

Relationship between Non-production Traits and Survival Rates in Danish Dairy Cows ¹⁾

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Introduction

Culling due to other factors than yield often brings the farmer large costs in the form of vet bills, extra work, lower production. A reduction in the number of cows culled for other reasons than low yield is thus desirable. Direct selection on the longevity of cows will probably not be effective as the heritability is low and the generation interval will be significantly prolonged. Selection on correlated traits which can be registered early in the cow's life can be used to improve or maintain the cow's stayability.

The objective of this paper is to consider the correlation between traits included in the Danish total merit index (S-index) and stayability traits.

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Materials and methods

Definition of traits

The stayability of a cow is expressed by means of survival rate and number of days in feed. The survival rate of a cow is coded 0 or 1 depending on whether the cow is alive or slaughtered at the end of the period. The number of days in feed is the number of days from first calving to culling or to the end of the period.

Due to differences in the methods of calculating the two stayability measures, survival rate and number of days in feed, they do not provide exactly the same information but the difference between the two stayability traits is limited. The stayability trait, survival rate, is best suited to show when in a cow's life a trait is having an effect on stayability and less suited to identify the relative importance of the trait for stayability. The number of days in feed is a better indication of the trait's relative importance for stayability.

Data

The data set comprised cows which have their first calving after 1 January 1989 to August 1994. 535,700 Danish Black and White (SDM), 102,542 Danish Red (RDM) and 109,654 Jersey cows were included in the data set. Information on the cows' status as per 1 January 1995 was available.

The following BLUP-sire model was applied for the estimation of the bull's breeding values (BV) for survival rate and days in feed. Cows were only included if they had had the opportunity to survive to the end of the period after first calving. The model was:

	Effect	Type of effect
Y	= herd x year	fixed
	+ year x month	fixed
	+ calving age	fixed
	+ breed	fixed
	+ sire	random
	+ residual	random

where

Y = days in feed or survival rate

A heritability of 0.05 was assumed for both survival rate and number of days in feed. The pedigree information of the bulls was traced 3 generations back.

Estimated breeding values (EBV) for the two stayability traits were correlated with EBVs for

all traits in the S-index and some other traits that are not published officially for time being. Only Danish bulls owned by an AI-society born after 1983 with EBVs for stayability based on at least 70 first batch of daughters were included in the analyses.

Results

Breed average and variation

Table 1 shows average, variation width and standard deviation for survival rate and number of days in feed at 400, 700 and 1,000 days after first calving in Danish Black and White (SDM), Danish Red (RDM) and Danish Jerseys (DJ) for progeny groups of bulls.

The average survival rate at 400 days after first calving was about 72 percent. The standard deviation was about 6 percent. The survival rate between groups varied between 39 and 91 percent. At 400 days there was no difference between the breeds but at 1000 days the Jerseys had most surviving cows as Jersey bulls had an average of 34 percent live daughters whereas RDM had 27 percent. The breed differences were also to be seen in the number of days in feed.

Correlations

Tables 2-4 show the simple correlations between the EBVs for stayability and other traits. A further investigation included only the SDM breed. The EBVs for stayability traits were corrected simultaneously for the yield index and an EBV indicating the cow's slaughter value (functional herdlife). This trait was defined as slaughter weight multiplied by the actual price per kg according to the EUROP principle (table 5 and 6).

For all traits high BVs are favourable. This also applies to the traits "somatic cell count" and "other diseases".

Relationship between production and stayability

As expected there was a positive correlation between the EBVs for yield and stayability. For all breeds the highest correlation was found at 400 days and it decreased at 700 and 1000 days. The performance test results of the bulls were not quite coincident for the breeds. In RDM and Danish Jerseys there was a tendency to a negative correlation between stayability and daily gain, whereas the same correlation was significantly negative for SDM. This negative correlation could only partly be explained by the correlations between daily gain/yield and daily gain/slaughter value of the cows. As regards muscle area RDM cows tended to have an unfavourable correlation at 700 and 1000 days but the correlations were not significant. In SDM there was a small negative correlation of muscle area with stayability in the first 400 days after first calving (-0.10). In RDM and Jerseys the feed intake capacity is positively correlated

with stayability whereas this was not the case in SDM. The feed intake capacity was generally higher in SDM than in RDM and Jerseys. The differences may also be due to the fact that the breed composition of the SDM bulls was more homogeneous compared to RDM and Jerseys where the proportion of foreign genes from American Brown Swiss and American Jerseys, respectively, differs more.

