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SELECTION INDICES FOR IMPROVING BODY WEIGHT IN GABALI RABBITS.

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ABSTRACT: Selection indices were constructed for improving body weight in Gabali rabbits, utilizing records of 515 progenies born from 29 does and 8 sires for four consecutive years. The statistical analysis was carried out using a multi trait animal model to estimate additive, common-litter and residual effects' variances. The adopted model included fixed (the effects of season, parity and litter size at birth) and random effects (additive genetic and common-litter effects) for post-weaning growth traits. Means of body weights of Gabali rabbits ranged from 604.4 g at 4 weeks of age to 2019.9 g at 12 weeks of age. Estimates of h^2 were 0.06, 0.18, 0.26, 0.11 and 0.10 for individual body weight at 4th, 6th, 8th, 10th, and 12th weeks of age, respectively. The estimate of common-litter effects (c^2) for body weight at weaning was higher compared with other ages. Estimates of r_G were high and positive for all possible/attained genetic correlations between body weights at various ages (ranged from 0.37 to 0.91). Selection indices were constructed incorporating the Gabali rabbits body weights at five different ages; body weight at 4th (X1), 6th (X2), 8th (X3), 10th (X4) and 12th (X5) weeks of age; respectively. In all indices the values of b's for individual traits varied from one index to another and were even, low, moderate to high plus negative in some and positive in other indices. On the basis of relative efficiency of the indices (RIH), the following four indices were recommended for sake of maximizing genetic response to selection.

Index no.	Values of b	RIH
I14	- 0.5195 X2 + 0.6460 X3	0.633
I9	0.8293 X3 - 0.7570 X4 + 0.2950 X5	0.597
I11	- 0.1036 X1 + 0.2854 X3	0.504
I17	0.4562 X3 - 0.1689 X4	0.496

Expected genetic gain changes in each trait varied a lot from one index to the other. Yet, though RIH in some of the indices were found negative while positive in the others in the best indices, expected genetic changes of various traits were all positive. Standard deviation the aggregate of the genotypic (σ_H) estimates were moderate or high and the heritability values for I14, I9, I11 and I7 indices were 0.21, 0.29, 0.15 and 0.25 respectively,

Keywords: Gabali Rabbits-body weights-heritability-common-litter-correlations- selection.

INTRODUCTION

In Egypt, Gabali seems to be a productive local rabbit breed. It was ignored for many times without selection. It needs to be genetically ameliorated to produce more meat and cover the consumers demand. An attention of modern husbandry could be paid to realize this objective. Fortunately, the obtained estimates of heritability and most of the genetic correlation coefficients were high; letting one's expects that if they were used in a breeding plan that would be effective to this breed to be improved somewhat rapidly. Common-litter effect is expected to be important for post-weaning traits; therefore, it is included in the genetic evaluation of any suggested breeding programs (Iraqi, 2008; Youssef et al., 2009 and Soliman et al., 2014). Among various methods of selection, when the objective of the breeding programme is to improve several characters, the most efficient way of using the available information is usually to construct a selection index which is considered to be the most efficient method (Choudhury and Goswami, 2012). Therefore, this work is devoted to construct selection indices for improving post-weaning growth performance) body weights at different ages) in Gabali breed of rabbits.

MATERIALS AND METHODS

Animals and data

Body weights were recorded at 4th, 6th, 8th, 10th, and 12th weeks of age, in Sinai Gabali rabbits. Data were consisted of records of 515 progenies born from 29 does and 8 sires for five consecutive years. Mating was done according to the breeding plan, a buck was assigned at random for mating with a group of four females, with a restriction of avoiding full-sib, half-sib and parent-offspring Matings. Each buck was given the chance to produce all his litters from the same females all over his life-span in the course of the period of the study and females were palpated 10 days later post-Mattings. Therefore, the mating design produced several progeny for each successful sire-dam combination

