TYPE TRAITS AND MILK YIELD GENETIC PARAMETERS AND BREEDING VALUES OF HOLSTEIN IN IRAQ

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ABSTRACT

In this study a total of 928 Holstein cows daughters of 33 sires bred at Al-Naser Dairy Cow Station (60 km south of Baghdad) were used to appraisal the final score for the 14 linear type traits: rear udder height (RERUDHIH), teat length (TETLENGT), strength(STRENGTH), dairy form (DAIRYFOM), rump angle (RUMPANGL), body depth (BODYDEP), fore udder attachment (FORUDER), teat placement (TETPLACM), udder depth (UDERDEPT), udder suspension (UDERSUSP), rear udder width (RERUDWID), rear leg set (RLSET), foot angle (FOTANGLE) and rump width (RUMPWIDT).

Heritability of type traits ranged from 0.080 to nearly one, and different methods did not exhibit high variability in heritability estimates for each trait. Age showed significant affect on BODYDEPT and TETPLACEM. Day in milk showed significant effect on TETLENGT, STRENGTH and UDDERDEPT.

The genetic correlation among type traits ranged from -0.724 to 0.904. It was positive and high between milk yield and RERUDERWIDT, RUMPANGL and TETLENGT. However, milk yield negatively correlated with UDERDEPT and RLSET. The breeding values for sires in deferent traits ranged from -7.656 to 8.868, and showed a high variability among sires for each trait in this study.

INTRODUCTION

Type traits have been used as indirect selection criteria for herd life (12, 17 and 18). Type traits are recorded relatively early in life, most often in the first lactation, and are medium to high heritable (1, 5 and 9), which makes selection relatively more efficient. Hence, genetic evaluations for direct longevity information based on number of culled cows should be combined with indirect information based on early predictors such as type traits.

Among the linear type traits, udder traits had the strongest effect on the survival of cows (11). Fore udder attachment, udder texture, udder depth, rear udder attachment height, rear

udder attachment width, and median suspensor were the udder traits having the strongest relationship with longevity of cows. Among the feet and legs traits, bone quality and heel depth had the largest influence on functional survival. Stature and size had the least influence on the survival of cows. Only traits related to udder and feet and legs. One of the primary goals of the linear classification program is to identify and to emphasize traits associated with longevity.

The objectives of this study were to estimate heritability of body and udder linear measurements and to calculate genetic correlation and breeding values of these traits for studied sires.

MATERIALS AND METHODS

Data resource:

Data were obtained from Al- Nasr Dairy Cattle Station, United Company for Animal Resources Ltd. The station located 50 km south of Baghdad. The total number of Holstein was 628 cows. Type data were limited to only register daughters of the 33 sires and included a appraisals for final score and 14 linear type traits evaluated by the Howard Dairyman(4). The linear type traits are rear udder height (RERUDHIH), teat length (TETLENGT), dairy form (DAIRYFOM), rump angle (RUMPANGL), body depth (BODYDEP), fore udder attachment (FORUDER), teat placement (TETPLACM), udder depth (UDERDEPT), udder suspension (UDERSUSP), rear udder width (RERUDWID), rear leg set (RLSET), foot angle (FOTANGLE) and rump width (RUMPWIDT) as described by (10).

Data analysis:

The General Linear Model (GLM) within the SPSS (14) program was used to study the effect of age and days in milk as fixed factors on the studied traits. Sire and error were also included as random factors.

Type scores were adjusted for age and stage of lactation at evaluation by factors currently used in adjusting records for sire evaluation (16). Heritability of different types was measured by four methods (ANOVA, MINQUE, ML, and REML).

The Animal Model (A.M.) was also applied to evaluate sires using one trait to estimate the breeding values of the 33 sires. The values were ranked in descending order for selection purposes.

