Egyptian J. Anim. Prod., Vol. 32(1) (1995):13-31.

THE PHENOTYPIC RELATIONSHIPS AMONG TYPE AND PRODUCTION TRAITS OF HOLSTEIN DAIRY COWS IN THE KINGDOM OF SAUDI ARABIA

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SUMMARY

The relationships among type traits were estimated from 13642 records collected from Masstock dairy farms in Saudi Arabia. Two different assessments of type traits were used: 1) Linear-type traits which included seventeen biological traits from extremes based on 1-9 scale and 2) subjective type traits with six categorical grades from poor to excellent. Correlation coefficients were corrected for discontinuity. Stature had the highest correlation coefficient with body depth (r=0.68). Some negative correlation coefficients were observed between each of chest width and body depth and other type traits. The correlation coefficients between production and linear-type traits were low (< 0.2). In Masstock farms, 40 - 60% of the cows were classified as good or good plus for both linear and subjective type traits. Linear functions of udder traits had a high multiple correlation with total score (r_m = 0.74) . Canonical correlations between udder traits and teat traits were the highest (r_c = 0.77).

Keywords: Phenotypic relationships, type traits, production traits, Holestein, Kingdom of Saudi Arabia

INTRODUCTION

Relationships among body measurements of the dairy cows are of special interest to the dairy farmers for

several reasons. Among these reasons are : 1) Cows are often judged on the basis of body conformation, 2) Body dimensions such as heart girth, wither height, and body length are related to milk production (Wilk et al., 1963; Seykora and McDaniel, 1983; and Line et al.,1987), 3) Udder conformation may account for some differences of mastitis resistance (Hickman, 1964) and Thomas et al., 1984, 4) Udder of the cow is defined as the most important criteria used to predict milk yield (Hickman, 1964 and Shanks and Spahr, 1982), 5) Selection for large cows with wide pin bones and long sand sloping rumps should improve calving ease of cow (Ali et al., 1984), 6) Selection for milk yield has changed the udder measurements as a correlated response (Peterson et al., 1985; Shanks and Spahr, 1982) and 7) combining body measurements and milk yield into an index could result in a great gain in milk yield than selection based only on first lactation yield. (Brum and Ludwick,1969).
The objectives of this study were:
1) To explore the distribution of type traits of dairy cows in Masstock farm in Saudi Arabia. 2) To find the relationships among linear type traits by: a) computing Pearsson-product moment correlations between type traits, b) Adjusting the correlation coefficients for discontinuity, c) Computing multiple correlation coefficients between total score (SC) and linear functions of type traits, d) Computing canonical correlations among linear functions of type traits, and 3) To find relationship between production and type traits by: a) Estimating product-moment correlations between production traits and type traits, b) Computing multiple correlation coefficients between production traits and linear functions of type traits.

MATERIAL AND METHODS

The data used in this study included two sets of records obtained from Masstock Saudia herds.
1) Type-traits file with 13642 records distributed among five lactations were used. Each record has the information on: a) Linear type traits namely total score (SC), chest width (CW), body depth (BD), angularity (ANG), rump angle (RA), rump width (RW), rear legs side view (RLS), rear legs rear view (RLR), foot angle (FA), fore udder attachment (FUA), fore udder angle (FA), fore

udder attachment (FUA), fore udder angle (FANG), rear udder width (RUW), udder support (US), udder depth (UDD), teat placement rear view (TPR), teat placement side view (TPS) and teat length (TL), b) Subjective type traits, namely breed character (BCR), body capacity (BCP), legs and feet (LF), udder (U) and teats (T).

The assessment of the first 17 type traits (ST to TL) were from extremes based on 1-9 scale, while the grade of subjective traits (BCR to T) was identified by the number of points that the animals had awarded. So, a score of 90-100 was given to the excellent grade (E), 89-81 to very good (VG), 80-72 to good plus (GP), 71-63 to good (G), 62-54 to fair (F) and 53-10 to poor(P). The cow had been in its fourth lactation before it had awarded excellent status.

The evaluators had visited Masstock farms once a year in the spring season or mostly around that time (when most of the cows are reached their peak and they are in the fifth to seventh month of lactation). Each cow had judged once in her life. If a cow was judged during her first lactation; she must be evaluated again in the next visit to the farm.

