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# Genetic Evaluation of Body Weight Traits in Local Rabbit

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**Abstract.** This study was carried out on seventy-six local rabbit (white, black and white and brown white coat color) to investigate the effect of some non-genetic factors on body weight traits in local rabbits with the genetic evaluation of local rabbits by estimated BLUP value of marketing weight. The overall mean of marketing weight, dressing % and average daily gain arrived 1476.01 ± 33.10 g/rabbit, 51.32 ± 0.84 % and 17.22 ± 0.69 g/day/rabbit, respectively. The black-white coat color rabbits excelled in most of the studied traits, especially in weight at marketing (1615.88 ± 31.96 g/rabbit), daily weight gain (19.90 ± 0.64 g/rabbit) and carcass weight (820.588 ± 15.813 g/rabbit) over the other colors, while the highest dressing ratio was in the white rabbits (52.83 ± 0.67 % /rabbit). A significant and numerical superiority of male rabbits over female in the traits under study. A significant positive correlation was recorded among most traits under study. The BLUP values for rabbit ranged from -700 to 100 g/rabbit. These result indicated that there are big genetic variations in this population of local rabbit. It indicates that selection can play a major role in improving body weight traits in local rabbit.

**Keywords.** Local rabbit, BLUP, Marketing weight, Carcass, Dressing.

## 1. Introduction

Rabbit is one of the potential animals and can be used for experimental or development for meat production, the existence of selection and crossbreeding is performed in rabbits [1]. Rabbits are mammals with a high economic value, which require little amount of food to produce meat with a higher protein content (20%) and good flavor. Rabbit meat is easy to digest, has low in fat (11-20%) and low caloric value (795) and rich with minerals. Additionally, rabbits have being short life cycle animals, don't require wide places for breeding and don't compete with human for their food. The economy of the rabbit industry depends on rabbits being developed and maintained with the highest level of reproductive efficiency. [2]. Rabbit meats has a desirable protein content as well as essential amino acid proportions. Moreover, the effectiveness in dietary manipulation, combined with a promising improvement of oxidative stability of rabbit meat with its "functional" properties, qualify rabbit meat is also one of the most valuable sources of meat [3, 4]. In study on Pannon white rabbits [5] reported that the body weight of rabbits at 74, 84 and 94 days of age, arrived 2.53, 2.84 and 3.15 kg/ rabbit, respectively. [6] Showed that average body weight at 10 weeks of Angora rabbits arrived 1.43±0.10 kg/rabbit. In a New Zealand white, Papillon and Flemish giant rabbits, [7] reported that the average live body weight at 3 months of age was 1687.08, 1759.23 and 1860.42 g/rabbit, respectively, and the average daily weight gain from 1- 3 months of age was 20.52, 23.5 and 24.36 gm/rabbit/day, respectively.

The choice of farm animals for increasing the income from animal breeds should be based on the availability of information's on these animals. In addition, growth characteristics are a good key and indicator since they affect how efficiently farm animals reproduce. Fast growths characteristics enable

animals to be reared earlier and produce more offspring throughout their lives. Identification and characterization of breeds is a must to identify the genetic resources and also to prioritize breeds for conservation and development. Assessing genetic variability within and among populations is essential for analyzing complete population structure. The complete population structure helps to plan strategies for conservation and development of a breed [8].

The aim of this study is to investigate the effect of some non-genetic factors on body weight traits in local rabbits with the genetic evaluation of local rabbits by estimated BLUP value of marketing weight in the Kurdistan region of Iraq.

## 2. Materials and Methods

This study was carried out in Grdarasha station, College of Agricultural Engineering Sciences, Salahaddin University-Erbil. A 76 local rabbit with one month of age (26 white-colored rabbits, 21 black and white-colored rabbits, and 28 from brown white colored rabbits) were used. Animals were kept in opened cages surrounded by fence, furnished with water supply (nipple drinkers), lighting (14 h light: 10 h darkness), and exhaust ventilation. Water and feed were available ad libitum. Animals were fed a pelleted commercial diet, containing 23% crude protein, 16.1% crude fiber, and 3.2% crude fat.

Rabbits were weighed every month continuously until they reach marketing weight and slaughtered at marketing age (fourth month). The daily gain also recorded. The animals were slaughtered under a permit from the Local Ethics Committee in Quran. The rabbits were stunned and immediately bled, pelted, and eviscerated. Carcass traits were recorded, including hot carcass weight without head, and cold carcass weight.

The PROC GLM (General Linear Model) procedure in [9] was used to analyze the data. Fixed effects: rabbit coat color, sex of rabbit was fitted in the following model:

$$Y_{ijk} = \mu + C_i + S_j + \varepsilon_{ijk}$$

Where: Y ijk = 1-month weight, 2-month weight, 3-month weight and ADG of n rabbits, of i coat color (Ci, i=1 white, 2 black white and 3 brown white); of j gender of rabbit (Aj, j= 1 male; 2 female), μ = Population means; Eijk = random error. It was estimated that was normally and independently distributed with mean zero and variance. The correlation coefficient was also determent by PROC CORR in SAS (2002) software among body weight traits in local rabbits.