RESULTS AND DISCUSSION

Heritability:

Heritability of different traits (Table, 1) ranged from 0.080 (RERUDHIH) to nearly one (FORUDER). Different methods did not exhibit high variability in heritability estimates for each trait. Heritability estimates for type traits ranged from 0.04 to 0.52(2). Heritabilities did not differ greatly from earlier estimates calculated from smaller data sets by Henderson's method 3 (7 and 15) or by multiple trait REML (6). Type traits associated with body size, udder, and teats had higher heritabilities than estimates found in previous studies (8, 12, 13 and 16). However, heritability estimates for feet and leg traits were smaller than estimates in the earlier studies (8, 12, 13 and 16).

Since most traits were highly heritable, they are very important to be included in breeding programs aimed to improve dairy cow types, especially the traits those positively related to yield traits and longevity of dairy cattle.

Table (1): Heritability of different traits measured by ANOVA, MINQUE, ML and REML methods

Traits	ANOVA	MINQUE	ML	REML
RERUDHIH	0.121	0.153	0.080	0.106
TETLENGT	0.511	0.691	0.556	0.573
STRENGTH	0.715	0.883	0.748	0.758
DAIRYFOM	0.688	0.845	0.781	0.790
RUMPANGL	0.706	0.747	0.736	0.746
BODYDEP	0.645	0.761	0.703	0.715
FORUDDER	0.800	1.021	0.973	0.978
TETPLACM	0.544	0.829	0.591	0.607
UDERDEPT	0.487	0.523	0.480	0.495
UDERSUSP	0.339	0.427	0.349	0.367
RERUDWID	0.534	0.772	0.600	0.615
RLSET	0.721	1.055	0.884	0.891
FOTANGLE	0.685	0.840	0.796	0.805
RUMPWIDT	0.838	1.060	0.959	0.965

Effect of age:

Age showed significant affect on BODYDEPT (P<0.05) and TETPLACEM (0.001) respectively (Table, 2). Age groups 3-4 and >5 years were recorded higher values in comparison to other groups (6.035±0.191 and 6.023±0.209 respectively). Whereas, cows aged 2-3 years got the lowest value (5.149±0.310). Cows aged 4-5 years obtained highest TETPLACEM (5.567±0.230), while those at the age of 3-4 and >5 were similar (4.750±0.229 and 4.804±0.256 respectively). Again cows aged 2-3 years showed the lowest value (4.241±0.373). This result similar to an earlier study appeared the lowest type score for BODYDEPT and TETPLACEM was for two years old cows. Whereas, age has no significant affect on the other type traits in the present study, however, they find that the means of many type traits was increased with age in USA Holstein cows, may be due to actual biological development beside older cows result from some selection for type traits and culling for low production among cows (7).

Table (2):Effect of age on different body and udder measurements (mean ± se).

Traits	Age (years)				Significant level
	2-3	3-4	4-5	>5	
RERUDHIH	5.721±0.378	5.265±0.232	5.426±0.233	5.909±0.260	NS
TETLENGT	4.040±0.392	4.742±0.241	4.863±0.242	4.958±0.269	NS
STRENGTH	5.111±0.306	5.525±0.188	5.395±0.186	5.757±0.206	NS
DAIRYFOM	5.138±0.322	5.832±0.198	5.643±0.195	5.867±0.219	NS
RUMPANGL	5.808±0.390	5.208±0.233	4.868±0.235	5.193±0.265	NS
BODYDEP	5.149±0.310b	6.035±0.191a	5.581±0.188 ab	6.023±0.209 a	0.05
FORUDDER	4.692±0.230	5.236±0.317	4.775±0.283	5.017±0.233	NS
TETPLACM	4.241±0.373b	4.750±0.229ab	5.567±0.230a	4.804±0.256 ab	0.001
UDERDEPT	5.936±0.300	5.515±0.185	5.284±0.185	5.218±0.206	NS
UDERSUSP	7.029±0.387	6.886±0.238	6.425±0.239	6.553±0.266	NS
RERUDWID	5.687±0.359	5.364±0.220	5.629±0.221	6.012±0.246	NS
RLSET	5.761±0.322	6.118±0.198	6.134±0.199	5.952±0.221	NS
FOTANGLE	5.660±0.361	5.158±0.222	5.399±0.222	5.036±0.248	NS
RUMPWIDT	4.776±0.421	5.193±0.255	5.430±0.256	5.058±0.284	NS