2) Production file with 14072 records was used and each of which has information on the herd number, origin number, lactation number, age class, Lactation period of the first lactation (D1), milk yield of the first lactation (Y1), Lactation period of the second lactation (D2), milk yield of the second lactation (Y2) and total score (SC).

After editing both records of type-trait and production for missing scores, odd milk yield, unreasonable days in milk and for abnormal lactations of less than 150 days, type traits file and production file were merged by cow number within herd to establish a combined file which was used for studying the relationship among type and production traits. SAS (1982) package was used to analyze the edited data where pearson product moment correlations were computed among different linear type traits. However, these correlations were corrected for discontinuity using technique developed by Cox (1974).

Multiple correlations coefficients were estimated between each of ST, Y1, Y2, D1 and D2 and linear functions of type traits. Canonical correlation coefficients were computed between linear functions of type traits. To form linear functions, type traits were classified to five categories or classes. The first category (udder traits) included FUA, FAG, RUW, US and UD, while capacity traits like ST, CW, BD, RA and RW were included in the second category. The third class have the traits which described legs from side and rear view, and food angle. Angularity and rump angle were described in the fourth category. The last class included teat traits like DTPS, TPR and TL. The coefficients in corrected pearson moment correlation and multiple correlation according to the statistical methods described by Kshirsagar (1972). Likelihood ratio test (Kshirsagar, 1972) was used to test the hypothesis that population multiple and canonical correlation coefficients are equal to zero.

RESULTS AND DISCUSSION

Distribution of Subjective-Type Traits

Figures (1 to 10) show the distribution of the data by grade of the subjective traits. The asymmetric shaped distribution is the main feature of the Masstock type traits distribution. Most of the traits scored poor or excellent in 2% of the data with exception to the udder where about 8-10% of the cows had poor udder which was a relative indication of poor management in Masstock farm. Cassel et al. (1973) found that less than 2% of the data (from 336 to 253 single classification score) represented excellent and poor categories for final classification, general appearance, dairy character, body capacity, and mammary system.

Legs and feet, breed character and body capacity scored good plus for 65%, 50% and 35% of the data, respectively. Very good category was scored by 43% of the cows for body capacity. However, 6% of the cows have excellent body capacity. Moreover, 20% of the cows scored very good for breed character. Cassell et al. (1973) found that most of the data were in favour of the good category for dairy character (48%) and body capacity (32%). In good plus category, final score, general appearance, dairy character, body capacity and mammary system scored 39%, 27%, 46%, 51% and 34%, respectively. In other words, most of the data for subjective traits in Masstock farm lie in the good and good plus categories. However, Cassell et al. (1973)

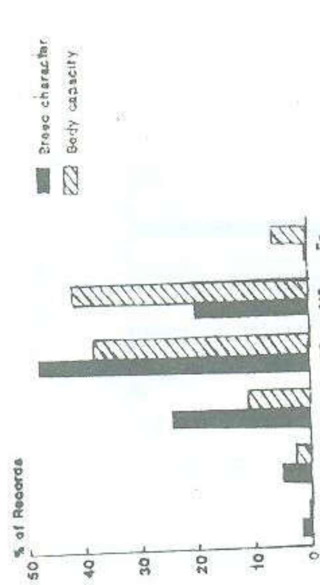

Fig. 1 Percent of records by grade for breed character and body capacity.

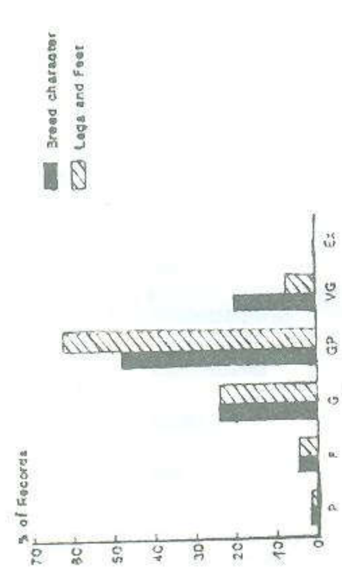

Fig. 2 Percent of records by grade for breed character and legs and feet.

