



RESEARCH PAPER

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Growth traits and genetic potential of local rabbits

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Key words: Rabbits, Linear body measurements, Body weight, Correlation, Heritability.

<http://dx.doi.org/10.12692/ijb/13.4.444-449>

Article published on October 30, 2018

Abstract

Growth traits and transmission of genetic potential of local rabbits were studied at Rabbitry unit of the University of Agriculture Peshawar. A total of 48 breeding rabbits (40 does and 8 bucks) were used in the study. General linear model (GLM) was used to study the effect of dam and sire on growth parameters. Average weaning weight and body weight gain was 0.449 ± 0.04 and 0.615 ± 0.15 g, respectively. Mean heart girth and body length was found 15.33 ± 2.21 and 15.74 ± 2.09 , respectively. Litter size was found 4.49 ± 1.15 . Dam and sire significantly ($P < 0.0001$) affected litter size, weaning weight, body weight gain, heart girth and body length. Positive and significant correlation (0.93 , $P < 0.0001$) was found between body weight gain and heart girth followed by high positive correlation (0.90) between body weight gain and body length. Heritability estimate (h^2) for weaning weight and body weight gain was 0.94 and 0.14 , respectively, while (h^2) for heart girth and body length was 0.15 and 0.08 , respectively. It was concluded from the study that dam and sire had significant and linear affect on weaning weight, body weight gain and other morphometric traits. Weaning weight heritability estimates indicating it as a candidate trait for selection in local rabbits. Relationship between heart girth and body weight is much stronger and may be consider in selective breeding.

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Introduction

Rabbit meat is one of the rich source of animal protein which is not commonly used in Pakistan. They require simple management skills, less capital investment, and quick income generation source making it a high profitable enterprise, and hence should be given priority for rearing to achieve the goals of the demand of animal protein and ever increasing population of the country. Rabbit meat contain 21% protein which is higher than any livestock specie. They have the potential to easily convert cellulose-rich plants to protein than chickens and turkeys (Lebas *et al*, 1997). Because of the highest percentage of proteins (21%), and less fat content, sodium and cholesterol it is considered safe for the people with cardiovascular diseases (Aduku and Olukosi, 1990). Keeping in view the economic feasibility of rabbit production, the number of kids born (litter size) is the most important economic character (AbouKhadiga, 2004; Belhadi, 2004; Nofal *et al*, 2005). By adopting certain breeding strategies coupled with the opportunity of diversity of rabbit breeds, the efficiency of commercial meat production can be enhanced (Piles *et al*, 2004). The number of kids born (litter size) is improved by crossbreeding between breeds or lines within breeds and it is mainly controlled by heredity (AbouKhadiga, 2004; Nofal *et al*, 2005).

Carcass characteristics, skeletal size, and live weight gain of rabbits are indicated through linear body measurements. The linear body measurements and body weight of meat animals have been found useful in quantifying body shape and size (Ibe and Ezekwe, 1994). The relationship present among various linear body measurements can also be used for genetic improvement in animals especially in rabbits. (Tihamiyu *et al*, 2000; Chineke, 2000, 2002, and 2005 and Abdullah *et al*, 2013). The present study was conducted to evaluate the growth traits and genetic potential of local rabbits and to correlate traits of economic importance in these rabbits.

Materials and methods

Selection of rabbit

A total of forty eight rabbits (8 males and 40 females) were selected for this study. Animals received ad

libitum quantity of concentrate pellet diet and green forage throughout the trials period (Table 1). The concentrate was formulated according to NRC (1977) crushed and converted to pellet form at the feed processing unit. Animals were have a free access to clean drinking water. Medication were given when necessary and strict hygienic conditions were maintained at the farm. Data of the following performance traits was recorded including linear body measurements.

Body weight gain

Body weight gain was taken in grams on weekly basis using analytical balance. The balance was cleaned through a piece of cloth to minimize error before measuring weight. The animals were individually weighted and the data were recorded.

Weaning weight

Weaning weight was taken in grams on day 45. After weaning the litters were housed as group of 6-8 in wooden cages fenced by metallic iron wire mesh.

