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# Evaluation on the effects of sex on growth and carcass characteristics of broilers

(Penilaian terhadap kesan jantina pada ciri-ciri pertumbuhan dan karkas bagi ayam pedaging)

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Key words: quantitative sex effect, growth, carcass, broilers

**Abstract**

Three experiments were carried out to determine the quantitative effects of sex on growth and carcass characteristics of Arbor Acre broiler chicken strain. In experiment I, birds were raised in straight-run groups while birds in sex-segregated groups were employed in experiment II. Individually-raised birds were investigated in experiment III. In terms of the various properties of growth performance studied, males were generally superior to females whether raised in mixed or sex-segregated groups or individually. Superiority in body weight, feed intake and feed conversion ratio ranged between 5.8–22%, 3.4–12.2% and 1.3–14.6%, respectively, over the ages of 22–46 days. At all ages under study, males were superior to females in body weight and feed intake. There was a trend of increased superiority with increasing age for body weight and feed conversion ratio. Differences in mortality rate and percentage of carcass yield between sexes were small and not significant while female birds showed indications of higher abdominal fat content than males, particularly at a young age of 22 days.

## Introduction

Body weight is probably the most important economic factor in the growth of broiler chickens. The male broiler has been known and accepted to be consistently superior to the female in terms of growth (Broadbent et al. 1981; Seet and Azizah 1981; Engku Azahan and Noraziah 2000). Engku Azahan (1984a) quoted superiority in body weight, males over females, of 20% at 56 days.

Another factor of economic importance to the broiler industry is carcass characteristics, specifically carcass dressed yield and fat content. The percentages of carcass yield and abdominal fat in male and female broilers have been variously reported in earlier work, ranging from observations of superiority in males (Engku Azahan et al. 2004), in females (Orr 1955) or the absence of any sex effect (Singh and Essary 1974; Seet and Azizah 1981).

Most modern-day broilers are raised straight-run in large groups. Even in certain cases where they are reared sex-segregated, group rearing is the norm. In the combined-sex straight-run group, males generally comprised some 50% of the flock. Males are generally more aggressive than females. Among those of the same sex, weaker birds reared in groups could be adversely affected by the stronger and more aggressive ones.

Although the superiority of males has been widely acknowledged, it is not known whether or not the superiority exists for all important growth and carcass parameters of economic importance and whether such

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superiority persists throughout the economic life of the bird. Further, if such superiority does exist for some or all economic growth parameters at various ages of the present-day broiler bird, it would be interesting to know the degree of superiority and the superiority pattern with advancing age of the bird. The possibility of competition from the more aggressive males or the stronger birds accounting at least in part for the inferiority of females, if any, should also be ascertained. This study attempted to seek answers to the above-mentioned questions.

**Materials and methods**

Three experiments were carried out to determine the quantitative effects of sex on the performance of commercial white broilers of the Arbor Acre strain raised under different rearing systems. Experimental birds were fed commercial starter crumbs (22.0% crude protein, CP; 12.4 MJ/kg metabolisable energy, ME) and finisher pellets (20.5% CP; 12.8 MJ/kg ME) ad libitum. All feeds were purchased from a single commercial source. Fresh drinking water was made available at all times.

In all experiments, comparative quantitative evaluations of growth and carcass yield were made on the male and female birds while in experiment II, abdominal fat content of the carcass was also investigated. Carcass yield was determined as the weight of empty carcass, without head, feet and shanks, as a percentage of live weight while the abdominal fat referred to all fats collected along the gastro-intestinal tract, from the proventriculus to the cloaca. All results were statistically analysed to determine differences between sexes at each age of evaluation.

***Experiment I: Effect of sex on body weight and dressed yield of broilers reared over four rearing ages***

A total of 336 broiler chicks were utilized in the trial conducted in a raised-floor wooden-slatted open house. They comprised equal number of males and females. These birds were divided into four equal replicate groups of 84 birds each. Each replicate was represented by equal number of male and female birds. Birds in each replicate were brooded separately under electric-bulb heating for 10 days.