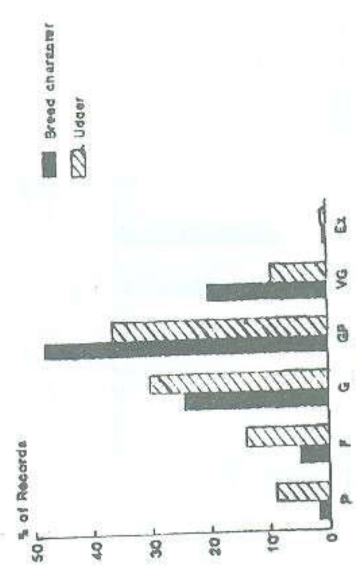

Fig. 3. Percent of records by grade for breed character and udder

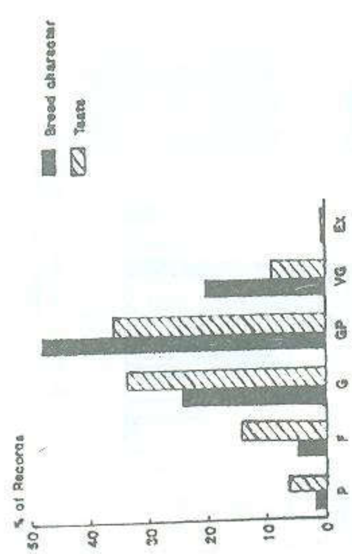

Fig. 4. Percent of records by grade for breed character and teats.

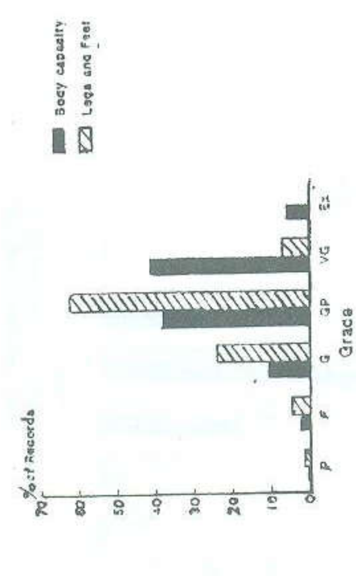

Fig. 5 Percent of records by grade for body capacity and legs and feet

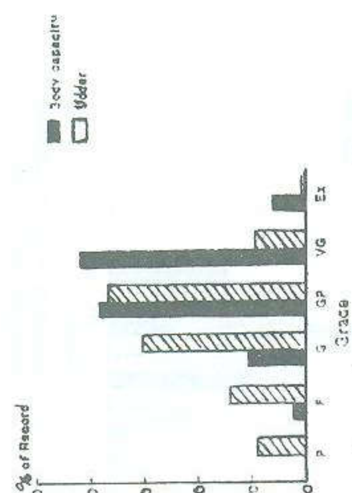

Fig. 6. Percent of records by grade for body capacity and udder

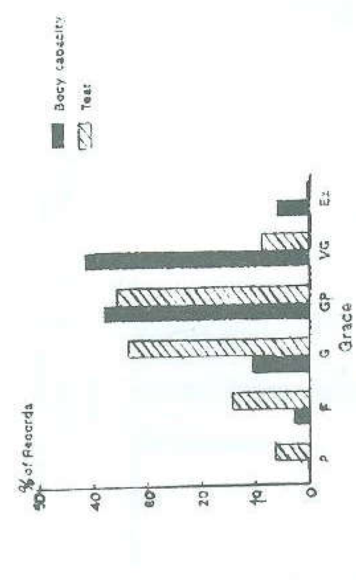

Fig. 7. Percent of records by grade for body capacity and teats

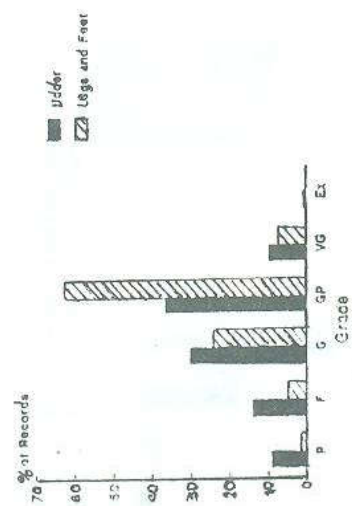

Fig. 8 Percent of records by grade for udder and legs and feet.