Effect of days in milk:

Days in milk showed significant (P<0.05 or 0.01) effect on TETLENGT, STRENGTH and UDDERDEPT (Table, 3). All these measurements were belonging to udder measurements. Cows milked for 200-300 days were significantly (P<0.05) higher (5.150±0.311) than cows milked for 100-200 days (3.865±0.348). While there were no significant differences among cows milked for <100, 200-300 and >300days. However, teat length increased as days in milk increased in Canadian (11) and USA (7) Holstein cows. Stage of lactation was significant affected (P<0.05 or 0.01) for all type traits (7).

Table(3):Effect of days in milk on different body and udder measurements(mean±se)

Traits	Day in milk				Significant level
	<100	100-200	200-300	>300	
RERUDHIH	5..609±0.244	5.328±0.336	5.928±0.300	5.455±0.247	NS
TETLENGT	4.828±0.253	3.865±0.348	5.150±0.311	4.760±0.256	0.05
STRENGTH	5.901±0.197	5.233±0.270	5.601±0.242	5.053±0.196	0.05
DAIRYFOM	6.124±0.207	5.379±0.283	5.385±0.255	5.592±0.207	NS
RUMPANGL	5.438±0.234	5.243±0.328	5.518±0.307	4.878±0.239	NS
BODYDEP	5.829±0.199	5.489±0.273	5.965±0.245	6.506±0.199	NS
FORUDDER	4.692±0.230	5.236±0.317	4.775±0.283	5.017±0.233	NS
TETPLACM	4.609±0.240	4.562±0.331	4.909±0.296	5.282±0.243	NS
UDERDEPT	5.669±0.194	5.194±0.267	5.992±0.238	5.098±0.196	0.01
UDERSUSP	6.335±0.250	7.049±0.344	6.966±0.307	6.543±0.253	NS
RERUDWID	5.350±0.231	5.958±0.319	5.852±0.285	5.532±0.234	NS
RLSET	6.006±0.208	6.008±0.286	6.215±0.256	5.736±0.211	NS
FOTANGLE	5.808±0.232	5.282±0.320	4.869±0.286	5.295±0.236	NS
RUMPWIDT	4.948±0.267	5.009±0.368	5.037±0.337	5.464±0.271	NS

Genetic correlations:

The genetic correlations among type traits had a wide range from -0.724 to 0.904 (Table, 4). This result is nearly to that obtained from (2) which ranged from -0.77 to 1.00. However, it's differ from (16) ranged -0.43 to 0.93 and (3) who ranged from -0.41 to 0.95.

The genetic correlation was positive and high between milk yield with RERUDERWIDT, RUMPANGL or TETLENGT (0.72, 0.71 and 0.55 respectively) (Table,

4). However, milk yield negatively correlated with UDERDEPT and RLSET (-0.258 and -0.069 respectively).TETLENGT highly related to FOTANGE, RERUDWID and UDERDEPT and RUMPANGL (0.704, 0.755 and 0.633 respectively), while it was negatively correlated with UDERDEPT (-0.391). As genetic correlation between milk yield and RERUDERWIDT, RUMPANGL and TETLENGT was highly significant, it is easy to select heifers in early ages depending on these traits.

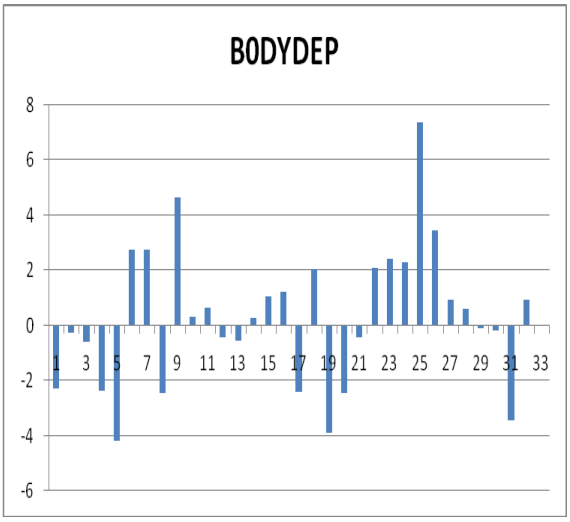
STRANGTH is highly correlated genetically to RUMPANGL, RERUDERWIDT and FORUDDER. Since all traits are related to udder size, therefore increasing STRANGTH may indirectly increasing milk yield through the increasing in udder size.