For the first three weeks all birds were provided with starter crumble feed. This was followed by feeding commercial finisher pellets until the termination of the experiment at 46 days. At the ages of 23, 30, 37 and 46 days, male and female birds were separately weighed by replicate. At each of these ages, three females and the same number of male birds from each replicate were randomly sampled for determining carcass yield. Since male and female birds were raised together, measurements of feed consumption by sex were not possible.

***Experiment II: Effect of sex on growth and carcass parameters of broilers reared in sex-segregated groups***

In this experiment, 280-day-old male broiler chicks and the same number of females were purchased for the study. Birds of each sex were randomly divided into four equal replicate groups of 70 birds each. The brooding, nutrition, feeding method and feeding schedule were as adopted in experiment I. The experiment was carried out over a duration of 42 days. At the ages of 22 days and 42 days, body weight and feed intake were recorded by replicate. Feed conversion ratios (FCR) for each replicate over 22 days and 42 days were calculated based on the amount of feed consumed and body weight gained over the same period. Mortality for each replicate group was recorded as and when it occurred. At the age of 22 days and at the termination of the experiment at 42 days, 10 female birds and the same number of males were randomly sampled for determination of carcass yield and abdominal fat content.

***Experiment III: Growth performance and carcass yield of male and female broilers raised in individual cages***

Twenty male broiler chicks and an equal number of female birds were brooded separately in groups in wire-floor cages. At the age of 14 days, they were transferred to individual wire-floor cages measuring 50.8 cm wide x 55.9 cm deep x 61 cm high. From the age of day one until the age of 14 days, the birds were fed commercial starter crumble feed. This was followed by finisher pellets until the termination of the experiment at 42 days. Individual body weights were recorded at the ages of 14 days and 42 days. The intakes of feed over the same period were measured and the respective FCR calculated. At the end of the experiment, all birds were slaughtered and dressed to determine the dressing percentage.

**Results**

***Experiment I***

At all the ages investigated, live weights of male birds were greater than the corresponding weights of females *(Table 1)*. The superiority in weight of males over females was significant at all ages ($p$ <0.05) and ranged from 12.2–22%. The difference in live weight between males and females increased as the birds aged *(Figure 1)*.

For both male and female birds, there was a pattern of increasing dressed yield as the birds aged. However, at each of the ages under study, differences in percentage of dressed yield between sexes were small and not significant ($p$ >0.05).

***Experiment II***

A similar growth pattern and yield of carcass was observed in sex-segregated birds *(Table 2)*. Males reared separately from females showed superiority in live weight ($p$ <0.05) over females and the difference in weight was more pronounced at the older age of 42 days as compared to that at 22 days.

Male broilers consumed significantly more feed ($p$ <0.05) than females over both ages. The differences at the two rearing ages ranged from 3.4–4.6%. Males were also more efficient in converting feed to body weight and the superiority in FCR was greater at the older age *(Table 2)*.

There were indications of females having more abdominal fat per unit body weight at both ages although significant difference was only in the carcass of birds slaughtered at the age of 22 days.

Differences in mortality rates and carcass yield between sexes were inconsistent or small and not significant at both ages under study.

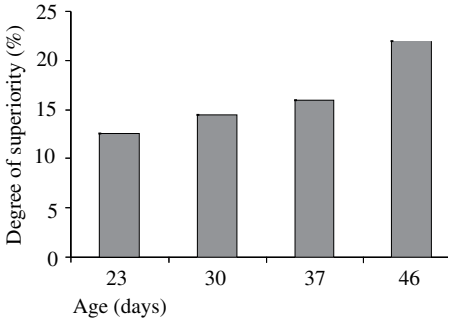


*Figure 1. Superiority in body weight of male over female broilers at different ages*

Table 1. Body weight and carcass yield of male and female broilers reared together in mixed groups over the ages of 23–46 days (means ± standard errors of the means)

| | | 23 days | 30 days | 37 days | 46 days |
|---|---|---|---|---|---|
| Body weight (g) | Male | 1088 ± 17 | 1670 ± 83 | 2189 ± 06 | 2840 ± 155 |
| | Female | 966 ± 27* | 1459 ± 12* | 1887 ± 59* | 2328 ± 113* |
| Dressed yield (%) | Male | 70.6 ± 1.3 | 70.6 ± 1.3 | 72.6 ± 1.4 | 74.4 ± 1.7 |
| | Female | 69.4 ± 1.3ns | 70.1 ± 2.0ns | 72.4 ± 2.2ns | 72.4 ± 1.1ns |