For genetics evaluation of doe for numerous performance characteristics, Best Linear Unbiased Prediction (BLUP) procedure described by Henderson (1973) was employed. For this purpose, the Mixed Model was used (fixed + random effects) of SAS (2002) software**.**

## 3. Results and Discussion

As in Table No. 1 that there are significant differences between rabbits of different colors in weight characteristics at different ages. There is a significant difference between the black-white rabbits with white and brown white coat color in the first, third months and daily weight gain. The black-white furred rabbits excelled in most of the studied traits, especially in weight at the age of one month (518.57 ± 23.22 g/rabbit) and three months of age (1615.88 ± 31.96 g/rabbit) and daily weight gain (19.90 ± 0.64 g/rabbit). While the lowest weights were for rabbits with brown white coat color in the first and third months, as well as the daily weight gain (Table, 1). As for the white rabbits, their weights were intermediate between the two previous colors in the three weights and the daily weight gain from the first month until the marketing weight. As it shown in table 1 by increasing daily weight gain the body weight increased the rabbit that have a higher daily weight gain has higher body weight in every month. These differences in weights and the daily weight gain between the three colors of rabbits may be due to the presence of differences in the genetic structure of the different colors. This results were agreement with what reported by [7] in three different rabbit breed (New Zealand white, Papillon and Flemish giant) rabbits were live body weight at 1, 2 and 3 months of age was (537.92, 443.08 and 496.42 g/ rabbit), (1104.17, 1123.46 and 1182.5 g/rabbit) and (1687.08, 1759.23 and


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1860.42 g/rabbit), respectively, and the average daily weight gain from 1- 3 months of age was 20.52, 23.5 and 24.36 gm/rabbit/day, respectively.

The results of the statistical analysis show a significant and numerical superiority of male rabbits over female in the traits under study, as the marketing weight and daily weight gain of males (1550.41 ± 30.21 g/rabbit and 18.71 ± 1.33 g/day/rabbit) versus (1440 ± 34.15 g/rabbit and 16.36 ± 0.61g/day/rabbit) in females (Table, 1). These results are in line with the result from previous studies [10] reported that the reason for this is due to the effect of the male hormone and its effect on nitrogen retention in the body and the increase in utilization of it, thus increasing the daily weight and final weight more for males compared to females.

**Table 1.** Mean ± SE for effect of Rabbit coat color and sex on body weight traits in the local rabbit.

| Factors | Trait | Mean ± SE | | | |
|---|---|---|---|---|---|
| | | One Month weight(g) | Two Month weight(g) | Three Month weight(g) | ADG |
| Coat color | Black White | 518.57 ± 23.22 a * | 1068.57 ± 28.25 c | 1615.88 ±31.96 a * | 19.90 ± 0.64 a * |
| | Brown White | 440.45 ± 23.26 b | 820 ± 22.81 a ** | 1290.90 ±36.03 c | 14.25 ± 0.77 ab |
| | White | 468.86 ± 11.73 ab | 955.27 ± 25.28 b | 1521.25 ±31.32 b | 17.50 ± 0.66 a |
| Gender | Male | 535.76 ± 12.85 a ** | 973.18 ± 22.60 a | 1550.41 ±30.21 a * | 18.71 ± 1.33 a |
| | Female | 417.64 ± 6.24 b | 933.04 ± 28.76 a | 1440 ± 34.15 b | 16.36 ± 0.61 a |

The same letter at the same Colom of each factor means non-significant., * It means significant at (P≤0.05), ** It means significant at (P≤0.01) [9].

**Table 2.** Mean ± SE for Effect of Rabbit coat color and sex on carcass weight and dressing % in local rabbit.

| Factors | Trait | Mean ± SE | | |
|---|---|---|---|---|
| | | Live Body weight (g) | Carcass weight (g) | Dressing % |
| Coat color | Black White | 1615.88 ± 31.96 a * | 820.588 ± 15.813 a*** | 50.95 ± 0.65 ab |
| | Brown White | 1290.90 ± 36.03 c | 637.500 ± 29.685 b | 50.18 ± 1.21 b |
| | White | 1521.25 ± 31.32 b | 804.375 ± 19.684 a | 52.83 ± 0.67 a* |
| Gender | Male | 1550.41 ± 30.21 a * | 794.583 ± 17.53 a* | 51.25 ± 0.61 a |
| | Female | 1440 ± 34.15 b | 733.333 ± 23.09 b | 51.67 ± 0.77 a |

The same letter at same Colom of each factor means non-significant., * It mean significant at (P≤0.05), *** It mean significant at (P≤0.001) [9].