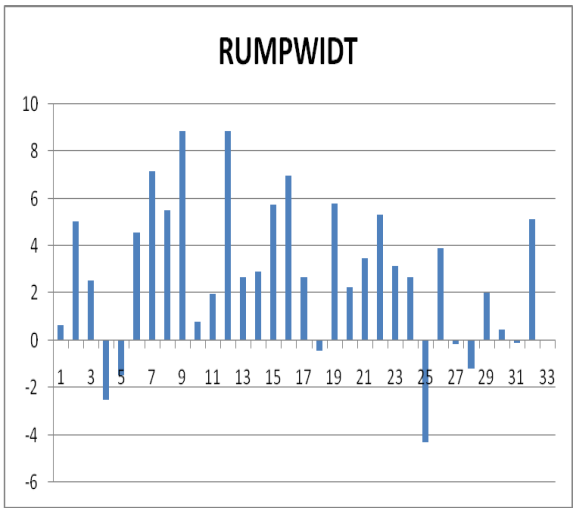
Table (4): The genetic correlations among the studied traits.

	BODYDEP	FORUDDER	FOTANGLE	RERUDERWIDT	RERUDHIH	RLEST	RUMPANGL	RUMPWIDT	STRENGTH	TETLENGT	TETPLACM	UDERDEPTH	UDERSUSP	DAIRYFORM	MILK YIELD
B0DYDEP	1.000														
FORUDDER	0.277	1.000													
FOTANGLE	-0.092	0.254	1.000												
RERUDERWIDT	0.125	0.525	0.593	1.000											
RERUDHIH	-0.123	-0.368	0.128	0.330	1.000										
RLSET	-0.092	0.217	-0.024	-0.143	-0.089	1.000									
RUMPANGL	0.138	0.394	0.502	0.465	-0.047	0.440	1.000								
RUMPWIDT	0.533	0.659	0.273	0.489	-0.348	0.030	0.406	1.000							
STRENGTH	0.219	0.416	-0.049	0.420	-0.007	0.209	-0.007	0.520	1.000						
TETLENGT	-0.064	0.489	0.704	0.735	0.013	0.272	0.653	0.420	0.322	1.000					
TETPLACM	-0.641	-0.242	0.487	0.156	0.049	-0.043	0.139	-0.038	-0.148	0.280	1.000				
UDERDEPTH	-0.341	-0.724	0.038	-0.592	0.213	-0.061	-0.319	-0.704	-0.489	-0.391	0.227	1.000			
UDERSUSP	-0.236	-0.451	0.004	0.243	0.904	-0.066	-0.103	-0.433	0.147	-0.042	0.019	0.228	1.000		
DAIRYFORM	0.515	0.472	-0.131	0.459	-0.213	-0.475	-0.056	0.586	0.459	0.205	-0.384	-0.648	-0.236	1.000	
MILK YIELD	0.051	0.135	0.453	0.720	0.345	-0.069	0.714	0.216	0.040	0.556	0.255	-0.258	0.283	0.191	1.000

Breeding values:

The type traits breeding value ranged from -7.656 for TETLENGT to 8.868 for RUMPWIDT. Body measurements breeding values were shown in (Fig, 1).