*Statistically significant ($p$ <0.05) at each age group and for each parameter
ns = Statistically not significant at each age group and for each parameter

Table 2. Growth and carcass characteristics of broilers reared in sex-segregated groups at 22 days and 42 days (means ± standard errors of the means)

| | | 22 days | 42 days |
|---|---|---|---|
| Body weight (g) | Male | 876 ± 40 | 2326 ± 49 |
| | Female | 828 ± 11* | 1931 ± 24* |
| | Difference (%) | 5.8 | 20.5 |
| Feed intake (g) | Male | 1260 ± 14 | 3875 ± 29 |
| | Female | 1205 ± 22* | 3749 ± 96* |
| | Difference (%) | 4.6 | 3.4 |
| Feed conversion ratio (FCR) | Male | 1.52 ± 0.06 | 1.70 ± 0.03 |
| | Female | 1.54 ± 0.02ns | 1.99 ± 0.05* |
| | Difference (%) | 1.3 | 14.6 |
| Mortality (%) | Male | 2.1 ± 2.7 | 15.2 ± 3.4 |
| | Female | 1.8 ± 1.2ns | 17.0 ± 3.7ns |
| | Difference (%) | 14.3 | 10.6 |
| Dressed yield (%) | Male | 68.6 ± 1.3 | 73.1 ± 1.3 |
| | Female | 68.7 ± 1.3ns | 74.0 ± 1.2ns |
| | Difference (%) | 0.1 | 1.2 |
| Abdominal fat (%) | Male | 1.18 ± 0.32 | 2.01 ± 0.31 |
| | Female | 1.48 ± 0.42* | 2.08 ± 0.45ns |
| | Difference (%) | 20.3 | 3.4 |

*Statistically significant ($p$ <0.05) at each age group and for each parameter
ns = Statistically not significant at each age group and for each parameter

Table 3. Growth and carcass yield of broilers reared individually in cages over 42 days (means ± standard errors of the means)

| | | |
|---|---|---|
| Body weight at 14 days (g) | Male | 362 ± 21 |
| | Female | 329 ± 20* |
| | Difference (%) | 10.0 |
| Body weight at 42 days (g) | Male | 2201 ± 140 |
| | Female | 1896 ± 151* |
| | Difference (%) | 16.1 |
| Feed intake, 14–42 days (g) | Male | 2869 ± 142 |
| | Female | 2557 ± 202* |
| | Difference (%) | 12.2 |
| Feed conversion ratio, 14–42 days (FCR) | Male | 1.54 ± 0.09 |
| | Female | 1.63 ± 0.07* |
| | Difference (%) | 5.5 |
| Dressed yield at 42 days (%) | Male | 76.7 ± 1.0 |
| | Female | 76.9 ± 1.3ns |
| | Difference (%) | 0.3 |

*Statistically significant ($p$ <0.05) at each age group and for each parameter
ns = Statistically not significant at each age group and for each parameter

***Experiment III***

In individually-raised birds, superiority of males over females was again observed for various growth parameters *(Table 3)*. Differences in body weights, feed intake and FCR were all statistically significant between male and female birds ($p$ <0.05) while the difference in dressed yield was small and not significant. Between the ages of 14 and 42 days, the degree of superiority

of males over females was apparently most pronounced for body weight gain (14.8%) followed by feed intake (12.2%) and FCR (5.5%).

**Discussion**

The superiority of male over female broilers has been amply demonstrated in all experiments conducted in this study. Males were superior to females in body weight and feed intake at all ages investigated while for FCR, significant superiority for males was noted at the older age of 42 days. Overall, these findings provide more information as well as further augment the reports by earlier workers on broilers (Engku Azahan and Noraziah 2000; Noraziah et al. 2001; Liu et al. 2006) as well as works on various poultry species such as turkey (Engku Azahan 1994), ostrich (Noraziah and Engku Azahan 1999) and pheasant (Engku Azahan et al. 1993).