The slaughter value of the culled cows varies a lot. The standard deviation of the bull's breeding value for slaughter value of the cows in SDM was about DKK 130. In comparison the deviation of the net value of milk production is DKK 320. There was a positive correlation of animals obtaining a high slaughter price with early culling for slaughter. Direct selection on stayability without considering the slaughter value will lead to reduced slaughter values of the cows.

Relationship between non-production traits and stayability

Reproduction and health

Female fertility and health had a large effect on stayability but the effect is blurred by the very negative correlation with yield. In all breeds the correlation of stayability with female fertility was low or negative at 400 days whereas it was positively correlated with the survival rate at 1000 days (table 5-6). When the EBVs for stayability were corrected for yield, there was a positive correlation of stayability with female fertility. The non-return rate tended to have a relatively higher effect in the beginning of the cow's productive life whereas the two measures of length, calving to first insemination and length of insemination period were more important later on.

For all breeds there was a positive correlation between mastitis resistance, somatic cell count and stayability. If the estimated breeding values were corrected for yield, the correlation of survival rate with mastitis resistance was equal to 0.33 at 700 days which is high especially when considering the fact that the estimated breeding values for mastitis resistance, somatic cell count and other diseases were based only on data reported in the period until 180 days after calving in first lactation. As regards somatic cell counts there was generally speaking the same trend as for mastitis resistance. In SDM the correlation between stayability was highest for mastitis resistance whereas the correlation of somatic cell count was higher in RDM and Jerseys. For other diseases there was an unfavourable correlation of stayability with the breeding value for other diseases at 400 days. There was thus a tendency that animals suffering from other diseases were not culled immediately. On the other hand, functional herd life was extremely positively correlated with other diseases at 1000 days. Both true and functional herd life were positively correlated to calving traits.

Milking speed and temperament

In all breeds correlations between stayability and milking speed were positive, indicating that a selection on milking speed had been carried out. The strongest selection took place in RDM, which is the breed with the generally poorest milking speed. The correlation was highest at 400 days, which indicates that the most intense selection took place in first lactation. As regards temperament RDM selected during the whole period whereas SDM only selected immediately after first calving. In Jerseys there was no significant correlation between stayability and temperament.

Conformation

In Denmark all linear assessments are combined into the 3 indexes, body, feet & legs and mammary system. Only in RDM a positive correlation was found between stayability and body but for all breeds there was a positive correlation of good "feet & legs" and mammary system with stayability.

The EBVs of linear type traits were correlated with the EBVs of stayability traits at 1000 days after first calving for SDM (table 7). Dairy form was positively correlated with stayability but this was only due to the positive correlation with yield.

Deep and wide cows with large rump widths had a poorer stayability but this is mainly due to the fact that the cows had a higher slaughter value and they were thus culled earlier. Only cows with a strong topline and not too much chest depth seemed to have a better stayability.

Good hock quality and bone quality were the 2 "feet and legs" traits that were most important to stayability. Furthermore, steep food angle was significantly correlated with stayability. All mammary traits had a significant positive correlation with stayability.

Discussion and conclusion

Besides yield, many other traits are influencing the stayability of cows. This investigation has confirmed that good reproduction and health traits are of decisive importance for our efforts to produce long-living cows. The correlations of the stayability measures with the individual traits are correlations between breeding values. Many of these traits have low heritabilities and the repeatability of these traits is relatively low. The genetic correlation between stayability and reproduction/health traits is thus considerably higher than the correlations between EBVs. The body traits have no or inconsiderable importance whereas good feet and legs as well as mammary system contribute to produce long-living cows. There is an unfavourable correlation of bulls' growth rate with stayability which cannot be explained immediately. Direct selection on stayability is likely to result in cows with a lower slaughter value.

