

JOURNAL
OF
ANIMAL PRODUCTION
OF THE
UNITED ARAB REPUBLIC
J. ANIM. PROD. U.A.R.

VOLUME III

NUMBER 1

1963

Edited by
the Egyptian Society of Animal Production
Published by
The National Information and Documentation Center

JOURNAL OF ANIMAL PRODUCTION
OF THE

UNITED ARAB REPUBLIC

Vo. III.

1963

No. 1

HERITABILITY AND REPEATABILITY OF
BODY WEIGHT AND GROWTH RATE IN
EGYPTIAN BUFFALOES AND CATTLE

By

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SUMMARY

A statistical analysis was carried out on the weight records of two herds, one of Egyptian cattle, and another of buffaloes belonging to the Animal Breeding Department, Faculty of Agriculture, Cairo University.

Records used in this work were collected over a period of 22 years (1933 - 1955). The data comprised 109 males, 126 females of Egyptian cattle, and 107 males, 108 females of buffaloes.

The results obtained are summarized in the following :-

Estimates of heritability obtained for body weight at birth, 4, 6, 12, 18 and 24 months of age were 0.475, 0.147, 0.092, 0.0002, 0.355, 0.685 for cattle, and 0.315, 0.735, 0.699, more than one, 0.588, and more than one in buffaloes respectively.

Repeatability for body weight was 0.508 in cattle and 0.573 in buffaloes.

Heritability estimates for relative growth rate R_1 , R_2 , R_3 , R_4 , and R_5 were 0.113, 0.0004, 0.771, 0.253, and 0.013 in cattle and 0.174, 0.686, 0.686, 0.183, 0.0007, and 0.805 in buffaloes.

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INTRODUCTION

Few numbers of Merino, Suffolk and Leicester sheep were introduced into Tahreer Province in January 1956. This importation had two main objectives: first, the test of breeding these new breeds of sheep under the local conditions of this region and studying to what extent do their high potentiality of both mutton and wool could stand the peculiarities of their new environment; second, the use of their inherent characteristics, represented in high fertility, great wool production and rapid rate of growth in improving the indigenous breeds of sheep and probably in developing new breeds of better potentialities.

MATERIAL AND METHODS

In January 1956, the Tahreer Province imported 25 ewes and 2 rams of Suffolk sheep, 25 ewes and 2 rams of English Leicester sheep from England, as well as 27 ewes and 14 rams of Merino Precoce sheep from France. These sheep were born in their home-lands during the last three weeks of March and the first few days of April 1955.

Samples used in the analysis were taken from the imported breeds of sheep at the following ages:

- (a) 12 months old, in which wool grew almost entirely abroad.
- (b) 24 months old, in which wool grew at Tahreer Province.
- (c) 36 months old, in which wool grew at Tahreer Province.

The traits dealt with were grease fleece weight, clean wool percentage, density of wool fibers, fiber diameter, number of crimps per 2 centimeters, staple length, fiber length and kemp percentage. For studying these traits

Heritability of birth weight in cattle was 0.475 (Table 1) compared to 0.315 for buffaloes (Table 2). These are nearly of the same value as those obtained by Knapp and Clark (1950) who reported an estimate of 0.53, while Gregory et al (1950) gave another of 0.45 for foreign breeds of cattle. They are also in accordance with those reported by Asker and Ragab (1952) for Egyptian cattle being 0.417, and Abd El-Aziz (1960) of 0.413 for birth weight of Friesian Cattle raised in Egypt. All these values were arrived at using the half sibs method. The heritability estimated arrived at by Shelby et al (1955) for birth weight using the same method (i.e. 0.72), was higher than the estimates arrived at in this analysis, while Dawson et al (1947) gave a lower estimate 0.29 for original birth weights in beef cattle, and when weights were corrected for age of cow, sex, and dams index it was lowered to 0.11.

Koch (1953) gave an estimate of 0.42 for birth weight including the hereditary part of the maternal influence. Koch and Clark (1955) using the regression of offspring on dam method, reported a heritability of 0.44 for birth weight, and was 0.35 using the regression of the progeny's average on sires' performance.

Those previous estimates were close to those obtained here for Egyptian cattle and buffaloes using half sibs method.

The heritability of weaning weight was 0.147 in cattle and 0.735 in buffaloes (Tables 1 & 2) at the age of 4 months. Gregory et al (1950) gave estimates of 0.26 and 0.52 for two different herds of beef cattle. These were higher than that obtained for Egyptian cattle and less than that of buffaloes' weaning weight. Knapp and Clark (1950), Koch and (1955), Shelby et al (1955) reported similar results to that given by Gregory et al (1950). Abd El-Aziz (1960) gave an estimate of 0.7018, which is similar to that found for weaning weight in buffaloes.

At 6 months of age the heritability value for body weight was found to be 0.092 in cattle and 0.699 in buffaloes (Tables 1, 2).