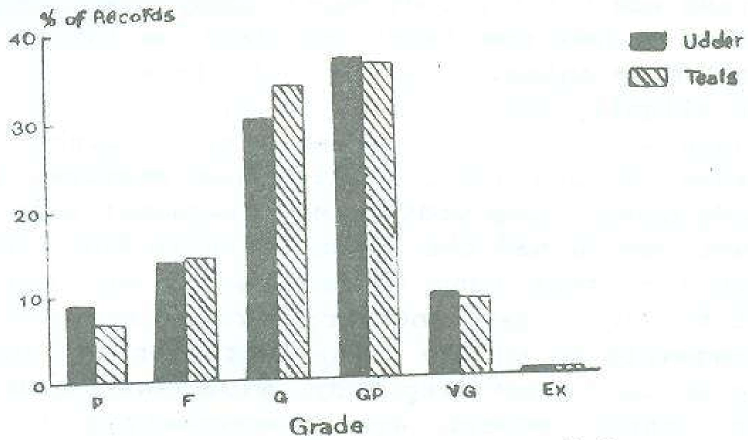

Fig. 9 Percent of records by grade for udder and teats.

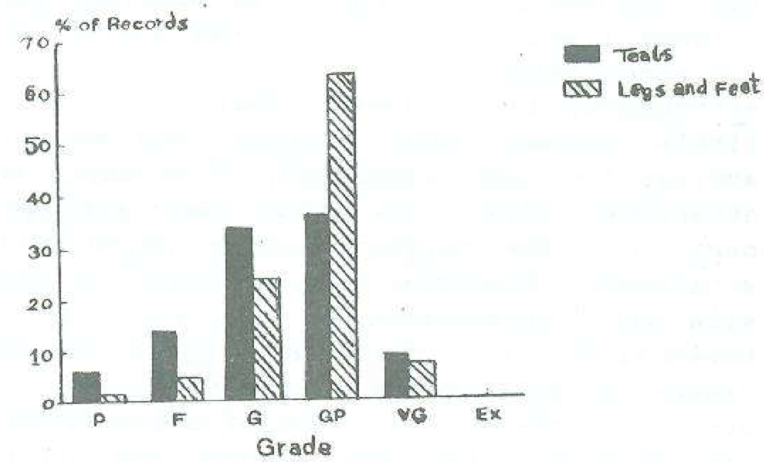

Fig.10 Perçent of records by grade for teat and legs feet.

found that most of the score-çard traits represented in good plus and very good categories.

Linear-type traits: Means and Standard Deviations

Table 1 shows the means and standard deviations (SD) of linear-type traits in each lactation and for the overall data. Across all lactations, the overall average of 3.9 was the lowest for teat placement rear view, i.e. the placement of the teat is wide. However, the highest grade was 5.5 for body depth (deep body). Rear legs side of view had the least standard deviation. This means that more animal have legs with intermediate set in hock or slightly set in hock. On the other hand, fore udder angle was the most variable trait since its standard deviation was 2.07. Traits like stature, chest width, body depth, rump width, teat placement side of view, and teat length had the least score in the first lactation since heifers tend to have small and shallow bodied, with narrow chest and narrow rump. The scores increased gradually up to the fifth lactation so older cows tend to be tall with deep body. wide chest width, wide rump and their udders are characterized by bigger and centrally placed teats. The changes of these grades from one lactation to another might be due to the effect of age on maturity, smoothness of the body measurements and the clarity of body conformation. Also these changes might be due to culling of low scoring cows.

Table 1 shows that udder traits such as udder shape and size change with age, so young cows had firm udder attachment, small udder, shallow udder floor with a little defined cleft. Younger cows scored higher than average for udder supported, udder depth and fore udder attachment. Older cows scored lower average than younger ones in udder support, udder depth and fore udder attachment. From one side, changes in udder shape and size with advancement in age are mainly due to the hormonal effect of the estrous cycle and pregnancy which causes the development of the fore udder tissue. On the other hand the continuation of the milking process from lactation to the next dilate the udder attachment apparatus and enlarge teat size and shape. These results of age effect on linear type-traits support the findings by White et al. (1967), Thomposon et al. (1983), Lucas et al. (1984) and Ali et al. (1984). All results agreed that age is a significant source of variation for stature, strength, dairy character, rump width, rear udder width and udder depth.

Table 1 shows no observable conformation change across lactations for angularity, rump angle, rear legs side of view, rear legs rear of view and foot angle. This might be due to the early setting of bone and the frame setting conformation of the cow which do not change by advancing of age.