Linear body measurements

The following measurements were taken in cm. Heart girth (HG) the circumference of the body just behind the fore limbs. Body length (BL) The distance from the atlas to the first coccygeal vertebra. (Ebegbeulem; 2012).

Statistical analysis

Data were analyzed using GLM ($Y_{ijk} = \mu + \alpha_i + \beta_j + \epsilon_{ijk}$). The SAS software was used for analysis of variance and means were compared through Duncan multiple range test.

Calculation of heritability

Heritability was estimated using statistical random model devised by lush (1940),

$$h^2 = 4 \text{ var}_{se} / 4 \text{ var}_s \text{ var}_w$$

Results and discussion

Performance traits

Litter number

Average litter size in local rabbits was found 4.49 \pm 1.15, ranges from 2.00 to 6.00 (Table 2). Analysis of variance of litter number was significantly ($P < 0.0001$) affected by Dam and sire.

Correlation of litter size was positive and significant ($P < 0.0001$) with weaning weight, body weight gain, heart girth and body length as shown in (Table 3). Similar results shown by (Oloffeso *et al*; 2012) that average litter size is 4.43 ± 1.03 and is significantly affected by dam and sire. The litter size was positive and significant ($p < 0.05$) with all linear body measurements. This positive and significant correlation of litter size with linear body measurements was also shown by (Ebegbulam; 2012, Ozimba & leukefhar; 1991, Dalle zote and Pacii; 2012) but they reported the litter size 8.3 ± 0.15 and high value is because of breed difference. They used exotic breeds like California, Red baldhi etc. These animals have high reproductive efficiency as compared to local rabbits used in the present study.

Weaning weight

Average weaning weight in local rabbits was $0.449 \pm 0.04g$, ranged from 0.363 to 0.497g (Table 2). Analysis of variance of weaning weight was significantly ($P < 0.0001$) affected by dam and sire. Correlation of weaning weight was positive and significant ($P < 0.0001$) with litter size, body weight gain, heart girth, body length in local rabbits shown in (Table 3). Garcia *et al*; 2002 conducted a study on litter traits and they reported average weaning weight of $0.492 \pm 0.12g$ and its analysis of variance was highly significant ($P < 0.0001$) which was similar to our present study and also described that weaning weight is positive and significantly correlated to different lengths as studied in the present study. However, (Ozimba & Leukifahr; 1991) reported slightly high value of weaning weight because the breed used by them was New Zealand white and other crossbreed rabbits while in the present study local rabbits were reared and they had low genetic potential as compared to those breeds.

Body weight gain

Average body weight gain in crossing local rabbits was found $0.615 \pm 0.15g$ ranges from 0.391 to 1.210g (Table 2). Analysis of variance of body weight was significantly ($P < 0.0001$) affected by dam and sire. Correlation of body weight gain was positive and significant ($P < 0.0001$) with litter size, weaning

weight, heart girth and body length in local rabbits shown in (Table 3). The study performed by (Olawwmi; 2014) shows similar results to the present study, however (Karima *et al*; 2002, Abdel ghani; 2000 and Dalle zotte; 2012) in their study showed high body weight gain of $1,118 \pm 35.8$, $1,143 \pm 13.4$, $1,163 \pm 0.15g$, respectively. This high weight in contrast to present study is because of time interval. In present study the mature weight was taken while the weight reported by them was adult weight and the difference of time interval between mature weight and adult weight is 8 weeks.

Heart girth

Average heart girth in indigenous rabbits was found $15.3 \pm 2.21cm$ ranges from 10 to 20.8cm (Table 2). Analysis of variance of heart girth was significantly ($P < 0.05$) affected by dam and sire. Correlation of heart girth was positive and significant ($P < 0.0001$) with litter size, weaning weight, body weight gain and body length, in local rabbits shown in (Table 3). The findings of the present study was slightly lower from the results shown by (Ebegbeulam; 2012) who reported the body length $22.12 \pm 0.52cm$ but the difference was due to time interval and age of the rabbits. However the correlation with linear measurements of heart girth was similar to the present results.