Starting mixed model values were obtained applying REML method of VARCOMP procedure of SAS 2003. These starting values were used for the estimation of the more precise and reliable estimates of multi-trait animal model variance and covariance components. Data were analyzed using combinations of two-body-weight-traits animal model using MTDF-REML programs of Boldman et al., (1995). Analyses were done applying the following general linear model:

$$y = Xb + Z_a a + Z_c c + e.$$

Where:

y=vector of body-weight-traits' observation

X= incidence matrix of fixed effects including season (3 levels), parity (4levels), and type of birth (6 levels);

b = vector of unknown fixed effects;

Z_a and Z_c = incidence matrices corresponding to random effects of additive (a) and common-litter (c) effects, e = vector of random errors.

All estimates of BLUP were derived by multi-trait animal model (MTAM) using the STDF-REML program (Boldman et al., 1995) adapted to use the sparse matrix package, SPARSPAK (George and Ng 1984). The MTAM considered the relationship coefficient matrix (A^{-1}) among animals in the estimation (Boldman et al., 1995). Heritability coefficients were computed as additive direct ($h_a^2 = \sigma_a^2 / \sigma_p^2$), where σ_a^2 and σ_p^2

are the components of variances due to the additive genetic and phenotypic effects; respectively,

Selection Indices:

Different properties of the selection index were calculated as following: Standard deviation of the index (σ_I) $=\sqrt{b'Pb}$; Standard deviation of the aggregate genotype (σ_H) $=\sqrt{a'Ga}$; Correlation (accuracy) between the index and the aggregate genotype $R_{IH} = \sigma_I / \sigma_H$. values of b (partial regression coefficient) were computed as $b = P^{-1}Ga$, where P^{-1} is the inverse of the variance-covariance matrix of phenotypic values, expected genetic gain (ΔG) was computed as $\Delta G = r \sqrt{G}$ where r is the correlation between the trait and the index (r_{IX}) and $\sqrt{G}$ is the square root of the genetic variance. Prior to computing the complete index, the relative economic values (REV) were calculated depending on the phenotypic standard deviation where, $REV=1/\sigma_p$ where σ_p is the phenotypic standard deviation of the trait, according to Sharma and Basu 1986 and Falconer and Mackay, 1996 using Minitab programs.

RESULTS AND DISCUSSION

Means, standard deviations, coefficients of variability for body weight traits in Sinai Gabali rabbits are given in Table 1 to characterize phenotypically the population used. Means of body weights of Gabali rabbits ranged from 604.4 g at 4 weeks of age to 2019.9 g at 12 weeks of age, these means are relatively high to those reported by (Gad, 2007; Iraqi, 2008 and Soliman et al., 2014).

Variance components) values and proportions):

Proportions and standard error of additive genetic (h^2_a) , common-litter effect (c^2) and error (e^2) relative to phenotypic variance for post-weaning growth traits in Sinai Gabali rabbits are presented in Table2.

Heritability:

Estimates of h^2 shown in Table 2 were 0.06, 0.18, 0.26, 0.11 and 0.10 for individual body weight at 4, 6, 8, 10 and 12 weeks of age. The low and moderate heritability estimates obtained in the present study could be explained by a small amount of genetic variability in the population and the moderate standard of hygiene and the uniformity of the environment (El-Raffa, 1994) and these moderate heritability estimates at 6 and 8 weeks indicated that they response to selection promising. The moderate heritability estimates obtained in the present study were similar to those estimates obtained in some studies in Egypt (Gomez et al., 2000; Khalil et al., 2000; Iraqi et al., 2002, Iraqi, 2003; Gad, 2007 and Soliman et al., 2014). The low heritability estimates at 4, 10 and 12 weeks were similar to those estimates reported by Ferraz et al., 1992 and Lukefahr et al., 1996. Akanno and Ibe, 2005 with NZW and Dutch breed rabbits found which higher heritability estimates 0.43 for 6-week body weight and 0.36 for 12-week body weight, respectively than the estimates presented in this study. The small estimates of h^2 may be large maternal effects could have masked any additive genetic variance and increasing the non-additive genetic effects. Estimates of h^2 found in the literatures were very different, it may be due to various reasons including the number of observations used in estimation, the method of analysis and estimations, the genetic make-up of the breeds in the population and the corrections for nongenetic factors which were made on each set of data.