It should be noted that this superiority extended not only to common growth parameters such as body weight and feed intake, but FCR as well. This implies that the male not merely put on more weight than the female because of its higher feed intake, but was also due to its better physiological capacity in converting feed into body mass.

Females raised in groups, whether in combination with males or sex-segregated, showed similar magnitudes of inferiority to males ranging between 20.5–22% at the ages of 42–46 days. This could indicate that there was no suppressive domination of females by males during growth which could have resulted in hindered growth of the former group. In fact group rearing could have encouraged more consumption of feed by birds resulting in increased growth. The results of slightly lower body weights for birds reared individually (Experiment III) as compared to those of the same age raised in groups (Experiment II) tend to support this contention, although no statistical comparison was made in this study. With no encouragement or competition from group members, individually-raised bird might not be tempted to consume extra feed which could be converted into body weight.

Younger birds were more efficient than older animals in converting feed. The superiority was observed in both males and females. However the magnitude of superiority of males over females in feed conversion efficiency increased as the bird aged as similarly observed for body weight.

Percentage of carcass yield is a measure of the empty carcass in relation to live weight. In the preparation of carcasses, 23–27% of live weight was lost at 35–46 days. At younger ages of 30 days or younger, some 30% body weight was lost. These losses were contributed mainly by blood, feathers, head, feet and shank, abdominal fat, viscera and gut contents. The apparent lack of significant differences in this measure between male and female birds was also observed by Singh and Essary (1974), Engku Azahan (1984a, b), Engku Azahan and Noraziah (2000) and Engku Azahan et al. (2004). This indicates that the development of the internal organs was in proportion to the build-up of the total body parts of the bird irrespective of sex.

Female animals, including poultry, generally build up more abdominal fat than males. The same was observed for the broilers in this study although significant difference was noted only at the younger age of 22 days.

**Conclusion**

Male broilers were superior to females in growth parameters such as body weight, feed intake and feed conversion efficiency. This superiority ranged from 1.3–22.0%, was most significant for body weight and generally was apparent at all stages of the economic life of the broiler. The degree of superiority generally increased with advancing age. The difference in mortality rate between sexes was not significant. As a percentage of live weight, no difference in dressed yield was observed between male and female carcasses while there

were indications of higher abdominal fat deposition in females than males, especially in young birds.

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**Abstrak**

Tiga uji kaji telah dijalankan pada ayam pedaging daripada strain Arbor Acre untuk menentukan kesan kuantitatif jantina terhadap ciri-ciri pertumbuhan dan karkas. Dalam uji kaji I, ayam dipelihara dalam kumpulan yang mengandungi ayam betina dan jantan secara bercampur. Ayam yang dipelihara dalam kumpulan yang berasingan jantina dikaji dalam uji kaji II manakala uji kaji III pula mengkaji prestasi ayam pedaging yang dipelihara secara individu. Dari segi ciri-ciri pertumbuhan, ayam jantan mempunyai kelebihan daripada ayam betina sama ada dipelihara secara berkumpulan atau individu. Kelebihan dari segi berat badan, pengambilan makanan dan nisbah penukaran makanan masing-masing julat antara 5.8–22%, 3.4–12.2% dan 1.3–14.6% bagi tempoh umur pemeliharaan 22–46 hari. Pada kesemua umur yang dikaji, ayam jantan menunjukkan kelebihan dalam ciri berat badan dan pengambilan makanan. Terdapat trend ke arah peningkatan pada kadar keunggulan ayam jantan dengan meningkatnya umur ayam, bagi ciri berat badan dan nisbah penukaran makanan. Perbezaan pada peratus kematian dan peratus hasilan karkas antara jantina adalah kecil dan tidak signifikan manakala ayam betina menunjukkan tanda-tanda mempunyai kandungan lemak abdomen yang lebih tinggi, khususnya pada umur 22 hari.


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