EFFECTS OF FEEDING TONGKAT ALI EXTRACT ON THE PERFORMANCE OF CAPONIZED AND NON-CAPONIZED MALE BROILER CHICKEN REARED IN CHICKEN-OIL PALM INTEGRATED FARMING SYSTEM

KEVIN LAI WAI ONN

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF AGRICULTURE SCIENCE WITH HONOUR

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FACULTY OF SUSTAINABLE AGRICULTURE
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__________________________
Kevin Lai Wai Onn
BR 1111 0035
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1. ASSOC. PROF. DR. MD. SHAHIDUR RAHMAN
   SUPERVISOR

2. DR. KIRON DEEP SINGH KANWAL
   EXAMINER 1

3. DR. ABDUL RAHIM AWANG
   EXAMINER 2

4. PROF. DR. WAN MOHAMAD WAN OTHMAN
   DEAN OF FACULTY OF SUSTAINABLE AGRICULTURE
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The Author
The effects of Tongkat Ali (*Eurycoma longolia*) feeding on the performance of caponized and non-caponized broiler chicken were investigated in this study. Twenty-eight commercial male broiler chickens were separated into four groups which were capon without Tongkat Ali (TA) and capon with TA feeding, and non-capon without TA and non-capon with TA feeding. Each group consisted of 7 replicates. After rearing in the oil palm integration for 5 weeks, their mortality, body weight gain, meat quality and shank length were determined. Data were analyzed using chi-square and two-way ANOVA at 5% significant level. The results obtained showed that total capons (41.67%) - both TA fed and without TA feeding, had significantly lower mortality rate compared to the non-capons (61.9%). As for body weight gain, the chicken group without TA feeding was seen to have a significantly higher body weight compared to the TA fed group at all times during the rearing period of 5 weeks. As for meat quality parameter analyzed, only abdominal fat weight was significantly lower at TA fed chickens. TA fed chickens had almost 50% lower abdominal fat content (1.06%) than that of chickens without TA feeding (2.07%). Further research needs to be done on the proper dosage of TA given to broiler chickens to increase productivity, as well as to look into the suitable farm management system to rear capons in the means of increasing desired traits, such as, meat quality and body weight gain.
Kesan pemakanan Tongkat Ali (Eurycoma longifolia) (TA) kepada prestasi ayam pedaging kebiri atau bukan kebiri telah disiasat dalam kajian ini. Dua puluh lapan ayam pedaging komersial telah dibahagikan kepada empat kumpulan laitu ayam kebiri tanpa TA dan ayam kebiri dengan pemakanan TA, serta ayam bukan kebiri tanpa TA dan ayam bukan kebiri dengan pemakanan TA. Setiap kumpulan mempunyai 7 replikasi. Selepas pentemakan di ladang integrasi kelapa sawit selama 5 minggu, kadar kematian, berat badan, kualiti daging dan panjang kaki ayam-ayam tersebut telah ditentukan. Data dianalisis dengan menggunakan khi-kuasa dua dan dua hala ANOVA pada aras keertian 5%. Keputusan yang diperolehi menunjukkan bahawa ayam kebiri (41.67%) mempunyai kadar kematian jauh lebih rendah berbanding dengan ayam bukan kebiri (61.9%). Bagi parameter berat badan, kumpulan ayam tanpa pemakanan TA dilihat sebagai mempunyai berat badan yang lebih tinggi berbanding dengan kumpulan ayam yang diberi makan TA dalam tempoh pentemakan 5 minggu. Bagi parameter kualiti daging, hanya berat perut lemak menunjukkan penurunan yang ketara pada ayam yang diberi makan TA. Ayam yang diberi makan TA (1.06%) mempunyai berat badan lemak di bahagian abdomen yang lebih rendah berbanding dengan ayam tanpa pemakanan TA (2.07%) sebanyak hampir 50%. Kajian lebih lanjut perlu dilakukan untuk mengkaji dos TA yang dapat diberikan kepada ayam daging untuk meningkatkan produktiviti serta sistem pengurusan ladang yang sesuai untuk pentemakan ayam kebiri bagi meningkatkan ciri-ciri yang dikehendaki seperti kualiti daging dan pertambahan berat badan.
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1. Mortality rate (%) = \frac{\text{Total number of dead chickens in treatment}}{\text{Total initial number of chickens in the treatment}} \times 100

\text{Weight of Dried Sample} - \text{Weight of Defatted sample}

2. \% \text{Fat} = \frac{\text{Weight of Dried Sample} - \text{Weight of Defatted sample}}{\text{Original weight of the sample}} \times 100