Common-litter effect (c^2):

The estimate of common-litter effects (c^2) compared with the phenotypic variance for body weight at weaning presented in Table 2 was higher compared with other ages which reflect a high variability in common-litter effects at weaning. The higher estimate was due to that litters were litters were being nursed by the same dam and reared in the same cage and a rapid reduction of maternal or common-litter effect with advanced of age. The proportion in the present study were 74%, 46%, 34%, 41% and 35% at 4, 6, 8, 10 and 12 weeks of age. These tendencies are in agreement with results reported by (Iraqi, 2008 and Soliman et al., 2014) , and percentages of c^2 in this study were higher than those reported by (Gad, 2007) with Gabali rabbits for body weight at4, 8 and 12 weeks of age, which were 15%, 28% and 25%, respectively. (Iraqi, 2008, Youssef et al., 2009 and Soliman et al., 2014) reported also that the common-litter effect is very important for post-weaning growth traits, and one can conclude that the common-litter effect should be included in the genetic evaluation of breeding programs.

Estimates of error proportions e^2 for body weights were higher with advanced of age and the percentage were 20%, 37%, 40%, 48% and 60% at 4, 6, 8, 10 and 12 weeks of age. Results here were within range to those estimates by (Gad, 2007 Iraqi, 2008, Youssef et al., 2009 and Soliman et al., 2014)

Correlations:

Estimates of Genetic (r_g), common-litter (r_c), environmental (r_e) and phenotypic (r_p) correlations between body weight traits are given in Table 3. The phenotypic and genetic correlations between any two traits indicate how a change in one character will affect the other. Knowledge of genetic and phenotypic correlations is necessary for constructing selection indices.

Genetic Correlations:

Estimates of r_G were high and positive for all the possible genetic correlations between body weight at different ages (ranged from 0.37 to 0.91), the multi-trait animal model Table 3 indicate that, results in the present study were within range to those estimates by Gad, 2007 found that genetic correlations were low (0.01) between 8 and 12 weeks of body weight and high (0.61) between 4 and 8 weeks of body weight and highest (0.89) obtained between body weight at 8 and 12 weeks of age in Gabali rabbits using animal model analysis. Iraqi, 2008 found that genetic correlations were very different ranged from 0.08 to 0.89 between 4 and 8 weeks, between 8 and 12 weeks and between 4 and 12 weeks of age in Gabali rabbits. Soliman et al., 2014 reported that with Gabali rabbits most of the genetic correlation coefficients were high between different body weights and ranged from 0.05 to 0.90. So in order to set up an optimum rabbit programmer, estimates of genetic correlations between the body weights under consideration are frequently necessary. Bias in estimates of the genetic correlations may arise from two circumstances. Firstly, it can be due to a lack of appropriate correction factors for a possible environmental influence. Secondly, the bias can also be caused by selection (rabbit's surviving to the last weight). Genetic correlations are of interest to the rabbit breeder that they permit as estimate of the direction and magnitude of change in one body weight as a correlated response to early direct selection for a second weight at younger age. Estimates of these parameters are necessary for selection indices (Khalil et al., 1986).

Common-litter Correlations:

Estimates of common-litter correlations (r_C) for all the possible genetic correlations between body weight at different ages were positive and mostly of high (ranged from 0.53 to 0.94) and these results are in agreement with Gad, 2007 estimated higher r_C (0.73 to 0.92) between body weight at different ages in Gabali rabbits and higher than Iraqi, 2008 who found that r_C were low and positive which were -0.10 (between 4 and 12 weeks), 0.02 (between 4 and 8 weeks) and 0.10 (between 8 and 12 weeks) , respectively. Also, Soliman et al., 2014 stated that estimates of rc were 0.07, -0.1, 0.51, 0.20, 0.10 and 0.10 between 4 and 8 weeks, between 4 and 12 weeks, between 4 and 16 weeks, between 8 and 12 weeks, between 8 and 16 weeks and between 12 and 16, respectively. Thus, it is very important that common environmental effects should be considered in the model of estimation of variance and covariance components to get unbiased estimates of genetic, phenotypic and environmental correlations.

