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GENETIC PARAMETERS OF BODY CONDITION SCORE AND THE CORRELATION WITH SOME PRODUCTIVE TRAITS IN LOCAL JENUBI COWS.

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SUMMARY

Thirty two Jenubi cows were used. Body condition scoring was carried out according to the East of Scotland college of Agriculture system.Cows were fed a concentrate diet at a daily rate through drying and lactation period.Cows were given an access to pasture in addition to wheat straw as well. Milk yield was recorded twice a day for each cow. REML -Restricted Maximum likelihood method used to estimate the variance and covariance for random effects by using statistical analysis system (SAS). Heritability has estimated by using paternal half-sib method, and the genetic and phenotypic correlation has been estimated from the variance calculated by the REML method. The results show that heritability of the traits indicates that an important part of its phenotypic variance relates to additive gene effect which give a chance to improve these traits via selection and that means body condition score indicates good potential for selection. The estimates of repeatability indicate the possibility of predicating of the animal performance potential, which allows the farmer to select cows in early age. The estimated value of correlation between body condition score and the productive traits were mostly highly significant ($P<0.01$)

Keywords: *body condition score, Jenubi cows, genetic parameters*

Abbreviation key: BCSD = body condition score at drying off
BCSC = body condition score at calving
BCSCH = change in body condition score

INTRODUCTION

The main focus in dairy cattle breeding and in the selection of dairy cows has been on production traits. This has lead to an increase in production which is not followed by a corresponding increase in feed intake capacity (Van Arendonk *et al.*, 1991). This results in an increased negative energy balance, which often leads to a poorer reproductive performance (Domecq *et al.*, 1997).

Body condition score is a subjective method of assessing the amount of metabolizable energy stored in fat muscles in live animals (Ferguson *et al.*,1994) and it is a quick, noninvasive and inexpensive means of estimating fat stores in dairy cattle independent of

the animals frame size and body weight (Waltmner *et al.*,1993). Its main practical advantages lie in its ability to allow the farmer to monitor and manage the nutritional status and health status of high producing cows during their productive cycle.

Genetic parameters of body condition score have begun to be established and have been reported by several authors(Veerkamp,1998; Jones *et al.*,1999; Dechow *et al.*, 2001 and Koenen *et al.*, 2001).Estimates of heritability for body condition score ranged from 0.24 to 0.45 (Galls *et al.*, 1999; Veerkamp,1998; Veerkamp and Brotherstone, 1997) Berry *et al.*, (2002) found that heritability estimates for body condition score ranged from 0.27 to 0.37 while those for BCSCH ranged from 0.02 to 0.10 and the genetic correlation between body condition score and milk yield were negative.

In a study to estimate the heritability of body condition score and to describe the genetic and phenotypic relationships among body condition score and reproductive performance done by Dechow *et al.*, (2001) they found that heritability estimates for body condition score ranged from 0.09 at dry-off to 0.15 at postpartum in first lactation. Genetic correlation, between body condition score within first lactation were greater than 0.96 phenotypic correlations were lower than genetic correlations.

In another study formed to estimates the correlation among body condition score and dairy form in different lactation period Dechow *et al.*, (2004) found that genetic correlation estimates are stronger(ranged from – 0.61 to – 0.72) than the phenotypic correlation estimates (ranged from – 0.38 to – 0.46).

Dairy characteristic has economic importance depends on genotype- environmental interaction. Some of these as milk production days in milk and persistency are controlled by a polytropic genes and selection is one of method to improve it (Venneman, 1997).Indirect selection would be one of the important methods to improve trait with low or moderate heritability (Falconer and Mackay, 1997). Body condition score could be used to improve animal performance.

In Iraq there was no research has been done to estimate the genetic parameters of body condition score and productive traits for local breeds of cows. Therefore the objective of this study was to estimate genetic parameters (heritability, repeatability and genetic and phenotypic correlations) of BCSD, BCSC and BCSCH and some productive traits.

MATERIALS AND METHODS

The study included 32 cows of Jenubi breed in Salman Pack area. Cows were fed a concentrate diet at daily rate of (2.5–3 kg/cow/day) through drying and (3.5-4 kg/cow/day) through lactation period. The concentrate diet included 17% crude protein. Cows were given an access to pasture, and wheat straw also offered (3–3.5 kg/cow/day).Milk yield for individual cows were recorded every day on morning and afternoons, beginning three days after calving. Cows were in second and third parity.