\text{Weight of dried sample} = (\text{Weight of beaker + filter paper + dried sample}) \text{ minus} (\text{Weight of beaker + filter paper})

3. \text{Weight of beaker plus filter paper} = A

\text{Weight of beaker plus filter paper + sample} = B

(\text{before drying}) \text{ in grams}

\text{Weight of beaker plus filter paper + sample} = C

(\text{after drying}) \text{ in grams}

\% \text{Moisture} = \frac{(B - C)}{(B - A)} \times 100

(B - A) = (\text{weight of sample})
CHAPTER 1

INTRODUCTION

1.1 Background

Chicken meat is the second most consumed meat in the world after pork and is still increasing in demand. An online article, Poultry Site (2013) showed that in a worldwide scale, total poultry meat consumption increased from 66.4 million tonnes in 2000 to about 91 million tonnes in 2009. The site also stated that in 2013, total poultry meat consumption was more than 106 million tonnes of which, 94 million tonnes were chicken meat. Researches on chicken have to be ongoing and its importance is very significant to the low income world. Dessie (2011) stated that chicken production had potential to improve livelihoods of rapid population increment of the developing countries. This was because chickens were the only type of livestock which could be obtained at a cheap price, easy maintenance as they could look after by themselves, able to provide high quality protein source as well as extra income for the poor farmers.

Chicken meat is the main protein source of meat in Malaysia. The Poultry Site (2014) stated that the domestic consumption of poultry meat in Malaysia was expected to grow from 1.40 million tonnes in 2013 to 1.43 million tonnes in 2014. According to Loh (2004), per capita annual consumption of broiler meat was 31kg/year. Malaysia has been self-sufficient in chicken production since 1984 (Loh, 2004). In order to maintain self-sufficiency, further research has to be done on increasing quality and quantity of meat, as well as, an economical market value for chicken meat.
Commercial broilers are the main chicken meat providers and consist mainly of high yielding strains such as Ross and Cobb. They are produced under intensive system and the production cost is mainly affected by housing and feed management. The growth curve of chickens is exponential shaped. The Poultry Site (2008) stated that broilers did not grow in a linear way but most of their growth takes place after 27 days, which was the latter part of the growth curve. The growth curve of broilers remains exponential up to 48 days but broilers are usually harvested at 35-40 days before their growth reaches their maximum potential. Hence, there is a scope to exploit the full exponential phase of the growth of commercial broilers, instead of selling them at an earlier age.

With this scope of exploitation of growth phase, castration of rooster can be a stepping stone to increase the productivity. Castration is defined as a process of neutering a male animal by removing the testicles, be it surgically or chemically. In farm animals, castration is used to gain benefits such as increasing growth of the male animals. In chickens, castration is called caponization. Caponization can be defined as a modification process to alter the sexual maturation of male chickens with the aim of improving the quality characteristics of carcass and meat. In the Sydney Morning Herald, Hadlington (1931) claimed that the caponization reduces bullying in a flock of cockerels, provides tender meat at any age of the capon, and produces larger birds compared to cockerels provided that they are retained long enough to allow weight gain. The fact is that caponization produces larger birds that might provide an opportunity to caponize the commercial male broilers to exploit their full growth potential as well.

'Tongkat Ali' (TA) also known as *Eurycoma longifolia*, which belongs to a family of Simaroubaceae, has been widely used by South East Asian countries as a herbal folk medicine for centuries (Lee et al., 2012). According to Lee et al. (2012), the bioactive compounds in TA such as quassinoids, canthin-6-one alkaloids, beta-carboline alkaloids, tirucallane-type triterpenes and biphenyleneolignans are reported to have biological activities on antimalarial, antiulcer, antipyretic, antitumour, antiparasitic and cytotoxic to cancer cells. TA is generally used to increase growth, strength, vitality and energy of the older generations. TA is seen as a natural testosterone booster in males. Based on research done by Ang and Cheang (2001), TA feeding in some animal species causes
significant increase in body weight gain. Hence, TA can be seen as another tool used to exploit the growth phase of the commercial broiler chicken.

Commercial broilers are reared using the intensive production system which requires them to be housed, fed ad libitum and crammed together for high production (Awaludin, 2003). They are also given antibiotics to avoid bacterial infections. On the other hand, chickens reared in free range are left to roam and scavenge around for food. This reduces other feed inputs needed to be given to it. Due to the absence of intensive feeding, the free range chickens are known to be slow growing and thus, take a longer time to reach the market weight. However, their product is in high demand compared to the commercially reared broilers. There are several factors affecting the demand and price of free range chickens. Sonaiya and Swan (2004) stated that the market price for free-range birds was more stable because the meat is tastier and has a stronger flavour compared to commercial broiler meat. The meat is tougher and hence, texture can be retained although prepared in dishes with long cooking period. People are getting more health conscious these days and go for organic meat, without antibiotics. The free range chickens are not fed with compounded feed which may contain antibiotics or other synthetic chemicals (Sonaiya and Swan, 2004).