The results of the weight of rabbits during marketing were reflected in the carcass weight and the dressing ratio (Table, 2), as the black and white rabbits exceeded the carcass weight (820.588 ± 15.813 g/rabbit) over the other colors, while the highest dressing ratio was in the white rabbits (52.83 ± 0.67 % /rabbit). The males (794.583 ± 17.53 g/rabbit) also outperformed the females (733.333 ± 23.09 g/rabbit) in carcass weight and significantly. These results were agreement with [11] in Algeria rabbit who found significant different between male and female in average body weight 2.85 kg for females


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and 2.70 kg for males. Non-significant between the sexes in the dressing ratio, in study by [12] states that male rabbits generally weight more than females. In contrast, [13] revealed that although live female rabbits produced lower slaughter ratio than male rabbits despite being sustainably heavier. These variations were described by the higher gut contents in female rabbits. In many species males have a higher development potential than females, but when rabbits are slaughtered prior to adult weight the variation are rarely noticeable [14].

The results of Table No. 3 show that there is a significant positive correlation between the daily weight gain rate with each of the body weight at the age of two months and the marketing age with the carcass weight, while the carcass weight has a significant positive correlation with each of the two months old weight, the market weight and the dressing ratio. Similar results were reported [11] in Algeria rabbit who found the correlations between weight at different ages and of ADG are all positive and very significant. Negative correlations were recorded between each of the weight at the age of one month with the daily weight gain and the dressing percentage, and between the weight at the age of two months and the dressing percentage as well, similar previous results, in agreement with present study, were reported by [15].

**Table 3.** The correlation coefficient among body weight traits in the local rabbit.

| Traits | One month weight | Two Month weight | Threemonth weight | Carcass weight | Dressing percentage | ADG |
|---|---|---|---|---|---|---|
| One month weight | 1 | 0.471 *** | 0.244 N.S | 0.173 N.S | - 0.163 N.S | - 0.036 N.S |
| Two Month weight | | 1 | 0.768 *** | 0.605 *** | -0.08 N.S | 0.366 * |
| Three-month weight | | | 1 | 0.875 *** | 0.096 N.S | 0.794 *** |
| Carcass weight | | | | 1 | 0.561 *** | 0.755 *** |
| Dressing percentage | | | | | 1 | 0.193 N.S |
| ADG | | | | | | 1 |

N.S means non-significant, * means significant at (P≤0.05), *** means significant at (P≤0.001) [9].

Best Linear Unbiased Prediction (BLUP) can be used with various models to predict breeding values and estimate environmental effects. The properties of the BLUP procedure are as follows:

Best: maximization of the correlation between the true breeding value and the predicted breeding value.

Linear: predicted breeding values are linear function of the observations. Unbiased: estimates of fixed effects are unbiased and the unknown, true breeding values are distributed about the predicted breeding values.

Prediction: the procedure predicts the true breeding values.

BLUP is generally used to predict sire breeding values, given measurements on progeny, or to predict breeding values of animals with repeated records, or to predict breeding values of all animals in the pedigree [16]. BLUP is the procedures for genetic evaluation of livestock require accurate estimates of genetic and environmental parameters. Best linear unbiased prediction is one of the current methods of choice for genetic evaluation of quantitative traits.

The estimated Best Linear Unbiased Prediction (BLUP) of rabbit for the marketing is presented in (Table 4). The BLUP values for rabbit ranged from -700 to 100 g/rabbit. Nearly the same result obtained by [17] which showed that there are significant genetic differences between rabbit for body weight traits. It indicates that selection can play a major role in enhancing body weight characteristics in local rabbits.


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**Table 4.** BLUP value of three months' weight in local rabbit.

| Rabbit No. | BLUP | Rabbit No. | BLUP | Rabbit No. | BLUP |
|---|---|---|---|---|---|
| 31 | -700 | 38 | -350 | 25 | -50 |
| 41 | -700 | 47 | -350 | 53 | -50 |
| 54 | -700 | 65 | -350 | 17 | -50 |
| 37 | -670 | 3 | -340 | 52 | 0 |
| 28 | -640 | 69 | -270 | 76 | 0 |
| 43 | -620 | 7 | -250 | 51 | 50 |
| 44 | -600 | 14 | -250 | 75 | 50 |
| 34 | -600 | 24 | -250 | 23 | 100 |
| 18 | -600 | 66 | -250 | | |
| 40 | -520 | 74 | -250 | | |
| 11 | -500 | 71 | -230 | | |
| 18 | -600 | 13 | -200 | | |
| 4 | -400 | 58 | -200 | | |
| 9 | -400 | 73 | -200 | | |
| 19 | -400 | 15 | -150 | | |
| 45 | -400 | 26 | -150 | | |
| 64 | -400 | 48 | -150 | | |
| 2 | -370 | 55 | -100 | | |
| 6 | -350 | 57 | -80 | | |

## Conclusions

In conclusion, the overall mean of ADG 17.22 ± 0.69 g/day/rabbit and marketing weight 1476.01 ± 33.10 g/rabbit with dressing % 51.32 ± 0.84 in present study with the high range of BLUP value of marketing weight in local rabbit (-700 to 100 g/rabbit) indicated that there are big genetic variations among rabbit for these traits and selection process can play a big role in improving these traits in local rabbit.

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