Table 1. Mean (X) and SD of linear-type traits in the first five lactations and for overall data

Traits	Lactation No.											
	1st		2nd		3rd		4th		5th		overall	
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
ST	5.82	1.28	6.46	1.32	6.50	1.30	6.53	1.33	6.75	1.34	6.19	1.36
CW	4.98	1.35	5.51	1.32	5.72	1.20	6.00	1.17	5.91	1.14	5.38	1.35
BD	6.34	1.34	6.87	1.25	7.09	1.17	7.37	1.19	7.37	1.20	6.74	1.33
ANG	5.94	1.42	6.11	1.64	5.98	1.72	5.80	1.48	6.05	1.51	5.99	1.55
RA	4.33	1.16	4.26	1.14	4.22	1.16	4.11	1.21	4.20	1.23	4.27	1.17
RW	5.50	1.39	6.10	1.43	6.33	1.38	6.55	1.32	6.42	1.32	5.93	1.44
RLS	5.96	1.05	5.90	1.05	5.86	1.07	5.95	1.24	5.92	1.29	5.91	1.09
RLR	5.75	1.61	5.87	1.60	5.90	1.60	5.67	1.76	5.48	1.81	5.79	1.63
FA	4.62	1.13	4.65	1.10	4.63	1.08	4.56	1.23	4.65	1.16	4.63	1.13
FUA	4.84	1.72	4.48	1.81	4.03	1.84	3.57	1.91	3.51	1.85	4.39	1.86
FANG	5.23	1.92	4.63	2.00	4.19	2.07	3.80	2.04	3.80	2.11	4.66	2.07
RUW	4.93	1.55	5.10	1.67	4.86	1.73	4.47	1.66	4.49	1.74	4.87	1.66
US	5.81	1.30	5.59	1.51	5.21	1.74	4.72	1.79	4.49	1.75	5.46	1.58
UD	5.10	1.62	3.82	1.59	3.00	1.44	2.27	1.20	2.11	1.06	3.96	1.88
TPR	4.04	1.29	3.99	1.43	3.69	1.41	3.48	1.44	3.45	1.37	3.87	1.39
TPS	5.23	1.20	5.69	1.27	5.74	1.41	5.88	1.22	5.92	1.31	5.54	1.30
TL	4.57	1.41	5.03	1.42	5.40	1.46	5.56	1.54	5.57	1.46	4.99	1.50

Production traits: Mean and Standard Error

Production traits in this study for 14072 records, included milk yield and days in milk. The average total milk yield in the second lactation (4115 kg) is less than the average total milk yield of first lactation (5580 kg). This is mainly due to the lactation period of the first lactation was 305 days, while it was 376 days for second lactation. The standard errors for milk and days in milk were high because a large proportion of cows milked less than 150 days. Only 4150 of 14072 records had lactation period of ≥150 days. Least square analysis was carried out on lactations of ≥150 days to remove herd effect on production traits, herd effect had high significant effect on Y1, Y2 and D2. The least square means of total milk yield (Table 2). for the first lactation (with ≥150 days) was 6804 kg while it was 7741 kg for the second.

Table 2. Least squares means and standard errors of production traits and SC.

Trait	Least squares means	S.E.
SC	68.75	8.420
D1	305.00	3.000
Y1	6804.00	1701.000
D2	376.00	66.000
Y2	7741.00	2188.000

Relationships among linear-type traits

Stature had the highest correlation coefficient (r=0.68) with body depth (Table 3). The correlation coefficient between stature and chest width was 0.37. Chest width had a high correlation coefficient with body depth (r=0.54). Stature, body depth and chest width had high correlation coefficients with rump width (r=0.44, 0.49 and 0.51, respectively). So the tall and deep cow has a wide rump or large pelvic area, namely the hooks (hips), pins and hurls. Negative correlation coefficients between chest width and angularity from one side and other linear-type traits from the other side indicate that thick animals received more average score. This finding was supported by the negative relationship between angularity (sharpness and flatness of bone, openness of sits and length of neck) and rump width. Rump angle from hooks (hips) to pins had a small correlation coefficients (close to zero) with other linear-type traits. In other words, the height of the pins relative to the hips height did not show any relationship with traits of the body.