Hence, the concept of free range chickens integrated with oil palm is fairly practicable. Malaysian Palm Oil Board (MPOB) claims that chicken-oil palm integration is strongly recommended by the Malaysian government as it brings benefits for both the poultry and the plantation. The chickens act as biological weed control, hence replacing labour for weeding. Awaludin (2003) from MPOB observed that in an area of 0.4 Ha with a stocking rate of 1000 chickens, the grasses and weeds were consumed by the chickens. Chicken droppings also act as organic fertilizers contributing to soil fertility. He also claimed that integration of range chickens with oil palm is a viable enterprise as it can be applied to integrated pest management programme and allow maximization of land usage. Hence, there is an opportunity to test the performance of caponized males and the effects of TA feeding in commercial broiler in chicken-oil palm integrated system, which might overcome high mortality of chicken production beginning with day-old-chicks (DOC).
1.2 Justification

Malaysia is one of the world's largest palm oil exporters and currently supplies 39% of world palm oil production. According to online website, Palm Oil Health (2014), to meet up to the world’s demand, 4.49 million hectares of land in Malaysia was under oil palm cultivation. Hence, it is very important to utilize this large amount of land and maximize the production of it. Chicken-oil palm integration can be seen as new business avenue as well. Oil palm plantation companies can practice this to double their income, while waiting for oil palm harvesting. Besides that, existing chicken farmers are able to increase their profitability through caponizing as the chickens are from the same flock. There are no extra investments needed to purchase the chickens or to set up the housing. TA feeding may further promote the growth of the capons and commercial broiler males, producing higher quality meat for human consumption.

If this project is successful, the stereotype of commercial broilers which is thought as inorganic meat and are given antibiotics to increase the growth will be reduced. People will start accepting free range capons reared in an oil palm integrated system as a nearly organic or semi-organic meat. There will also be another breakthrough of the TA market if TA is proven to increase growth and meat quality of the commercial broiler chickens. Livestock feed companies may incorporate TA into their feed, producing premium feed to increase growth rate of the livestock animals. TA is also a natural herb and when consumed in proper amount, its side effects will not be as harmful as the synthetically produced growth promoters which leaves residues in the meat. Thus, conducting a research on investigating the effects of caponization and TA feeding on commercial broiler chicken reared in oil palm plantation will be really meaningful to the health conscious community.
1.3 Objectives

The objectives of this study were:

i. To investigate the effects of Tongkat Ali feeding on the growth performance of caponized or non-caponized broiler chicken.

ii. To investigate the effects of Tongkat Ali feeding on the meat quality of caponized or non-caponized broiler chicken.

1.4 Hypothesis

Hypothesis for objective is as follow:

\( H_0: \) Caponization along with Tongkat Ali feeding would have no significant effects on the growth performance and meat quality of commercial male broiler chicken.

\( H_a: \) Caponization along with Tongkat Ali feeding would have significant effects on at least one of the growth or meat quality characteristics of commercial male broiler chicken.
CHAPTER 2

REVIEW OF LITERATURE

2.1 Broiler Chicken

Malaysia is a net exporter of chicken meat and eggs. The production of broilers and layers in the country is highly intensive with very strong commercial entity (Awaludin, 2003). In the market, most of the chickens available are broiler chickens as they gain weight faster and provide high amount of meat. Scheurmann et al. (2003) strengthened this point by stating the selection programs done in present times to increase the rapid growth and body conformation that have produced the successful commercial broiler strains, especially favouring the breast muscles which have a high economic value. The relative bone weight of the commercial broiler gradually decreases as the body weight increased, which is suitable for a meat producing bird (Lokman et al., 2011). Ganabadi et al. (2009) did a research on the carcass characteristics comparison between jungle fowl, broilers and Indigenous chickens. They have concluded that broiler has significantly higher whole weight and muscle weight compared to Indigenous chicken and jungle fowl. Under intensive selective breeding, broiler chickens reach their market weight at approximately 5-7 weeks of age. Online Animals Australia (1980) wrote in an article that over 50 years ago, it took 98 days for a chicken to grow to 1.6kg, but in 1986, it took only 37 days due to intensive breeding. Broiler chickens are commercially produced by large scale producers under intensive production system. Awaludin (2003) from MPOB claimed that to produce cheap meat for human consumption, the birds were squeezed together in houses and lack of freedom. Antibiotic was also commonly used due to their stress environment to reduce the bacterial infection (Awaludin, 2003).
2.1.1 Growth of Broilers