Environmental correlations:

Estimates of re were moderate or high and positive ranging from 0.21 to 0.82 between records of body weights. These estimates of re were within range to those estimates recorded by Iraqi, 2008 who found that all estimates of environmental correlations between body weights were positive and higher than r_C and ranged from 0.71 Soliman et al., 2014 found all estimates of re between body weights were positive and high and ranged from 0.65 to 0.92. A large different, particularly in sign due to genetic and environmental sources of variation affect the characters through different physiological mechanism (Falconer, 1989).

Phenotypic correlations:

Phenotypic correlations estimates were positive and moderate or high magnitude and ranged from 0.48 to 0.82 in Table 3. Significant and positive phenotypic between two weights of does necessarily indicate that selecting on one of these weights will lead to improvement in the other because an r_p is not always reliable estimate of the genetic relationship existing between traits. For example environmental effect upon two weights could be so strong and positively correlated that a negative genetic correlation is masked (Khalil et al., 1986). El-Deghadi, 2005 found that moderate or high and positive estimates of phenotypic correlations between growth traits at different ages give considerable advantage for rabbit breeders in their management and culling decisions.

Selection Indices:

Selection indices were constructed incorporating the body weights at five different ages; body weight at 4 (X1), 6 (X2), 8 (X3), 10 (X4) and 12 weeks (X5) of Gabali rabbits respectively are presented in Table 4. A total of 19 indices were developed incorporating all the five traits, every four of the five traits, every three of the five traits, as well as every two of the five traits.

In all indices the values of b (b = partial regression coefficient) in the individual traits varied a lot from index to index. Even, in some of the indices were low, moderate and high and were negative and positive in other indices. These results within range to some studies, McReynolds, 1974 found that selection for 8 weeks weights in New Zealand White rabbits indicated that the partial regression coefficient for 21-day weight (b_1 = 0.875) was higher than the corresponding value for gain from 21 to 56 days of age (b_2 = 0.169); Khalil, 1986 found that high values of partial regression coefficient were obtained for 6-week weight in all the indices constructed. On the other hand, b values of 12- week weight were lower than those of 6- week weight in the four indices for Bauscat and Giza White rabbits; El-Fiky, et al., 2001 reported that the actual index weights (b's) for each trait in the (I_1) and b's are estimated on the basis of economic weight of the traits (I_2). These b's indicate that the relative emphasis for each trait should receive to maximize profitable genetic response. The value of b for body weight at 4 weeks was greater than that of body weight at birth and estimates of b's were 0.65 and 1.25. Choudhury and Goswami, 2012 In all 11 indices the values of b's in the individual traits varied a lot from index to index. Even, in some of the indices were low, moderate and high and were negative and positive in other indices.

In the present study, on the relative efficiency of the indices, the following four indices were recommended for use to maximize response.

Index no.	**Values of b**	**RIH**
I14	- 0.5195 X2 + 0.6460 X3	0.633
I9	0.8293 X3 - 0.7570 X4 + 0.2950 X5	0.597
I11	- 0.1036 X1 + 0.2854 X3	0.504
I17	0.4562 X3 - 0.1689 X4	0.496

These results within range to some studies about estimates that the relative efficiency of the indices by McReynolds, 1974 and Khalil, 1986 have led to the conclusion that selection indices based on earlier growth traits are more efficient than those based on later growth traits to select for later body weights of rabbits. El-Fiky, et al., 2001 found that the accuracy of an index is based on its correlation with the aggregate genotype (r_{IH}) where the genetic gain from the use of an index is directly proportional to (r_{IH}). The estimate of correlation was 0.81 indicating the high accuracy of index based on the three traits studied. The high efficiency of index might be attributed of the high absolute phenotypic and genetic variances of the traits. Choudhury and Goswami, 2012 found that the four indices identified in the bests will help in locally bringing about genetic improvement of rabbit in organized farms. For the commercial purpose, I6 is obviously the best and the simplest as it incorporates only two early traits namely body weight at weaning (at 42 days) and body weight at marketing having a high relative efficiency (RIH=0.872).