For evaluating the rear legs, the classifier evaluated the rear legs from the side, noting the amount of set of the hock joint. The straighter, or more pasty the set, the lower score for the legs (close to 1), the more set or curve in the hock joint, the higher the number the cow had taken (close to 9). However, the classifier noted the closeness of the hocks or the distance between hocks by viewing the cow from the rear. Cows

Table 3. Cox adjustable correlations (above diagonals) and pearson product momment correlations (lower diagonals) among linear-type traits

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1		0.331	0.662	0.108	-.014	0.417	0.061	0.067	-.005	0.115	0.130	0.225	-.014	-.059	0.078	0.094	0.126
2	0.368		0.515	-.477	-.079	0.467	-.076	0.160	0.084	0.009	0.025	0.119	-.112	-.232	-.060	-.025	0.122
3	0.681	0.539		-.023	-.127	0.488	0.032	0.280	-.020	0.130	0.170	0.284	-.010	-.217	0.027	0.075	0.126
4	0.108	-.489	-.022		-.028	-.278	0.123	-.041	-.112	-.023	-.045	0.044	0.121	-.002	0.057	0.240	-.001
5	-.018	-.102	-.150	-.033		-.046	-.039	-.090	0.022	-.003	-.043	-.031	-.034	0.024	0.042	-.044	0.045
6	0.442	0.506	0.487	-.272	-.056		-.030	0.179	0.064	0.092	0.113	0.199	-.050	-.157	0.012	-.012	0.126
7	0.074	-.093	0.036	0.106	-.054	-.036		-.347	-.236	0.034	0.054	-.050	0.019	0.077	0.037	-.025	-.059
8	0.066	0.159	0.256	-.036	-.101	0.169	-.373		0.144	0.175	0.187	0.332	0.118	0.010	0.012	0.048	0.021
9	-.006	0.104	-.022	-.125	0.031	0.075	-.316	0.156		0.088	0.073	0.036	0.014	0.018	0.075	0.008	0.064
10	0.099	0.008	0.110	-.019	-.034	0.080	0.034	0.140	0.087		0.808	0.591	0.442	0.750	0.659	-.139	-.101
11	0.107	0.021	0.132	-.034	-.041	0.091	0.049	0.139	0.067	0.808		0.582	0.451	0.795	0.603	-.157	-.123
12	0.219	0.118	0.261	0.093	-.035	0.189	-.054	0.255	0.039	0.471	0.430		0.380	0.293	0.352	0.063	0.015
13	-.016	-.126	-.010	0.124	-.041	-.054	0.024	0.116	0.017	0.401	0.349	0.375		0.456	0.362	-.016	-.078
14	-.052	-.200	-.150	-.004	0.025	-.135	0.075	0.008	0.033	0.549	0.534	0.231	0.409		0.396	-.266	-.305
15	0.085	-.072	0.028	0.057	0.052	0.012	0.045	0.011	0.091	0.525	0.496	0.339	0.397	0.347		0.102	-.053
16	0.106	-.029	0.080	0.249	-.058	-.013	-.033	0.049	0.011	-.116	-.134	0.063	-.018	-.242	0.114		0.089
17	0.127	0.127	0.122	-.001	0.053	0.125	-.066	0.022	0.073	-.076	-.095	0.013	-.081	-.253	-.054	0.095	

1=ST, 2=CW, 3=BD, 4=ANG, 5=RA, 6=RW, 7=RLS, 8=RLR, 9=FA, 10=FUA, 11=FANG, 12=RUW, 13=US, 14=UD, 15=TPR, 16=TPS, 17=TL.

with close rear at the hock and toe out severely were poor cows, and cows with straight legs and teo-out were scored high. Correlation coefficient between these two view of legs was -0.37 which indicate that post-legged cows tended toward less toe-out than sickle-hocked cows. Similar results were found by Thompson et al. (1983) who found that the correlation coefficient between rear legs rear view with rear legs side view was -0.29. These two traits are important for the durability of the legs and feet. Posty-legged cows might have two much stress on their legs caused by an aggravation of joints. Sickle or close hocked cows might have too much stress on the legs muscles and tendons.

Foot angle describes the steepness of the angle of the foot as viewed from the side. So the more steep angled feet the better. This trait is important since it had related to cow's durability and mobility. It has also determined how frequently a cow's feet needs trimming. Correlation coefficients of foot angle with other linear-type traits were low (< 0.15).