In general, growth of chicken is suitably described as a sigmoid curve with an initial exponential growth phase, an Intermediate or transitory phase, and a final phase of slow growth which comprises of a gradual reduction in the growth rate, following an asymptotic increase in the body weight (Aguilar et al., 1983). Commercial broilers can be of several different types of strains. Some strains have showed a continuous genetic progress which increases their economic value. Souza et al. (1994) showed that the Ross, Cobb and Hubbard strains had a higher breast yield than the Arbor Acres strain of broiler. A research was done by Flemming et al. (1999) to compare the yield of carcass and parts of five commercial breeds which are Ross, Cobb, Hubbard, Arbor Acres and Isa Vedette. The results obtained showed the differences only between the Ross and Cobb, which showed a smaller yield (Fernandes et al., 2011). Ross was proven to have the best yield of boneless leg when compared with both Ross and Cobb breeds. Some researches proved otherwise, however. According to a recent evaluation done by Moreira et al. (2003) and Stringhini et al. (2003), it was verified that there were no difference in the yield of carcass or cuts between Ross and Cobb breeds. The productive performance of Ross and Cobb breeds were compared with two Embapa breeds and Moro et al (2005) concluded that there was no significant difference obtained at the age of 56 days for any productive parameter. There were no difference found in the carcass yield of 49-day-old chickens from four different strains, but differences of up to 20% in amount of abdominal fat were acknowledged between different commercial breeds (Vieira and Moran, 1998). The different results obtained might be due to other important factors determining chicken performance and carcass characteristics which include sex, breed and slaughter age (Bilgili et al., 1992).

2.1.2 Sexual Dimorphism of Broiler for Growth

Fernandes et al. (2011) did a research on the effects of strain, sex and age on carcass parameters of broilers. Figure 2.1 and 2.2 below shows the differential growth pattern of Cobb and Ross broilers with the advancement of their age.
Figure 2.1  Growth curve of Cobb Slow from 1 to 42 days old

Males — \( \hat{Y} = -10.355 + 32.028 X - 0.340 X^2; R^2: 0.94. \)

Females — \( \hat{Y} = 26.417 + 16.398 X + 0.558 X^2 - 0.017 X^3; R^2: 0.98. \)

Figure 2.2  Growth curve of Ross 308 from 1 to 42 days old

Males — \( \hat{Y} = 34.449 + 10.637 X + 1.1480 X^2 - 0.0251 X^3; R^2: 0.98. \)

Females — \( \hat{Y} = 31.394 + 13.217 X + 0.704X^2 - 0.0186X^3; R^2: 0.95. \)
In Figure 2.1 and 2.2, males presented a greater live weight than the female at significant level of 0.05 (Fernandes et al., 2011). This sexual difference could be due to the presence of testosterone in males compared to the females. Deyhim et al. (1992) claimed that testosterone level increased the muscle percentage and comb growth of treated birds. It could also be seen that the inflexion point of growth for both the Cobb and Ross breeds was at 35 days age. This was supported by Marcato et al. (2009). The inflexion point which was the turning point of the curve showing the time that the bird reached its highest growth rate and thus, started to decrease (Reddish and Lilburn, 2004). However, from Figure 2.1, Cobb males' growth rate had not reached its point of inflexion and was still increasing. Further exploitation of this growth rate of Cobb would probably increase the yield.

Gunasekar (2007) stated that the modern broilers were continuously improving in their genetic potential for growth, by increasing 50g each year. Therefore, broilers were marketed earlier yearly by an average of 0.75g/ day. Creswell (2007) estimated that the same broiler had the potential to double this performance. This might be done through exploiting the inflexion point. If the inflexion point could be exploited, birds with higher meat quantity might be produced. Birds may be reared for a longer period without decrease in the growth rate, and hence producing heavier birds with more meat.

Table 2.1 Interactions between slaughter age and sex of broilers on the yield of boneless leg meat

<table>
<thead>
<tr>
<th>Slaughter Age</th>
<th>43 days</th>
<th>45 days</th>
<th>46 days</th>
<th>49 days</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>25.69a</td>
<td>27.87</td>
<td>27.97</td>
<td>27.83</td>
<td>1quadratic</td>
</tr>
<tr>
<td>Female</td>
<td>27.31a</td>
<td>27.02a</td>
<td>27.43a</td>
<td>27.76a</td>
<td>NS</td>
</tr>
<tr>
<td>Effect</td>
<td>P &lt; 0.05</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