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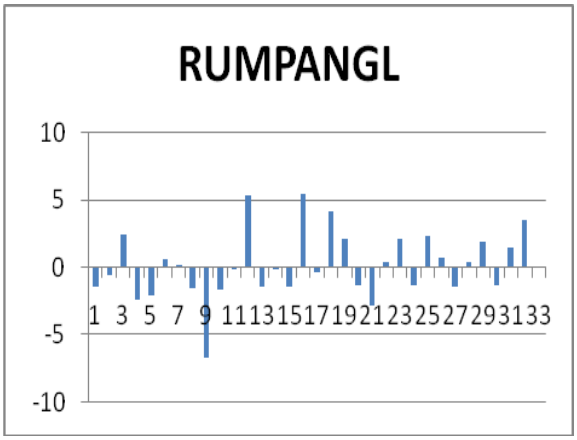

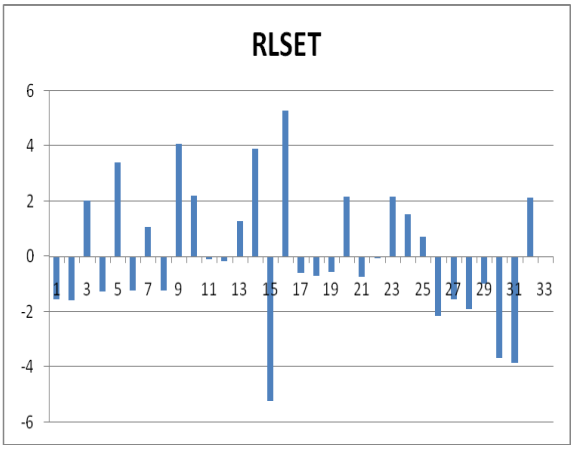

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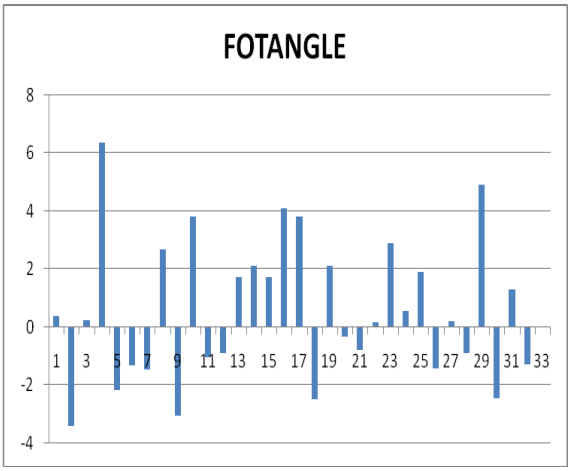
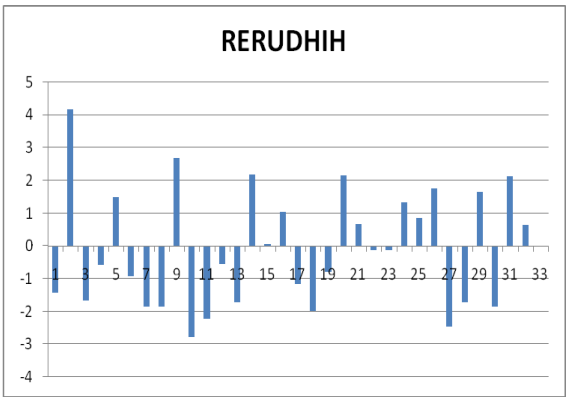
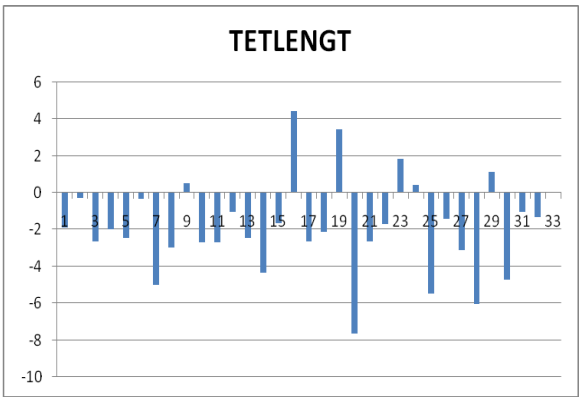