Estimates of expected genetic gain, kg (ΔG) in each trait are illustrated in Table 5. Expected genetic gain changes in each trait varied a lot from index to index. Even, in some of the indices were found negative and positive in other indices and the best indices it was found that the expected genetic changes in traits were all positive, Results as obtained in the present study show that the four indices identified as the best I14, I9, I11 and I7 could be used effectively by breeders, it seems that rapid genetic improvement of rabbit for growth performance in Gabali rabbits, and these results agree with Choudhury and Goswami, 2012 who found that the expected genetic changes in the individual traits varied a lot from index to index. Even, in some of the indices the expected genetic changes in individual traits were found negative. However, in the above mentioned four best indices it was found that the expected genetic changes in individual traits were all positive (I9, I2, I6 and I7).While Khalil, 1986 estimates of expected genetic changes in 6- and 12-week weight was generally slight in Bauscat and Giza White rabbits. Accordingly, it seems that slight improvement for growth traits of both breeds. El-Fiky, et al., 2001 found that the expected genetic gains in actual units of measurements and as a percentage of the overall mean of the trait achieved by selection differential of one standard deviation on the index per generation were 1.35, 22.54 and 30.28 gm for body weight at birth, 4 and 16 weeks of age, respectively.

Standard deviation the aggregate of the genotypic (σ_H) estimates were moderate or high and the heritability values for I14, I9, I11 and I17 indices were 0.21, 0.29, 0.15 and 0.25 respectively, these results lower than those estimated by Choudhury and Goswami, 2012 who found that the expected change in aggregate genetic worth and heritability values of these indices were found high. The heritability values for indices I9, I2, I6 and I7 were, respectively 0.859, 0.844, 0.761 and 0.731. Going by these estimates, it may be opined that all these four indices could effectively be used for obtaining satisfactory response to selection as regard to body weight at different ages in New Zealand White breed of rabbit.

CONCLUSION

The four indices (I14, I9, I11 and I17) identified in the present study as the best ones; could be used effectively by breeders to improve post-weaning live body weight of Gabali rabbits. It seems that rapid genetic improvement of rabbit for growth performance in Gabali rabbits, for the commercial purpose, I14 is the best and it incorporates early traits namely body weight at 6 and 8 weeks of age having a relative efficiency (RIH=0.633).

Genetic correlations are of interest to the rabbit breeder that they permit them to estimate the direction and magnitude of change in one body weight as a correlated response to early direct selection for a second weight, sometimes at a younger age. Estimates of these parameters are necessary selection indices; putting in mind it includes common environmental effects in the model of estimation to get unbiased more reliable b's for the index. Moderate or high and positive estimates of phenotypic correlations between growth traits at different ages perhaps would give considerable advantage for rabbit breeders in their management and culling decisions.

Table (1): Means, standard deviations and coefficients of variation (CV%) for post-weaning growth traits in Sinai Gabali rabbits.

Body weight Traits at	Mean	SD	CV%
4 weeks	604.4	179.6	29.7
6 weeks	968.1	216.1	22.3
8 weeks	1338.4	257.9	19.3
10 weeks	1681.5	273.4	16.3
12 weeks	2019.6	288.5	14.3

Table (2): Proportions and standard error of additive genetic ($h^2{}_a$) , common-litter effect (c^2) and error (e^2) relative to phenotypic variance for post-weaning growth traits in Sinai Gabali rabbits.