Means followed by different lowercase letters in the row differ by Tukey's test; Means followed by different capital letters in the column differ by Tukey's test, NS = non-significant; Y = -315.6637 + 14.6053 - 0.1555018X^2 R^2: 0.98.
Table 2.2  Live and carcass weight (%) of different broiler strains

<table>
<thead>
<tr>
<th>Factors</th>
<th>Observations</th>
<th>Live weight (g)</th>
<th>Carcass (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobb Slow</td>
<td></td>
<td>3172.07&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>71.58&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cobb Fast</td>
<td></td>
<td>3148.33&lt;sup&gt;b&lt;/sup&gt;</td>
<td>72.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ross 308</td>
<td></td>
<td>3139.52&lt;sup&gt;b&lt;/sup&gt;</td>
<td>72.14&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ross 508</td>
<td></td>
<td>3169.18&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>72.97&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hybro</td>
<td></td>
<td>3242.54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>71.62&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Avian 48</td>
<td></td>
<td>3157.86&lt;sup&gt;b&lt;/sup&gt;</td>
<td>72.06&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>3501.47&lt;sup&gt;b&lt;/sup&gt;</td>
<td>71.98</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>2859.44&lt;sup&gt;b&lt;/sup&gt;</td>
<td>72.15</td>
</tr>
<tr>
<td><strong>Slaughter Age</strong></td>
<td></td>
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<td></td>
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<tr>
<td>43 days</td>
<td></td>
<td>2876.26</td>
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<tr>
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<td><strong>ANOVA</strong></td>
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<tr>
<td>Strain</td>
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<td>P&lt;0.01</td>
<td>P&lt;0.05</td>
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<tr>
<td>Sex</td>
<td></td>
<td>P&lt;0.01</td>
<td>NS</td>
</tr>
<tr>
<td>Slaughter age</td>
<td></td>
<td>Linear&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Quadratic&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Means followed by different letters in the column differ by Tukey's test; NS = non-significant; 1<sub>Y</sub> = -1295.10 + 99.77X ; R<sup>2</sup> = 0.97; 2<sub>Y</sub> = -71.96 + 6.04X - 0.0632X<sup>4</sup> ; R<sup>2</sup> = 0.60

Table 2.1 compared the yield of boneless legs of males and females and at day 47, the maximum yield for this characteristic was obtained. From the results, it can be concluded that the males should be slaughtered later for a better yield, while female flocks, should be slaughtered at earlier (Fernandes et al., 2011). In Table 2.2, males are seen to present a higher body weight compared to females.
2.2 Caponization

A capon is a rooster (cockerel) whose reproductive organ (testes) is removed at a young age or in other words, a castrated rooster. Jacob and Ben Mather (2000) stated that removal of the testes causes elimination of male sex hormones and thus, reduces the male sex instinct and changes the capon's behaviour. Caponized males grow slower than normal males and more body fat accumulation occurs due to their docile behaviour. Caponization process is done by making a one-inch incision between the two posterior ribs. Then, both testes should be taken out carefully to prevent a "slip". A "slip" causes the failure of the capon to produce the highly desirable meat qualities expected (Jacob and Ben Mather, 2000). According to Jacob et al. (2011), male chickens are caponized at two to four weeks of age and grown capons are marketed at 15 to 18 weeks of age. Some research claims that chickens are castrated at different age. Chen et al. (2014) and Lin et al. (2012) caponized chickens at 8 weeks of age.

2.2.1 Growth Performance of Capons

Previous researches done to study the growth performance and muscle production of capons when compared to intact males have shown numerous results, some showing opposite results. Some researches proved that caponization enhanced chicken growth when compared to intact counterparts. This has been demonstrated in researches done by Mast et al. (1981), Hsieh (2003) and Chen et al. (2006). The significant differences between the mean final body weights of the caponized and non-caponized group might be due to the elimination of male sex hormone in the caponized birds (Mahmud et al., 2013). The reduction of testosterone causes the males to be more docile and less active, thus allowing more efficient feed conversion into growth, fat deposition and higher meat quality (Deyhim et al., 1992; Fennell and Scanes, 1992; Fennel et al., 1996; Jacob and Ben Mather, 2000). Welter (1976), Rahman et al. (2004) and Chen et al. (2006) also concluded that the same effect which is capons were significantly heavier than the intact males. Oppositely, according to a research done by Miguel et al. (2008), who tested the effect of caponization on growth and meat characteristics in Castellana Negra native Spanish chickens. It was found that after 8 weeks of growth, there was no weight improvement of the capons as compared to the uncastrated birds. However, the different results obtained might be due to differences in breed, age and age at caponization (Chen et al., 2007).
REFERENCES


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