(E)

Fig (1): Breeding values of sires for: (A) Body depth, (B) Rump width, (C) Rump angle, (D) Rear leg set and (E) Foot angle





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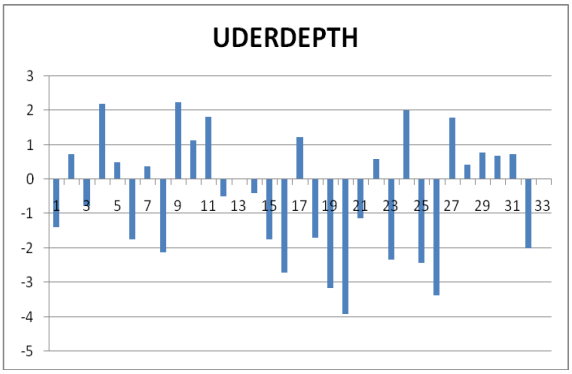

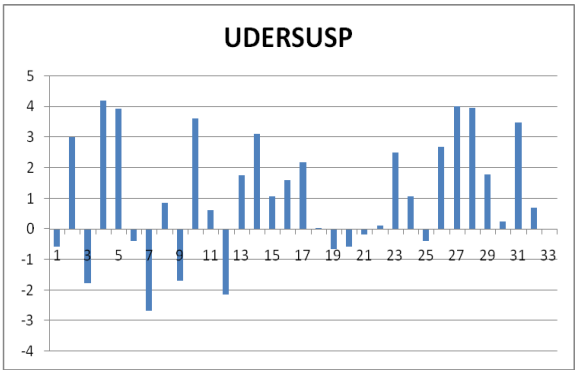

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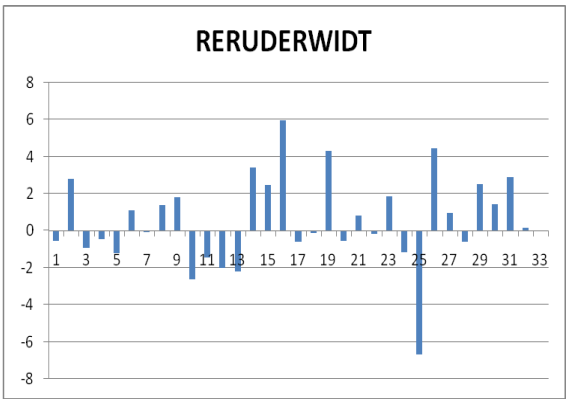