References

Dekkers, J.C.M., and L.K. Jairath, 1994. Requirements and uses for genetic evaluations for conformation and herd life. 5th World Congr. Genet. Appl. Livest. Prod., 17:61.

Table 1: Mean, variation (minimum, maximum) and standard deviation of the mean survival rate and days in feed for progeny groups and bulls with first batch of daughters

Days after first calving	Survival rate									Days in feed								
	400			700			1000			400			700			1000		
	SDM	JER	RDM	SDM	JER	RDM	SDM	JER	RDM	SDM	JER	RDM	SDM	JER	RDM	SDM	JER	RDM
Mean	73	72	71	49	51	46	31	34	27	351	347	347	533	530	522	647	654	628
Minimum	49	58	39	19	33	23	12	18	11	287	300	275	417	444	371	492	522	431
Maximum	91	91	88	74	73	70	64	57	53	385	386	380	625	619	617	818	817	797
Standard deviation	6.1	6.1	6.3	6.9	7.2	7.9	6.6	6.4	7.3	13.4	13.8	14.5	30.2	32.1	33.9	46.8	47.1	54.2
Number of bulls	1612	396	423	1349	330	359	1048	257	282	1612	396	423	1349	330	359	1048	257	282

Table 2: Correlations between estimated breeding values for survival rate/days in feed and the listed estimated breeding values (Danish Black and White).

Trait	Days after first calving					
	400		700		1000	
	I	II	I	II	I	II
S-index	0.45 ^c	0.43 ^c	0.44 ^c	0.48 ^c	0.41 ^c	0.48 ^c
Yield						
Y-index	0.40 ^c	0.41 ^c	0.33 ^c	0.42 ^c	0.31 ^c	0.39 ^c
M-index	0.43 ^c	0.42 ^c	0.28 ^c	0.40 ^c	0.22 ^c	0.35 ^c
F-index	0.31 ^c	0.33 ^c	0.32 ^c	0.35 ^c	0.29 ^c	0.34 ^c
P-index	0.43 ^c	0.42 ^c	0.30 ^c	0.41 ^c	0.27 ^c	0.38 ^c
Performance test						
I-index	-0.31 ^c	-0.32 ^c	-0.25 ^c	-0.32 ^c	-0.17 ^c	-0.29 ^c
Daily gain	-0.30 ^c	-0.34 ^c	-0.30 ^c	-0.35 ^c	-0.24 ^c	-0.33 ^c
Muscle area	-0.10 ^a	-0.07	-0.01	-0.06	0.00	-0.07
Feed intake cap.	0.03	0.00	-0.05	-0.02	0.01	0.03
Slaughter value	-0.21 ^c	-0.20 ^c	-0.21 ^c	-0.23 ^c	-0.17 ^c	-0.18 ^c
Female fertility						
Index	0.06	-0.03	0.07 ^a	0.02	0.09 ^b	0.03
Non-return rate	0.13 ^c	0.07 ^a	0.09 ^a	0.10 ^b	0.02	0.07
Calving to 1st ins.	0.01	-0.03	0.02	-0.01	0.07	-0.01
Insemination period	0.08 ^b	-0.02	0.09 ^b	0.04	0.09 ^a	0.06
Calving index	0.09 ^b	0.05	0.08 ^a	0.08 ^a	0.04	0.07
Mastitis resistance	0.17 ^c	0.17 ^c	0.25 ^c	0.20 ^c	0.20 ^c	0.19 ^c
Somatic cell count	0.16 ^c	0.16 ^c	0.20 ^c	0.17 ^c	0.16 ^c	0.16 ^c
Other diseases	-0.05	-0.08 ^a	0.11 ^b	0.01	0.10 ^b	0.04
Body	0.04	0.02	-0.02	0.01	0.00	0.02
Feet and legs	0.09 ^a	0.08 ^a	0.17 ^c	0.14 ^c	0.16 ^c	0.17 ^c
Mammary	0.18 ^c	0.17 ^c	0.23 ^c	0.22 ^c	0.26 ^c	0.25 ^c
Milking speed	0.06	0.06	0.05	0.06	0.06	0.03
Temperament	0.11 ^c	0.12 ^c	0.03	0.08 ^a	0.03	0.03
No. of bulls	852	852	852	852	674	674

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed

Table 3: Correlation between estimated breeding values for survival rate/days in feed and the listed estimated breeding values (Danish Jerseys).