High positive correlation coefficient was found between fore udder attachment and fore udder angle (r=0.81) and consequently the bigger fore udder angle will lead the stronger attachment of the udder to the body wall by lateral suspensory ligaments. Correlation coefficients were high (>0.40) between fore udder attachment and other traits. Therefore, fore udder attachment is an important trait in milk production since it determines how the fore udder will be carried and the likelihood of injury. Van Vleck and Norman (1972) have shown that cows with tightly attached fore udder tend to be culled for low production while those with deeper udders tend to be culled less often for low production but more often for fore udder problems. Therefore, tightly attached fore udder may be physiologically incompatible with high milk production. The correlation coefficients between fore udder attachment and rear udder width, udder support and udder depth were 0.47, 0.40 and 0.55, respectively. These high correlations are important since the strength and balance of the udder depend to a large extent on the existence of fore udder attachment, lateral suspensory ligament and the rest of the udder support (mainly median suspensory ligament of the cow which is the primary support of the udder). Rear udder with is determined by viewing the cow from the rear and therefore udder width is used as good indicator of the cows potential capacity for milk production. Udder support is also evaluated by viewing the udder from the rear support, since good udder is the one with extreme cleft and strong support. This kind of udder will be easy to milk and has the minimum likelihood for injury. Udder depth is another important measure for the udder capacity and susceptibility to injury and mastitis infection, so the most desirable udder for the cow is the rear side udder which characterized by extreme cleft and strong support and has an udder floor very well above the hock. The correlation coefficients were 0.38 between rear udder width and udder support, 0.23 between rear udder width and udder depth and 0.41 between udder support and udder depth, respectively. Close positive correlation (r=0.43) was found by Thomposon et al. (1981) between rear udder width and udder depth.

Proper teat placement in the udder allows for ease of milking and reduce the susceptibility of the cow to injury. The most desirable teat placement from rear view are those with their bases on the inside of the quarter and the teats themselves are very close. On the other hand, the teats are placed in the center of each quarter from the side view. According to what mentioned above, correlation coefficient between teat placement rear and side views was product moment. In this respect, teat placement rear view had higher correlation coefficient than teat placement side of view with other udder traits (r>0.30).

Teat length had a negative correlation coefficient with udder depth (-0.31). Line et al. (1987) found that the heifers with longer teats had larger teat diameter and the heifers with longer front teats had longer rear teats. Udder depth had a slight negative phenotypic correlation with teat length (Table 3). One must notice the compatible trend of the two type of correlations i.e. comparability between pearson product moment correlation and Cox adjustable correlation (Table 3).

Relationship between Production Traits and Linear-Type Traits

Table 4 shows the correlation coefficients between total score and production and linear-type traits. The correlation coefficients between production traits and linear-type traits were low (<0.2). For correlations between milk traits and linear-type traits, the correlation coefficient between days in milk in second lactation and udder depth was the highest (r=0.15). The correlation coefficient between milk yield for the first and second lactation and udder depth were 0.11 and 0.12. However, estimates of correlations between production traits and subjective or linear-type traits are similar to estimates found by Mitchell et al. (1961), Carter et al. (1965) and Norman and Van Vleck (1972).

Table 4. Correlation coefficients between production and total score and linear-type traits

Trait	D1	Y1	D2	Y2	SC
ST	.03	.01	.03	.05	.19
CW	.02	-.08	.01	.01	.06
BD	.04	-.05	.02	.04	.28
ANG	0	.10	-.04	0	.13
RA	-.01	.06	-.02	-.01	-.16
RW	.04	-.08	.01	0	.12
RLS	.02	.02	.03	-.03	-.05
RLR	.01	.01	.01	.02	.28
FA	.01	-.01	0	0	.14
FUA	.05	.04	.11	.10	.62
FANG	.02	0	.10	.08	.58
RUW	.03	.06	.04	.07	.54
US	.04	.08	.06	.07	.58
UD	.03	.11	.15	.12	.42
TPR	.04	.06	.06	.07	.57
TPS	-.01	-.01	-.06	-.05	.10
TL	-.02	-.03	-.07	-.06	-.13
SC	.07	.06	.09	.10	

All these reviewed studies reported low correlation coefficients around 0.2 or less. Correlation of total score with fore udder attachment was high (0.62). Total score had equal correlation coefficient of 0.57 with fore udder angle, udder support and udder depth. Other linear-type traits had correlation coefficient with total score of less than 0.30. This result is agreement with Norman et al. (1978), Lawstuen et al. (1987) and Smothers et al. (1988). The correlation between total score and milk yield and days of milk were less than