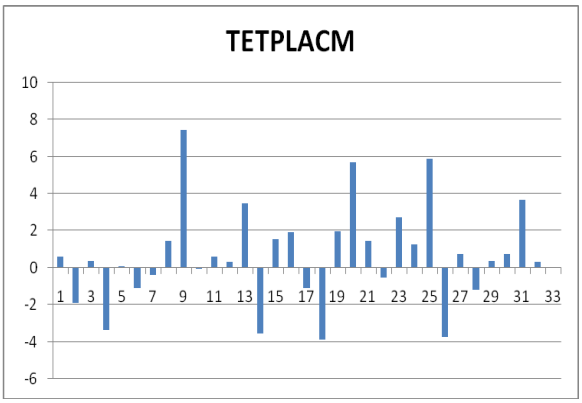

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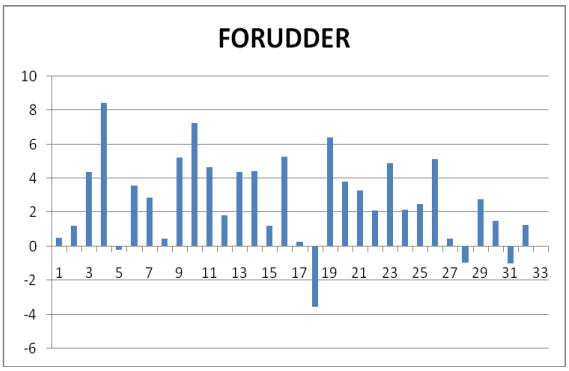
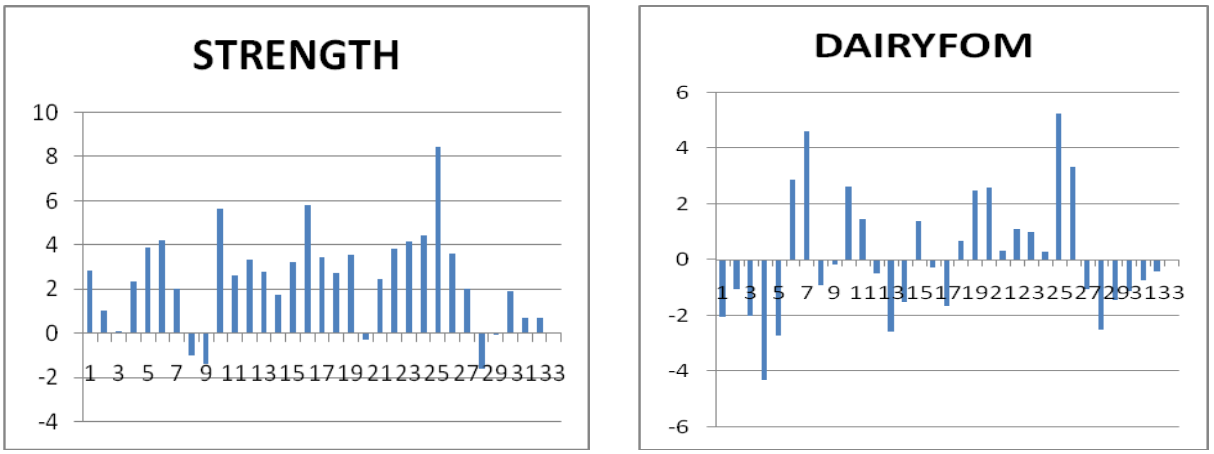


(G)

Fig (2) Breeding value of sires for: (A)rear udder height (RERUDHIH), (B) Teat length (TETLENGT), (C) Udder Depth, (D) Udder suspention, (E) Rear udder width, (F) Teat placement and (G) Forudder

Fourteen sires recorded positive breeding values for RERUDHIH, which count as 42.42% of total sires (fig, 2A). Positive values ranged from 0.2 to 4.3, whereas, negative values ranged from -2.8 to -0.5. However, six sires out of 33 (18.18%) had positive breeding values for TETLENGT (fig, 2B). These results indicated that selection would be more effective when done on rear udder height than teat length. As udder volume measured by RERUDHIH was more important than teat length. However, teat length can be most effective on milking machine. Therefore, selection practiced more on RERUDHIH, that nearly 42% of sires got positive breeding values.

When calculating STRENGTH breeding value (Fig, 3A), most sires got positive values (30 out of 33 or 90.91%). This may indicated that selection practiced heavily on this trait. The positive breeding values ranged from 0.1 to 8.3, while the negative values ranged from -1.7 to -0.1. Variability (overall range) of this trait was -1.7 to 8.3. As variability in breeding value exists, there is ability to use selection to improve traits.



(B)

Fig (3) Sire breeding values for (A) strength and (B) Dairy form

FORUDER,STRANGTH and RUMPWIDT showed highest positive breeding value (84.848, 81.818 and 75.758 respectively), while the lowest values were showed by TETLENGT (18.182), (Table, 5).

Table (5): Positive breeding value percentage for the studied type traits.