Body weight at:	h_a^2±SE	c^2±SE	e^2±SE
4 weeks	0.06±0.15	0.74±0.08	0.20±0.09
6 weeks	0.18±0.02	0.46±0.08	0.37±0.13
8 weeks	0.26±0.02	0.34±0.06	0.40±0.04
10 weeks	0.11±0.01	0.41±0.06	0.48±0.05
12 weeks	0.10±0.01	0.35±0.08	0.60±0.09

Table (3): Genetic (r_g), common-litter (r_C), environmental (r_e) and phenotypic (r_p) correlations post-weaning growth traits in Sinai Gabali rabbits.

Body weights Correlated traits:	r_g	r_c	r_e	r_p
4 & 6 weeks	0.51	0.88	0.72	0.76
4 & 8 weeks	0.37	0.75	0.61	0.63
4 & 10 weeks	0.66	0.63	0.39	0.54
4 & 12 weeks	0.89	0.53	0.21	0.68
6 & 8 weeks	0.91	0.94	0.82	0.81
6 & 10 weeks	0.38	0.82	0.55	0.82
6 & 12 weeks	0.42	0.68	0.39	0.48
8 & 10 weeks	0.50	0.94	0.73	0.76
8 & 12 weeks	0.71	0.88	0.58	0.68

Table 4: Selection indices using body weight at different ages showing the weight age (b) for each trait and the efficiency of the index (R_{IH}) and relative efficiency in Sinai Gabali rabbits.

Index no.	**Values of b**	**RIH**
I1	0.3109 X1 - 0.3759 X2 + 0.67320 X3 -0.8166 X4 + 0.0560 X5	0.481
I2	- 0.0002 X1 + 0.0099 X2 + 0.3680 X3 - 0.0719 X4	0.419
I3	0.0336 X1 - 0.0067 X2 + 0.2914 X3 + 0.0546 X5	0.415
I4	- 0.1988 X1 + 0.1189 X2 + 0.3010 X3	0.485
I5	- 0.0944 X1 + 0.2578 X2 + 0.0.0433 X4	0.364
I6	- 0.0514 X1 + 0.2199 X2 + 0.0.0821 X5	0.368
I7	0.0422 X2 + 0.3381 X3 - 0.0847 X4	0.409
I8	- 0.0017 X2 + 0.3160 X3 + 0.0283 X5	0.422
I9	0.8293 X3 - 0.7570 X4 + 0.2950 X5	0.597
I10	0.0924 X1 + 0.0228 X2	0.252
I11	-0.1036 X1 + 0.2854 X3	0.504
I12	0.0264 X1 + 0.0984 X4	0.312
I13	0.0847 X1 + 0.0974 X5	0.353
I14	-0.5195 X2 + 0.6460 X3	0.633
I15	0.2251 X2 + 0.0112 X4	0.379
I16	0.2108 X2 + 0.0435 X5	0.389
I17	0.4562 X3 - 0.1689 X4	0.496
I18	0.4258 X3 - 0.0733 X5	0.450
I19	0.0686 X4 - 0.0599 X5	0.257

X_1 = body weight at 4 weeks; X_2 = body weight at 6 weeks; X_3= body weight at 8 weeks; X_4 = body weight at 10 weeks and X_5 = body weight at 12 weeks;

Table (5): Expected genetic gain, kg (ΔG) in each trait and standard deviation the aggregate of the genotypic (σ_H) along with the heritability (h^2_I) for indices constructed using body weights at different ages in Sinai Gabali rabbits.