At 12 months of age heritability for body weight was 0.0002 (Table 1), which was similar to that found by Abd El-Aziz (1960) being 0.077 in Friesian cattle bred in Egypt.

In the case of buffaloes, the heritability estimate came to more than one which seems not reasonable. Koch and Clark (1955) reported an estimate of 0.47 for yearling weight in beef cattle.

At 18 months of age the heritability value was 0.355 in cattle compared to 0.588 for buffaloes (Table 1 and 2).

At 24 months of age heritability was 0.685 in cattle and more than one for buffaloes for body weights at this ages.

It is observed that the values of heritability for body weights decreased in general as age increased till 12 months of age in cattle (Table 1). In case of buffaloes the heritability values were rather high all over the two years (Table 2).

The variation in body weights due to the relative increase in the effect of environmental factors with the advance in age, as new factors, always came into play. Therefore the relative value of the genetic variance to the total is decreased resulting in lower values of heritability.

B.—*Heritability estimates for relative growth rate:*

Tables 3 and 4 comprise the heritability values for relative growth rates R_1 , R_2 , R_3 , R_4 , and R_5 in Egyptian cattle and buffaloes, weights of animals were corrected for sex. Correction of body weights was carried out before calculating the relative growth rate. The procedure was that of converting males' body weights into their female relevant body weight (Table 5 and 6).

Heritability of R_1 in cattle was 0.1130 (Table 3), while it was 0.1744 for buffaloes (Table 4) which is higher than that of cattle. Abd El-Aziz (1960) showed a high heritability estimate 0.7544 for R_1 in Friesian cattle. At the next period of age from 4 to 6 months, R_2 in cattle showed a very low estimate of heritability coming to about zero, while it was very high in the case of buffaloes being 0.6861 (Table 3 and 4).

In the following periods from 6 to 12, and 12 to 18 months of age, the heritability estimates for R_3 and R_4 were 0.7714 and 0.2532 in cattle, while it was 0.1831 and 0.0070 in buffaloes (Table 3 and 4).

Heritability for R_5 was 0.0126 in cattle, compared to 0.8053 in buffaloes which is very high (Tables 3 and 4).

It is observed that the values of heritability for relative growth rate fluctuated with no particular trend as it was observed in the case of body weights. It seems that the difference in magnitude between growth rate and body weight is responsible for such difference.

Growth rate is a relative measure which takes into consideration weights and time, while weight is a direct product of a less complex set of factors.

General Discussion :

Heritability estimates showed that heritability of body weight decreased as age increased during the first year in cattle, while it was rather high all over the two years of age in buffaloes. With the advance of age of relative increase in the effect of environmental factors becomes closer, as new factors always come into play. Therefore the relative value of the genetic variance to the total is decreased resulting in less values of heritability during the first year of cattles' life. Afterwards the genetic factors expressed themselves more evidently as animals grew up and became more competent in interacting with their ambient

environmental conditions. Thus the share of hereditary variation in the total variance increases. Heritability for relative growth rate fluctuated with no particular trend as it was observed in the case of body weights. It seems that the difference in magnitude between growth rate and body weight is responsible for such difference. Growth rate is a relative measure which takes into consideration weights and time, while weight is a direct product of a less complex of factors.

In the light of the findings aimed at in this work, it may be concluded that a serious effort must be done to increase weight and growth rate. This will indirectly affect both sexual maturity and milking potentiality the matter which will help to a great deal in improving the indigenous animals of the country.

TABLE 1.—Heritability (h^2) Values of Body Weight of Cattle at Different Ages Corrected for Sex.

Age	Heritability value (h^2)	No. of sires	No. of animals per sire
At birth	0.475	9	16.40
4 months	0.147	9	12.90
6 "	0.092	9	12.40
12 "	0.0002	8	10.50
18 "	0.355	7	10.27
24 "	0.685	7	6.92

TABLE 2.—Heritability (h^2) Values of Body Weight of Buffaloes at Different Ages Corrected for Sex.

Age	Heritability value (h^2)	No. of sires	No. of animals per sire
At birth	0.315	6	20.06
4 months	0.735	6	12.99
6 "	0.699	6	11.96
12 "	More than one	6	8.35
18 "	0.588	6	7.36
24 "	More than one	6	6.09

TABLE 3.—Heritability (h^2) Values of Relative Growth Rate of Cattle at Different Periods Corrected for Sex.

Period of growth	Heritability value (h^2)	No. of sires	No. of animals per sire
R ₁	0.113	9	12.90
R ₂	0.004	9	11.24
R ₃	0.771	7	10.69
R ₄	0.253	7	8.95
R ₅	0.013	6	6.76

TABLE 4.—Heritability (h^2) Values of Relative Growth Rate of Buffaloes at Different Periods Corrected for Sex.