Trait	Days after first calving					
	400		700		1000	
	I	II	I	II	I	II
S-index	0.25 ^b	0.30 ^c	0.28 ^b	0.30 ^c	0.33 ^c	0.36 ^c
Yield						
Y-index	0.22 ^b	0.29 ^c	0.24 ^b	0.27 ^b	0.24 ^a	0.30 ^b
M-index	0.27 ^b	0.30 ^c	0.22 ^b	0.29 ^b	0.22 ^a	0.34 ^c
F-index	0.15	0.18 ^a	0.22 ^b	0.20 ^a	0.20 ^a	0.19
P-index	0.24 ^b	0.31 ^c	0.22 ^b	0.28 ^b	0.24 ^a	0.33 ^c
Performance test						
I-index	-0.08	-0.09	-0.06	-0.08	0.11	0.05
Daily gain	-0.09	-0.14	-0.13	-0.14	0.02	-0.03
Muscle area						
Feed intake cap.	-0.02	0.02	0.08	0.06	0.18	0.16
Female fertility						
Index	0.02	-0.07	0.04	-0.02	0.13	0.03
Non-return rate	0.03	0.04	0.05	0.02	0.15	0.05
Calving to 1st ins.	0.05	-0.04	0.02	0.00	0.06	0.01
Insemination period	-0.02	-0.07	0.05	-0.03	0.16	0.04
Calving index	-0.07	-0.06	0.18 ^a	0.04	0.13	0.07
Mastitis resistance	0.08	0.13	0.20 ^a	0.11 ^a	0.16	0.10
Somatic cell count	0.20 ^a	0.22 ^b	0.28 ^b	0.23 ^a	0.25 ^a	0.23 ^a
Other diseases	0.08	0.14	0.09	0.10	-0.05	0.02
Body	0.01	-0.03	-0.12	-0.05	-0.06	-0.03
Feet and legs	0.09	0.15	0.08	0.11	0.05	0.06
Mammary	0.21 ^a	0.21 ^a	0.23 ^b	0.25 ^b	0.25 ^a	0.31 ^b
Milking speed	0.07	0.12	0.00	0.07	0.10	0.13
Temperament	0.05	-0.02	0.05	0.03	0.02	0.04
No. of bulls	128		128		99	

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed

Table 4: Correlations between estimated breeding values for survival rate/days in feed and the listed estimated breeding values (Danish Red).

Trait	Days after first calving					
	400		700		1000	
	I	II	I	II	I	II
S-index	0.51 ^c	0.53 ^c	0.34 ^c	0.51 ^c	0.32 ^c	0.47 ^c
Yield						
Y-index	0.45 ^c	0.48 ^c	0.28 ^b	0.44 ^c	0.25 ^b	0.43 ^c
M-index	0.40 ^c	0.41 ^c	0.27 ^c	0.41 ^c	0.29 ^b	0.46 ^c
F-index	0.48 ^c	0.50 ^c	0.29 ^c	0.48 ^c	0.25 ^b	0.45 ^c
P-index	0.46 ^c	0.48 ^c	0.29 ^c	0.45 ^c	0.26 ^b	0.44 ^c
Performance test						
Index	0.06	0.09	-0.09	0.02	-0.06	-0.01
Daily gain	0.03	0.03	-0.12	-0.03	-0.02	-0.04
Muscle area	-0.02	0.03	-0.09	-0.03	-0.14	-0.07
Feed intake cap.	0.16 ^a	0.17 ^a	0.05	0.14	0.06	0.13
Female fertility						
Index	0.00	-0.05	0.21 ^b	0.04	0.13	0.00
Non-return rate	-0.17 ^a	-0.21	0.06	-0.13	-0.01	-0.11
Calving to 1st ins.	0.03	-0.02	0.14	0.05	0.08	0.00
Insemination period	-0.01	-0.06	0.20	0.02	0.14	0.03
Calving index	0.15	0.14	0.02	0.11	0.08	0.09
Mastitis resistance	0.24 ^b	0.24 ^b	0.13	0.23 ^b	0.11	0.16
Somatic cell count	0.20 ^a	0.14	0.18 ^a	0.22 ^a	0.15	0.16
Other diseases	-0.11	-0.07	-0.10	-0.10	0.02	-0.03
Body	0.21 ^b	0.10	0.14	0.15	0.13	0.13
Feet and legs	0.18 ^a	0.13	0.22 ^b	0.19 ^a	0.23 ^a	0.20 ^a
Mammary	0.11	0.05	0.22 ^b	0.15	0.23 ^a	0.15
Milking speed	0.21 ^b	0.26 ^b	0.10	0.22 ^a	0.06	0.21 ^a
Temperament	0.25 ^b	0.19 ^a	0.29 ^c	0.28	0.25 ^b	0.25 ^b
No. of bulls	155		155		114	

