0.1±0.01^{b}

Mean values with different superscript between the column are significantly different ($p<0.05$). Data are expressed as Mean±SE

Table 3: Means of hind quarter trait among three breeds of chicken

Source	Broiler (n = 15)	Indigenous chicken (n = 10)	Jungle fowl (n = 10)
Whole weight (g)	359.4±5.84^{a}	218.9±15.98^{b}	108.4±5.43^{c}
Bone (g)	68.1±1.55^{b}	36.3±1.65^{c}	80.4±5.43^{a}
Skin (g)	40.6±1.26^{a}	24.0±3.72^{b}	22.0±3.99^{b}
Muscle (g)	196.6±3.34^{a}	122.6±5.78^{b}	7.6±0.52^{c}
Fat (g)	33.1±2.31^{a}	30.3±8.37^{a}	0.2±0.09^{b}
M:B ratio	2.9±0.08^{b}	3.4±0.08^{a}	0.1±0.00^{c}

Mean values with different superscript between the column are significantly different ($p<0.05$). Data are expressed as Mean±SE

highest bone weight for this region was obtained from the jungle fowl, whereas the indigenous chicken had the least bone weight. As for the muscle content, the broiler had significantly more muscle content compared to indigenous chicken and jungle fowl (Table 2). Highest fat content in the ribs was found in the indigenous chicken followed by the broiler and jungle fowl. These results show that the muscle to bone ratio is higher in broiler compared to indigenous chicken and jungle fowl. Broiler on the other hand contains more meat in the ribs compared to indigenous chicken and jungle fowl. The jungle fowl had the least muscle to bone ratio (Table 2).

Mean of Hindquarter Weight

The hind quarters whole weight is significantly higher in broiler (359.4±5.84 g) compared to indigenous chicken (218.9±15.98 g) or the jungle fowl (108.4±5.43 g). The bone of jungle fowl was again significantly higher with least muscle content (Table 3). Broiler has the highest muscle weight and high amount of fat. But the indigenous chicken has high muscle: bone ratio (3.4±0.08) compared to broiler (2.9±0.08). Jungle fowl has the lowest muscle: bone ratio (0.10±0.00). These results show that indigenous chicken has more muscle in this region compared to the other two breeds (Table 3).

Mean of Breast Weight

The whole weight of breast is significantly higher in broiler (281.9±6.25 g) compared to jungle fowl (160.9±13.15 g) and indigenous chicken (118.8±4.81 g). However, the weight of the bone in this region is significantly higher in jungle fowl compared to the other two breeds. Broiler has a significantly higher breast muscle weight and fat content (Table 4). The least muscle weight and fat content is found in the jungle fowl.

Mean of Wing Weight

Whole weight of wing of the broiler (82.4±1.36 g) is higher compared to indigenous chicken (46.9±1.26 g) and jungle fowl (35.3±1.53 g). The bone of broiler is significantly heavier. Apart from

Table 4: Means of breast trait among three breeds of chicken

Source	Broiler (n = 15)	Indigenous chicken (n = 10)	Jungle fowl (n = 10)
Whole weight (g)	281.9±6.25^{a}	118.8±4.81^{c}	160.90±13.15^{b}
Bone (g)	24.8±0.82^{b}	10.5±0.63^{b}	106.20±11.41^{a}
Skin (g)	21.0±0.88^{a}	9.9±1.15^{c}	14.50±1.00^{b}
Muscle (g)	224.5±5.45^{a}	90.2±3.09^{b}	3.80±0.77^{c}
Fat (g)	7.2±0.80^{a}	5.5±2.06^{a}	0.17±0.09^{b}
M:B ratio	9.2±0.30^{a}	9.0±0.43^{a}	0.03±0.00^{b}

Mean values with different superscript between the column are significantly different ($p<0.05$). Data are expressed as Mean±SE

Table 5: Means of wing trait among three breeds of chicken

Source	Broiler (n = 15)	Indigenous chicken (n = 10)	Jungle fowl (n = 10)
Whole weight (g)	82.4±1.36^{a}	46.9±1.26^{b}	35.3±1.53^{c}
Bone (g)	27.8±0.57^{a}	14.7±0.55^{c}	17.2±0.94^{b}
Skin (g)	15.8±0.71^{a}	9.5±0.39^{c}	12.7±0.51^{b}
Muscle (g)	35.2±0.77^{a}	20.0±0.67^{b}	4.5±0.40^{c}
Fat (g)	0.3±0.13^{a}	0.2±0.12^{a}	0.1±0.04^{a}
M:B ratio	1.3±0.04^{a}	1.4±0.04^{a}	0.3±0.02^{b}

Mean values with different superscript between the column are significantly different ($p<0.05$). Data are expressed as Mean±SE

this, broiler had the highest muscle weight. Broilers fat content in this region is significantly higher compared to indigenous chicken and jungle fowl. Thus the meat:bone ratio of wing is higher in indigenous chicken compared to broiler and jungle fowl (Table 5).