All cows were condition scored at two months before calving (dry–off) and at calving (48 hour after calving). Body condition scoring was carried out by the same person according to the East of Scotland college of Agriculture system (ESCA, 1976)of condition scoring. The scoring based on palpation of the transverse processes of loin vertebrae, cranial cockerel vertebrae (tail head), and tuber ischii (pin bone).Scores were assigned using a five – point scale, where O = very thin to 5 = grossly fat, quarter scores were included.

Statistical analysis:

REML- Restricted maximum likelihood method (Patterson and Thompson, 1971) used to estimate the variance and covariance for random effects by using statistical analysis system (SAS, 2001) assuming the following mixed mode:

Yijk =M+Di+Sj +eijk

Were:

Yijk: is the value of observation for each trait.

M : :is the overall mean of trait.

Di : is the effect of body condition score(2.25, 2.50,2.75, 3,3.25)

Sj :is the effect of sire.

Eijk: is the random error to be mean equal to zero and variance is δ^2 e (N~O, δ^2 e)

From variance and covariance, the heritability has estimated by using paternal half – sibs method according to the following equation:

$h^2 = 4 S^2_S / S^2p$

were:

h^2 =is the estimated heritability

S^2_S=is the variance according to the sire effect.

S^2p=is the phenotypic variance.

Repeatability has estimated according to the following equation:

$r = S^2_D / S^2_D + S^2_e$

Were:

r: is the estimated repeatability

S^2_D: is the estimated variance according to the dam effect.

S^2_e: is the estimated variance of error effect.

The genetic and phenotypic correlation has been estimated from variance calculated by the REML method.

RESULTS AND DISCUSSION

The overall means for BCSD, BCSC and BCSCH were 2.75,2..75 and 0.00 respectively. The overall means for total milk and persistency were 936.43kg,185.87 day and 7.34 week respectively (Table 1).

Heritability:

The estimates of heritability for BCSD was 0.36, for BCSC was 0.38 and for BCSCH was 0.41(Table 1). Dechow *et al.* (2001) reported that heritability of BCSD was 0.09 and BCSC was 0.15.Other researchers found that heritability estimates for body condition score ranged from 0.27 to 0.37,while those for BCSCH ranged from 0.02 to 0.01 (Berry *et al.*, 2002). Veerkamp *et al.*, 2001 found that heritability of body condition score was 0.38, which is quite close to the finding of current study. The heritability of these traits indicates that an important part of its phenotypic variance relates to the additive gene effect which give a chance to improve these traits via selection, and that means body condition score indicates good potential for selection.

Heritability estimated of all traits, milk production, days in milk and persistency are given in Table (1) and were 0.18, 0.09 and 0.23 respectively. These estimates supported by the finding of (Al-Kurma, 2002 and Al-Timimi, 2003).

Repeatability:

Repeatability estimated for BCSD, BCSC and BCSCH are given in Table (1) and was 0.43, 0.43 and 0.57 respectively. These estimates indicate the possibility of predicating of the animal performance potential which allows the farmer to select cows in early age and this would leads to increase the effecting of selection. These estimates indicate as well that it is possible to do the culling decision according to one record or season (Falconer and Mackay, 1997)

Repeatability estimated for milk yield, days in milk and persistency are given in Table (1) and was 0.29, 0.16 and 0.34 respectively. The repeatability for all traits (body condition score, milk yield, days in milk and persistency) are moderate and high, which could indicates that environment condition has an obvious effect. This would explain why farmers always try to eliminate the effect of environment by husbandry programs.

Table (1): Mean ± Stander error, heritability and repeatability of BCSD, BCSC, BCSCH and the productive traits.