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed

Table 5: Correlations between estimated breeding values for survival rate/days in feed corrected for the Y-index and the listed estimated breeding values (Danish Black and White).

Trait	Days after first calving					
	400		700		1000	
	I	II	I	II	I	II
S-index	0.19 ^c	0.16 ^c	0.22 ^c	0.22 ^c	0.21 ^c	0.22 ^c
Yield						
Y-index	0.00	0.00	0.00	0.00	0.00	0.00
M-index	0.15 ^c	0.13 ^c	0.03	0.10 ^b	0.00	0.07
F-index	-0.05	-0.03	0.03	-0.01	0.02	-0.01
P-index	0.06	0.05	-0.00	0.03	-0.00	0.02
Performance test						
I-index	-0.29 ^c	-0.31 ^c	-0.25 ^c	-0.31 ^c	-0.14 ^b	-0.27 ^c
Daily gain	-0.28 ^c	-0.31 ^c	-0.28 ^c	-0.33 ^c	-0.19 ^c	-0.29 ^c
Muscle area	-0.11 ^a	-0.09	-0.02	-0.07	0.01	-0.07
Feed intake cap.	0.03 ^a	0.01	-0.06	-0.02	-0.02	0.00
Slaughter value	-0.11 ^c	-0.09 ^b	-0.13 ^c	-0.12 ^c	-0.09 ^a	-0.08 ^b
Female fertility						
Index	0.18 ^c	0.07 ^b	0.17 ^c	0.14 ^c	0.21 ^c	0.15 ^c
Non-return rate	0.21 ^c	0.14 ^c	0.14 ^c	0.18 ^c	0.08 ^a	0.14 ^c
Calving to 1st ins.	0.07 ^a	0.03	0.07 ^a	0.05	0.13 ^c	0.06
Insemination period	0.22 ^c	0.09 ^b	0.20 ^c	0.18 ^c	0.20 ^c	0.19 ^c
Calving index	0.10 ^b	0.07 ^a	0.10 ^b	0.11 ^b	0.06	0.10 ^b
Mastitis resistance	0.26 ^c	0.22 ^c	0.33 ^c	0.29 ^c	0.27 ^c	0.27 ^c
Somatic cell count	0.23 ^c	0.21 ^c	0.26 ^c	0.25 ^c	0.22 ^c	0.24 ^c
Other diseases	0.02	0.01	0.17 ^c	0.08 ^a	0.17 ^c	0.12 ^b
Body	0.00	0.02	-0.04	-0.02	-0.01	-0.01
Feet and legs	0.09 ^b	0.08 ^a	0.17 ^c	0.14 ^c	0.15 ^c	0.17
Mammary	0.22 ^c	0.21 ^c	0.26 ^c	0.26 ^c	0.27 ^c	0.29
Milking speed	0.08 ^b	0.09 ^b	0.06	0.08 ^a	0.07	0.07
Temperament	0.11 ^c	0.13 ^c	0.02	0.08 ^a	0.03	0.04

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed

Table 6: Correlation between estimated breeding values for survival rate/days in feed corrected for Y-index and slaughter value and the listed estimated breeding values (Danish Black and White).