Index no.	ΔG_{X1}	ΔG_{X2}	ΔG_{X3}	ΔG_{X4}	ΔG_{X5}	σ_H	h^2_I
I1	22.99	-14.81	100.97	-1.13	66.42	254.98	0.94
I2	14.76	4.78	76.38	20.59	--	204.43	0.21
I3	15.96	7.35	63.34	--	36.60	212.37	0.21
I4	3.41	26.75	66.65	--	--	173.05	0.20
I5	8.08	40.42	--	17.28	--	145.28	0.14
I6	11.94	36.42	--	--	22.61	153.49	0.15
I7	--	7.08	72.49	18.89	--	200.64	0.22
I8	--	6.57	66.93	--	35.43	209.19	0.24
I9	--	--	89.17	1.26	65.50	244.86	0.29
I10	11.36	17.43	--	--	--	81.42	0.09
I11	13.94	--	71.48	--	--	122.68	0.15
I12	10.34	--	--	27.93	--	92.05	0.08
I13	16.94	--	--	--	32.24	103.82	0.10
I14	--	26.29	84.8	--	--	148.60	0.21
I15	--	38.8	--	15.30	--	134.06	0.15
I16	--	37.2	--	--	21.14	135.93	0.14
I17	--	--	80.34	15.42	--	191.05	0.25
I18	--	--	75.42	--	31.95	207.86	0.28
I19	--	--	--	16.97	17.01	129.21	0.11

X_1 = body weight at 4 weeks; X_2 = body weight at 6 weeks; X_3= body weight at 8 weeks; X_4 = body weight at 10 weeks and X_5 = body weight at 12 weeks.

REFERENCES

Akanno, E. C. and Ibe, S. N., 2005. Estimates of genetic parameters for growth traits of domestic rabbits in humid tropics. Livestock Research for Rural Development 17 (7) http://www.lrrd.org/lrrd17/7/akan17086

Boldman K G, Kriese L A, Van Vleck L D, Van Tassell C P and Kachman S D 1995. A manual for use of MTDFREML. A set of programs to obtain estimates of variances and covariances [DRAFT]. U.S. Department of Agriculture, Agricultural Research Service, USA.

Choudhury S. Anjana1. , Goswami R. N. 2012. Selection indices for improving body weight in New Zealand White breed of rabbit maintained at the Hilly Indian state of Meghalaya. Proceedings 10 th World Rabbit Congress – September 3 - 6, 2012– Sharm El- Sheikh –Egypt, 25- 29.

El-Deighadi, A. 2005. Genetic evaluation for some productive traits in rabbits. Ph.D. Thesis, Fac. Agric., Moshtohor, Zagazig Univ., Banha Branch, Egypt.

El-Fiky. F.A., Aboul-Hassan, M. A., Attalah, G. E. Y. and Bata, S.S. 2001. Selection indices for improving body weight in Baladi rabbit. Egyptian Poultry Science, 21 (II): 305-318.

El-Raffa, A. M. 1994. Some factors affecting economical productive and reproductive traits in rabbits. Ph. D. Thesis, Fac. of Agric., Alex. Univ., Alexandria, Egypt.

Falconer, D.S. 1989. Introduction to quantitative genetics. 3th ed., Longman, London, UK.

Falconer, D. S. and Mackay, T. 1996. Introduction to quantitative genetics. 4th ed., Long man, Group Ltd, England.

Ferraz J., B., S., Johnson R., K., and Van Vleck L., D. 1992. Estimation of genetic trends and genetic parameters for reproductive and growth traits of rabbits raised in subtropics with animal models. Journal of Applied Rabbit Research, 15: 131-142

Gad, S. M. A., 2007. Genetic analysis for productivity of Gabali rabbits raised in the north-western coast of Egypt. Ph.D. Thesis, Department of Animal Production, Faculty of Agriculture, Moshtohor, Benha University, Egypt

George A and Ng E 1984. A new release of SPARSPAK: The waterloo sparse matrix package. Mimeo, Department of Computer Science, University of Waterloo, Waterloo, Ontario, Canada (Agricultural Research Service, USA, 1995).

Gómez E. A., Rafel O. and Ramón J. 2000. Preliminary genetic analysis of Caldes line: a selection experiment for a global objective. In 7th World Rabbit Congress 4-7 July 2000, Valencia Spain. World Rabbit Science Association 8 supplement, 1:417-424

Iraqi M. M. 2003. Estimation and evaluation of genetic parameters for body weight traits of New Zealand White rabbits in Egypt using different multivariate animal models. Livestock Research for Rural Development , 15 (6) 2003.