Type trait	Positive breeding value %(range)	Type trait	Positive breeding value % (range)
RERUDHIH	**42.42 (-2.78 _ 4.18)**	**TETPLACM**	**63.63 (-3.85 _ 7.45)**
TETLENGT	**18.18 (-7.66 _ 4.45)**	**RUMPWIDT**	**75.75 (-4.31 _ 8.87)**
STRENGTH	**81.81 (-1.63 _ 8.45)**	**FOTANGLE**	**54.54 (-3.41 _ 6.36)**
DAIRYFORM	**42.42 (-4.31 _ 5.26)**	**RLSET**	**39.39 (-5.21 _ 5.29)**
RUMPANGL	**51.51 (-6.68 _ 5.45)**	**RERUDERWIDT**	**48.48 (-6.70 _ 5.99)**
BODYDEP	**51.51 (-4.19 _ 7.39)**	**UDERSUSP**	**66.66 (-2.67 _ 4.21)**
FORUDDER	**84.84 (-3.57 _ 8.43)**	**UDERDEPTH**	**48.48 (-3.91 _ 2.24)**

On the other hand, the 33 sires showed a wide range of positive breeding values from 23.76 to 85.71% (Table, 6). And about 10% of total sires got more than 80% positive breeding value of studied traits, which may be used in nucleus herd (super elite). A total of 33 sires showed a range of 60 – 79% positive breeding values, which can be used as elite herd. A 39% of the rest sires showed positive breeding values ranged from 40 – 59% which can be used as sires in the commercial herds. However, nearly 19% of the sires exhibited a positive breeding value ranged less than 40%, which must be culled.

Table (6): Positive breeding value percentage for the stduied sires.

Sire number	Positive breeding value %	Sire number	Positive breeding value %	Sire number	Positive breeding value %	Sire number	Positive breeding value %
99229	23.76	7465	42.86	96283	57.14	762	71.43
74657	28.57	45	50.00	656	64.29	96232	71.43
556	35.71	651	50.00	658	64.29	97865	71.43
1	35.71	7667	50.00	665	64.29	916	85.71
689	35.71	96239	50.00	4510	64.29	7673	85.71
1671	35.71	96240	50.00	7669	64.29	7677	85.71
566	42.86	653	57.14	8655	64.29		
654	42.86	699	57.14	9913	64.29		
1505	42.86	74653	57.14	760	71.43		

الصفات الشكلية والمقاييس الوراثية لإنتاج الحليب والقيم التربوية لأبقار الهولشتاين في العراق

عدنان جبار جدوع

قسم الثروة الحيوانية - كلية الزراعة – جامعة البصرة – البصرة - العراق

الخلاصة

استخدمت في هذه الدراسة 928 بقرة هولشتاين وهي بنات لـ 33 أب مرباة في محطة أبقار النصر(تقع 60 كم جنوب بغداد) لتقدير الدرجة النهائية لـ14 صفة شكلية وهي: ارتفاع الضرع من الجهة الخلفية و طول الحلمة والقوة و شكل بقرة الحلوب و زاوية القطن و عمق الجسم و ارتباط الضرع مع البطن و اتجاه الحلمة و عمق الضرع و تعليق الضرع و سمك الضرع من الجهة الخلفية و وضع الرجل من الجهة الخلفية و زاوية القدم و سمك القطن.

تراوح المكافئ الوراثي للصفات الشكلية من 0.08 إلى قرابة الواحد، ولم تظهر الطرق المختلفة لقياس المكافئ الوراثي فروقا كبيرة في قيمته لكل من الصفات المدروسة. وقد ظهر إن لعمر الحيوان تأثيراً معنويا في عمق الجسم و اتجاه الحلمة. بينما كان لمرحلة إنتاج الحليب تأثيراً معنوياً في طول الحلمة والقوة وعمق الضرع.

تراوح الارتباط الوراثي بين الصفات الشكلية في هذه الدراسة بين - 0.724 و 0.904، وكانت قيمته موجبة وعالية بين إنتاج الحليب وبين كل من سمك الضرع من الجهة الخلفية و زاوية القطن و طول الحلمة. ومن ناحية أخرى فان لإنتاج الحليب ارتباط وراثي سالب مع عمق الضرع و وضع الرجل الخلفية.

تراوحت القيم التربوية للآباء في مختلف الصفات بين -0.765 و 8.868 ، وقد ظهرت اختلافات كبيرة بين الآباء لكل من الصفات في هذه الدراسة.

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