DISCUSSION

The results from this study showed that broiler has significantly higher whole weight and muscle weight compared to the indigenous chicken and jungle fowl. This is due to the genetic improvement and selection to get a desired trait. The domestication of wild jungle fowl marked the start of selective breeding of poultry and by the end of the nineteenth century many breeds were in existence. These showed marked differences between breeds and homogeneity within them for a range of traits, including production traits such as body size and musculature. Some of the poultry breeds were the basis of industrial poultry breeding (Van Kaam *et al*., 1998) and this has lead to a tremendous development of poultry industry. Many studies are done to get a chicken that can reach market weight in a short period of time like the broilers, without realizing the importance of the meat quality. Besides that, more emphasize is given on the feeds, where high quality feeds are being produced to optimize the growth rate but not the meat quality. Genetic selection together with high quality diet, increase the broilers body weight. However, excessive energy intake leads to increasing fat deposition in the body (Moravej *et al*., 2006). This supports present data where significantly higher fat weight was found in broilers in all regions studied except the rib region. Jungle fowl was found to content the least fat in all the regions studied. However, jungle fowl also had the least muscle weight and significantly higher bone weight, bringing the muscle: bone ratio in this bird to be very poor. This is due to the influence of the feed and their habitat. In another study conducted by Kamran *et al*. (2008), feeding broilers with low crude protein diets with constant metabolic energy:crude protein ratio has affected the growth performance but not the carcass parameters. However, in the present study, the broilers that are used were fed with commercial diet containing high crude protein and therefore, affecting the meat composition in particular the fat conent. The jungle fowl and village chicken had good carcass parameters as in the study by Kamran *et al*. (2008). However, the growth parameters were not measured in this study.

To our knowledge there are no studies done on the carcass composition of jungle fowl, since it belongs to a protected wild life species. Jungle fowl's diet consists mainly of insects (ants, beetles,

termites and flies), crustaceans (leeches, snails) and also plants as well as fruits. These are good sources of proteins and will be utilized efficiently by the jungle fowl. Unlike the broilers, jungle fowl need to travel a long distance to feed and during this process, high energy is used. Instead, the broilers are fed with highly formulated feed and not much energy is used in finding their food. Therefore, this will increase their body weight and also the fat content since the energy that is taken up are not being utilized efficiently as the jungle fowl, but stored in muscles as fat.

The carcass composition of the indigenous chicken on the other hand, mainly their muscle weight, bone weight, fat weight and muscle:bone ratio in all the various parts were higher than the jungle fowl but lower than the broilers. The diet of indigenous chicken consists mainly of kitchen left over, such as rice or used coconut pulp (Ramlah, 1996). Apart from these diets, other cheap and easily available food materials in the village, such as sago trunks and banana trunks are also fed to these chickens. They are fed once or twice a day and as for the rest of the day, they will find their own food which includes insects, plants, grass, fruits and earthworms. This explains why indigenous chicken has low fat and muscle weight compared to broilers as they need to use energy to find food.

As for the bone weight, despite having pneumatic bones, jungle fowl has significantly higher bone weight. This is again due to their diet which help to build stronger bones, as their diet contain very high level of calcium compared to the broilers diet.

The present study on the carcass composition of the three birds showed that the carcass composition of indigenous chicken is always in between the broiler and jungle fowl due to its similar habitat and feeding behaviour as the other two breeds of chicken. Indigenous chicken carcass composition will be the best to be consumed as it is healthy with medium level of fat, muscle and bone. Even though broilers have the highest muscle composition, but its fat level is also significantly high and can be a risk factor to many diseases, such as heart disease and diabetes in human. Therefore, the food and meat industry should focus on other aspect of feed in order to get good quality meat composition in poultry.

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