Items	No of observ.	Mean ± SE	Heritability (h^2)	Repeatability (R)
BCSD	96	2.75 ± 0.17	0.36	0.43
BCSC	96	2.75 ± 0.17	0.38	0.43
BCSCH	96	0.00 ± 0.32	0.41	0.57
Milk yield	96	936.43 ± 45.18	0.18	0.29
Days in milk	96	185.87± 5.24	0.09	0.16
Persistency	96	7.34 ± 0.65	0.23	0.34

Genetic and phenotypic correlation:

Correlation of BCSD, BCSC and BCSCH with production traits are given in Table (2).The genetic correlation between BCSD, BCSC and BCSCH with milk yield were 0.78,0.81 and 0.66 respectively, and the phenotypic correlation were 0.83, 0.81 and 0.55 respectively. The genetic correlation of BCSD, BCSC and BCSCH with days in milk were 0.41, 0.38 and 0.23respectively and the phenotypic correlation were 0.52, 0.33 and 0.29 respectively. The genetic correlation of BCSD, BCSC and BCSCH with persistency was 0.80, 0.82 and 0.90 respectively and the phenotypic correlation was 0.86, 0.85 and 0.88 respectively. The estimated value of correlation were mostly highly significant ($P<0.01$).In fact there are very few international studies have reported genetic correlation of body condition score with production traits. Dechow *et al.* (2001) found that genetic correlation for body condition score across lactation period was 0.77 and phenotypic correlation was 0.70. Lassen *et al.* (2003) found that genetic correlation between body condition score at different stages were higher than 0.82.

In another hand Kadarmideen and Wegmann (2000) found that genetic correlation between body condition score and milk yield was -0.12 to -0.17 and Berry *et al.*, (2002) reported that the genetic correlation between body condition score and milk yield were negative.

As this study is concern we can say that the high genetic correlation between any two traits point out that a big number of genes effect these two traits, and that is mean the selection for one trait would leads to improve the another trait. In another hand, the high

phenotypic correlation could be a result of the joint effect of environment and heredity on the two traits (Falconer and Mackay, 1997).

Table (2): Genetic and phenotypic correlation between body condition score and the productive traits.

Item	Genetic correlation (rG)	Phenotypic correlation (rp)
Milk yield and BCSD	0.78**	0.83**
Days in milk and BCSD	0.41**	0.52**
Persistency and BCSC	0.80**	0.86**
Milk yield and BCSC	0.81**	0.81**
Days in milk and BCSC	0.38**	0.33**
Persistency and BCSC	0.82**	0.85**
Milk yield and BCSCH	0.66**	0.55**
Days in milk and BCSCH	0.23^{ns}	0.29*
Persistency and BCSCH	0.90**	0.88**

***Significant at P<0.01. * Significant at P<0.05. N.S = Not Significant.*

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المعالم الوراثية لدرجة حالة الجسم والارتباط مع بعض الصفات الإنتاجية في الأبقار الجنوبية المحلية

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كانت اهداف هذه الدراسة تقدير المعالم الوراثية و البيئية لدرجة حالة الجسم و التغير في درجة حالة الجسم خلال فترة التجفيف و كذلك لبعض الصفات الانتاجية و الترابط الوراثي و البيئي بينها في الابقار الجنوبية.

تم استخدام ٣٢ بقرة من النوع الجنوبي،وتم قياس درجة حالة الجسم حسب نظام كلية الزراعة شرق اسكتلندا.تم تغذية الابقار بمعدل يومي خلال فترة التجفيف و اثناء فترة انتاج الحليب كما تم رعي الابقار فضلا من تقديم التبن.كان انتاج الحليب يسجل مرتين يوميا ولكل بقرة خلال فترة التجربة و تم تقدير مكونات التباين والتغاير للتاثيرات العشوائية بطريقة تعظيم الاحتمالات المقيدة(REML) ضمن نظام التحليل الاحصائي(SAS).وان المكافئ الوراثي قد قدر بطريقة انصاف الاخوة الاشقاء،بينما تم تقدير الارتباط الوراثي والمظهري من التباينات المحسوبة بطريقة REML.

اشارت نتائج المكافئ الوراثي للصفات المدروسة بان جزء مهما من التباين في مظهرها يعود للاثر التجمعي للعوامل الوراثية مما يوفر فرص امكانية تحسين هذه الصفات من خلال الانتخاب،وهذا يعني بان درجة حالة الجسم يعتبر مؤشرا يمكن الاعتماد عليه في الانتخاب وفي استراتيجيات التحسين.كما ان معامل التكراري المقدر اعطى مؤشرا على امكانية التنبؤ باداء الحيوان مستقبلا بحيث يمكن انتخاب الابقار بسن مبكر.وقد كانت قيمة الارتباط الوراثي والمظهري بين درجة حالة الجسم و الصفات الانتاجية على الاغلب عالي المعنوية ($P<0.01$).