0.11. These results are close to those reported by Mitchell et al. (1961) and Van Vleck et al. (1980).

Multiple and canonical correlation

Table 5 shows the multiple correlation coefficients (r_m) between production traits and linear functions of type traits. All correlations were small (<.2). Days in milk showed insignificant correlation coefficients with all linear function of type traits. Legs and feet showed insignificant multiple correlation coefficients with all production traits, while total score (sc) showed higher multiple correlation coefficients ($r_m \geq .20$) The highest multiple correlation was between SC and linear functions of udder traits (r_m = .74**). The second highest multiple correlation was between total score and teat characters (r_m= .59). So udder traits and teats represent the best linear function for predicting the total score.

Table 5. Multiple correlation coefficients between linear functions of type traits and production traits and total score

Category	SC	Y1	Y2	D1	D2
Udder	.74**	.19**	.10**	.07	.20**
Capacity	.30**	.06**	.07**	.04	.07
Legs	.31**	.03	.01	.04	.06
Angularity	.20**	.05*	.02	.01	.04
Teat	.59**	.04	.10**	.02	.11**

(p>0.01)

Grouping-type traits in linear functions showed slight increase in correlation with production traits. On the other hand, grouping-type traits in linear functions reflected the importance of udder characteristics in determining the value of total score. So, the cow with centered, balanced teats and deep fore udder and good udder support is considered as the most desirable cow, easy to milk and expected to have the minimum likelihood of injury.

Table 6 shows that the highest canonical correlation was between udder trait and teat characteristics (r_c=.77). This canonical correlation accounted for 84% of the total variation. The second highest canonical correlation was between udder traits and capacity (r_c=.67) and accounted for 95% of the total variability. The lowest canonical correlation was between leg and teat traits (r_c=.10) and accounted for 61% of the total variability.

Table 6. Canonical correlation coefficients between linear functions of type traits and eigenvalues

Category	canonical correlation	Eigen value	Eigen value (%)
Udder*Capacity	.67	.813	95
Udder*Leg	.37	.164	84
Udder*Angularity	.19	.038	75
Udder*Teat	.77	1.490	84
Capacity*leg	.35	.141	87
Capacity*Angularity	.60	.553	95
Capacity*Teat	.18	.031	57
leg*Angularity	.16	.026	71
leg*teat	.10	.011	61
Angularity*Teat	.26	.064	92

CONCLUSION

In terms of subjective traits, masstock dairy cows had grades in favour of good and good plus. The correlation coefficients among production traits were less than 0.2. Total score has high product moment and multiple correlation (r_m= .73) with udder traits (>0.5) while lower correlations were noticed with other type traits (<0.3). All correlation coefficients between legs or feet and other type traits were low (<0.1). Udder traits showed low correlations in subsequent lactations, While body capacity scored high correlations in subsequent lactations. Udder traits has the highest canonical correlation with teat traits (r_c=.77) followed by capacity traits (r_c=.67).

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العلاقات المظهريه بين الصفات الشكلية والانتاجيه فى ابقار الهولستين بالمملكه العربيه السعوديه

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تناول هذا البحث تقدير معاملات الارتباط المظهريه بين مقاييس الجسم وصفات الشكل التى تعتمد على التحكيم الشخصى وعلاقتها ببعض الصفات الانتاجيه وذلك باستخدام عدد ١٣٦٦٢ سجلا لابقار الهولستين المستورده والمرباه بمزارع ماستوك (مزارع المراعى لإنتاج الألبان) بالمملكه العربيه السعوديه وقد أظهرت النتائج الاتى:

- كان معامل الارتباط بين عمق الجسم والمظهر العام للحيوان ٠,٦٨
- وجد إرتباط سالب بين كل من عمق الصدر وعمق الجسم وبعض مقاييس الجسم الاخرى التى درست.
- كانت معاملات الارتباط بين الصفات الانتاجيه ومقاييس الجسم منخفضه (اقل من ٠,٢)
- حققت صفات الضرع مع التقدير الكلى قيما عالية لمعامل الإرتباط المتعدد (٠,٧٤) كما حققت صفات الضرع مع صفات الحلمات اعلى قيمة لمعامل الإرتباط للـ (Canonical Correlation) (٠,٧٧).