Body length

Average body length in local rabbits was found $15.74 \pm 2.09cm$ ranges from 12.00 to 22.00cm (Table 2). Analysis of variance of body length was significantly ($P < 0.0001$) affected by Dam and sire. Correlation of body length was positive and significant ($P < 0.0001$) with litter size, weaning weight, body weight gain and heart girth in local rabbits shown in (Table 3). Similar results of body length were shown by (Ogah; 2012 and Olawwmi; 2014).

Heritability estimate (h^2)

Heritability values, calculated through parental half-sib correlation method are given in (Table 4). Heritability estimate for performance traits were studied in the present study resulting (0.94 for weaning weight, 0.14 for body weight gain, 0.15 for heart girth and finally 0.08 for body length) respectively.

Moderate heritability obtained from the present study for body weight, body length and heart girth were similar to those estimates obtained from studies of Egypt (Khalil *et al* 2000; Iraqi *et al* 2002), in Spain (Estany *et al* 1992; Gomez *et al* 2000), and in Brazil (Ferraz and Eler 1994 and 1996). Although heritability for weaning weight in the present study is much greater to all of the above whereas high heritability in weaning weight was because of weaning time interval. In the present study weaning was done on day 45 as compared to other findings which was on 35 days. So, much weight is attained here.

Table 1. Ingredients and Chemical composition of diet fed to rabbits.

Ingredients (%)	Composition
Fresh fodder (Berseem)	50.0
Maize (Crushed)	25.0
Wheat bran	14.8
Cotton seed cake	4.0
Soybean meal	4.0
Palm oil cake	2.0
Mineral Mixture	0.20
Chemical Composition	
Crude Protein	16
Ether Extract	18.5
Crude Fiber	2.8
Digestible Energy (MJ/kg)	9.67

Table 2. Descriptive statistics of various traits for local rabbits.

Traits	Mean \pm SD	Local rabbits	
		Range	
		Minimum	Maximum
Litter size	4.49 \pm 1.15	2.000	6.000
Weaning weight(gm)	0.449 \pm 0.04	0.363	0.497
Body weight gain(gm)	0.615 \pm 0.15	0.391	1.210
Heart girth(cm)	15.33 \pm 2.21	10.000	20.800
Body length(cm)	15.74 \pm 2.09	12.000	22.000

Table 3. Correlation among various traits of local rabbits.

Traits	Litter Size	Weaning weight	Body weight gain	Heart girth	Body length
Litter Size	-----	0.534 0.0001	0.162 0.0001	0.174 0.0001	0.097 0.003
Weaning weight	-----	-----	0.351 0.0001	0.356 0.0001	0.25 0.0001
Body weight gain	-----	-----	-----	0.930 0.0001	0.906 0.0001
Heart girth	-----	-----	-----	-----	0.844 0.0001
Body length	-----	-----	-----	-----	-----

Table 4. Estimation of genetic worth of some economic traits for BCA, in local rabbits.

Traits	Genetic variance σ^2_g	Environmental variance σ^2_e	Phenotypic variance σ^2_p	Estimated genetic worth (h^2)
Weaning weight	0.00179	0.000059	0.0019	0.94
Body weight gain	0.0029	0.019	0.0219	0.14
Heart girth	0.73	4.24	4.97	0.15
Body length	0.33	4.08	4.41	0.08

Conclusions and recommendations

It was concluded from the present study that class variable Dam and Sire had significant and linear effect on weaning weight, body weight gain and other morphometric characteristics. Weaning weights had the highest genetic worth indicated it as a candidate trait for selection in local rabbits. Relationship between Heart girth and body weight is much stronger and may be used in selective breeding. Males with superior genetics may be used for optimizing economic traits of rabbits. Performance traits may be studied for production and carcass yield of local rabbits.

Acknowledgment

Financial support for this project was provided by the Agriculture Linkages Program (ALP) of Pakistan Agricultural Research Council (PARC) Islamabad which is highly acknowledged.

Conflict

No conflict of interest.

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