Iraqi, M. M. 2008. Estimation of Genetic parameters for post-weaning growth traits of Gabali rabbits in Egypt. Livestock Research for Rural Development , 20 (5): http: // www. Irrd.org/ Irrd 8 /6/ Iraq 18 083.htm.

Iraqi, M M, Youssef Y M K, El-Raffa A M and Khalil M H, 2002. Genetic and environmental trends for post-weaning body weights in New Zealand White and Z-line rabbits using the animal model approach. The 3rd Scientific Conf. on Rabbit Production in Hot Climates, 8-11 October 2002, Hurghada, Egypt.

Khalil, M. H.; Owen, J. B. and Afifi, E. A., 1986. A review of phenotypic and genetic parameters associated with meat production traits in rabbits. Animal Breeding Abstract 54: 725-749 (An article)

Khalil M H, Ibrahim M K, Youssef Y M K and El-Deighadi A S 2000. Estimation of sire transmitting abilities for post-weaning growth traits in New Zealand White and Californian rabbits raised in adverse hot climatic Egyptian conditions using an animal model. Egyptian Poultry Science, 20(1): 65-90

Lukefahr S D, Odi H B and Atakora J K A 1996. Mass selection for 70-day body weight in rabbits. Journal of Animal Science, 74:1481-1489.

McReynolds WE 1974. Genetic parameters of early growth in a population of New Zealand White rabbits. Dissertation Abstract International, B35,(8): 3970.

SAS., 2003. SAS Online Doc 9.13 SAS Institute Inc., Cary, NC, USA.

Sharma, A. and Basu S. B. 1986. Incorporation of profit variables for the maximization of genetic gain. Indian J. Dairy Sci., 39:35.

Soliman, H.A.M., Gad, S.M.A. and Ismail, I.M. 2014. Genetic parameters for post-weaning growth traits of Gabali rabbit in Egypt. Egypt. Poult. Sci. Vol (34) (II): 655-664.

Youssef, M. K.; Farid, A.; Gad-Alla, S. A. and Abo-Warda, M. A. 2009. Genetic evaluation for post weaning body weight traits in three genetic groups of rabbits under Egyptian conditions. 5th International Poultry Conference 10-13 March 2009. Taba Egypt.

لملخص العربى

أدلة أنتخابية لتحسين وزن الجسم فى أرانب الجبلى

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أجريت الدراسة لتقدير أدلة انتخابية لتحسين وزن الجسم فى أرانب الجبلى على 515 أرنب ناتج من تزاوج 29 أنثى و8 ذكر لمدة 4 سنوات متتالية. باستخدام برنامج النموذج الحيوانى بطريقة معظمة الاحتمال غير المقيدة وغير المعتمدة على حساب المشتقات التفاضلية DFRML. وقد أشتمل النموذج الإحصائى على تأثير (موسم الولادة ولترتيب البطن وعدد خلفة البطن) كعوامل ثابتة كما شمل تأثير الحيوان والتأثير البيئى الدائم كعوامل عشوائية. وتراوح وزن الجسم بين 604.4 جم عند 4 أسابيع الى 2019.9 جم عند 12 أسبوع. وكانت قيم المكافئ الوراثى 0.06 و0.18 و0.26 و0 .11 و0.10 لوزن الجسم عند 4 و6 و8 و10 و12 أسبوع على التوالى. وكان تقدير نسب التأثير المشترك لخلفة البطن عالى عند وزن الفطام مقارنة بالأعمار الأخرى. كانت قيم الارتباط الوراثى بين وزن الجسم عند الأعمار المختلفة عالية وموجبة وتتراوح بين 0.37 الى 0.91. .وتم تكوين أدلة الانتخاب لوزن الجسم عند 4 (X_1) و6 (X_2) و8 (X_3) و10 (X4) و12 (X5) أسبوع. ووجد أن الأدلة الأكثر كفاءة ودقة لإتمام عملية التحسين هى I14, I9, I11, I17 على الترتي