Period of growth	heritability value (h^2)	No. of sires	No. of per sire
R ₁	0.174	6	12.94
R ₂	0.686	6	12.65
R ₃	0.183	5	17.03
R ₄	0.007	4	6.79
R ₅	0.805	4	7.66

TABLE 5.—Ratio between Weights of Males & Females (cattle).

Age	Males Av.		Females Av.		Ratio
		No.		No.	
At birth	26.03	108	25.27	120	.97
4 months	99.90	78	90.28	109	.90
6 "	135.08	78	119.69	100	.98
12 "	221.49	51	192.86	92	.87
18 "	310.48	40	265.45	82	.85
24 "	416.15	27	319.32	63	.77

TABLE 6.—Ratio between Weights of Males & Females (buffaloes).

Age	Males Av.		Females Av.		Ratio
		No.		No.	
At birth	40.94	106	39.05	105	0.95
4 months	121.62	59	122.84	88	1.01
6 "	151.55	56	152.58	80	1.00
12 "	221.65	36	218.35	65	.99
18 "	325.79	28	300.18	65	.92
24 "	409.76	17	366.76	55	.90

$$\text{Ratio} = \frac{\text{Female } \bar{x}}{\text{Male } \bar{x}}$$

Ratio = Males, Wt. — Females' Wt.

REFERENCES

- ABDEL AZIZ, A. (1960). The growth of Friesian cattle and its crosses under different rearing levels. *M. Sc. Thesis, Faculty of Agric, Cairo University.*
- ASKER, A.A., and RAGAB, M.T. (1952). Factors influencing birth weights in Egyptian cattle and buffaloes. *Ind. J. Vet. Sci. & Anim. Husb.* 22 : 265 - 272.
- DAWSON, W.M., PHILLIPS, R.W. and BLACK, W.H. (1947). Birth weight as a criterion of selection in beef cattle. *Jr. Anim. Sci.*, 6 (3) : 247 - 257.
- GREGORY, K.E., BLUNN, C.T. and BAKER, M.L. (1950). A study of some of the factors influencing the birth and weaning weights of beef calves. *Jr. Anim. Sci.*, 9 (3) : 338 - 345.
- KOCK, R.M. (1953). Heritability of economic characters in beef cattle. *Iowa St. Coll. T. Sci.* 1955, 29 : 445 - 446 (A.B.A. 23 (4) : 1659).
- and CLARK, R.T. (1955). Influence of sex, season of birth and age of dam on economic traits in range beef cattle. *Jr. Anim. Sci.*, 14 (2) : 386 - 397.
- SHELBY, C.E., CLARK, R.T. and WOODWARD, R.R. (1955). The heritability of some economic characteristics of beef cattle. *Jr. Anim. Sci.*, 14 : 372 - 385.
- RAGAB, M.T. and ABD EL-SALAM, F. (1962). The effect of sex and month of calving on body weight and growth rate of Egyptian cattle and buffaloes. *J. Anim. Prod. U.A.R.* Vol. 2 No. 2, pp. 109 - 130.

(Printed in 1965)

المملخص

القيمة الوراثية والمعامل التكرارى لوزن الجسم
ومعدل النمو فى الماشية المصرية والجاموس

استعملت فى هذا التحليل سجلات أوزان ونمو حيوانات مزرعة كلية
الزراعة - جامعة القاهرة - وشمل التحليل سجلات ١٠٩ ذكراً و١٢٦ أنثى
من الماشية المصرية وكذلك ١٠٧ ذكراً و١٠٨ أنثى من الجاموس .

وقد اتضح من التحليل أن القيمة الوراثية لوزن الجسم عند الميلاد وفى عمر ٥٠
٤٠٤، ٦٠٦، ١٢، ١٨، ٢٤ شهراً على التوالي فى الماشية المصرية كانت ٤٧٥ر، ١٤٧ر،
٩٢ر، ٠٠٠ر، ٣٥٥ر، ٦٨٥ر على التوالي مقابل ٣١٥ر، ٧٣٥ر، ٦٩٩ر،
أكثر من الواحد الصحيح ٥٨٨ وأكثر من الواحد الصحيح للأوزان نفسها
فى حالة الجاموس .

أما المعامل التكرارى فقد كان ٥٠٨ لوزن الماشية مقابل ٥٧٣ للجاموس .

وقد تبين أن القيمة الوراثية لمعدل النمو فى الفترات بين الميلاد وأربعة شهور
٤٠٤ و٦٠٦ شهور، ١٢، ١٢، ١٨ شهراً و٢٤ شهراً فقد كانت ١١٨ر،
٠٠٤ر، ٧٧١ر، ٢٥٣ر، ١٣ر فى الأبقار مقابل ١٧٤ر، ٦٨٦ر، ١٨٣ر،
٧٠٠ر، ٨٠٥ر فى الجاموس .