Trait	Days after first calving					
	400		700		1000	
	I	II	I	II	I	II
S-index	0.20 ^c	0.16 ^c	0.24 ^c	0.23 ^c	0.22 ^c	0.23 ^c
Yield						
Y-index	0.00	0.00	0.00	0.00	0.00	0.00
M-index	0.15 ^c	0.13 ^c	0.03	0.09	-0.00	0.06
F-index	-0.05	-0.04	0.02	-0.02	0.01	-0.01
P-index	0.06	0.05	0.00	0.03	-0.00	0.02
Performance test						
I-index	-0.29 ^c	-0.30 ^c	-0.23 ^c	-0.30 ^c	-0.13 ^a	-0.26 ^c
Daily gain	-0.25 ^c	-0.29 ^c	-0.23 ^c	-0.29 ^c	-0.16 ^b	-0.26 ^c
Muscle area	-0.13 ^b	-0.11 ^b	-0.04	-0.09 ^a	-0.00	-0.08
Slaughter value						
Feed intake cap.	0.04	0.02	-0.04	-0.01	-0.00	0.02
Female fertility						
Index	0.18 ^c	0.08 ^a	0.17 ^c	0.14 ^c	0.21 ^c	0.16 ^c
Non-return rate	0.21 ^c	0.15 ^c	0.14 ^c	0.18 ^c	0.08 ^a	0.14 ^c
Calving to 1st ins.	0.08 ^a	0.03	0.07 ^a	0.05	0.14 ^c	0.07
Insemination period	0.22 ^c	0.10 ^b	0.21 ^c	0.18 ^c	0.21 ^c	0.20 ^c
Calving index	0.11 ^c	0.07 ^a	0.11 ^b	0.11 ^b	0.07	0.11 ^b
Mastitis resistance	0.25 ^c	0.21 ^c	0.33 ^c	0.29 ^c	0.28 ^c	0.27 ^c
Somatic cell count	0.24 ^c	0.22 ^c	0.27 ^c	0.26 ^c	-0.24 ^c	0.25 ^c
Other diseases	0.02	-0.02	0.18 ^c	0.09 ^a	0.17 ^c	0.13 ^c
Body	0.04	0.02	0.00	0.03	0.03	0.02
Feet and legs	0.08 ^a	0.07 ^a	0.16 ^c	0.13 ^c	0.15 ^c	0.16 ^c
Mammary	0.24 ^c	0.23 ^c	0.29 ^c	0.28 ^c	0.30 ^c	0.31 ^c
Milking speed	0.08 ^b	0.09 ^b	0.06	0.08 ^a	0.07 ^a	0.07
Temperament	0.12 ^c	0.13 ^c	0.03	0.09 ^b	0.04	0.04

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed

Table 7: Correlation of estimated breeding values for survival rate/days in feed with estimated breeding values for linear scored type traits. Danish Black and White. 1000 days after first calving

Trait	Corrected for					
	Yield				Yield and slaughter value	
	I	II	I	II	I	II
Stature	0.01	0.00	0.03	0.02	0.07	0.06
Body depth	-0.11 ^b	-0.10 ^b	-0.12 ^c	-0.13 ^c	-0.09 ^a	-0.10 ^b
Chest width	-0.10 ^b	-0.12 ^b	-0.03	-0.04	0.02	0.00
Dairy form	0.13 ^c	0.17 ^c	0.03	0.05	0.02	0.04
Top line	0.10 ^b	0.10 ^a	0.11 ^b	0.11 ^b	0.11 ^b	0.11 ^b
Rump width	-0.13 ^c	-0.15 ^c	-0.10 ^b	-0.11 ^b	-0.06	-0.07
Rump (side view)	-0.00	-0.03	0.02	-0.01	-0.00	0.03
Rear legs (side)	-0.04	-0.06	-0.04	-0.06	-0.04	-0.06
Rear legs (rear)	0.02	-0.00	0.06	0.03	0.07	0.04
Hock quality	0.16 ^c	0.20 ^c	0.13 ^c	0.18 ^c	0.12 ^b	0.17 ^c
Bone quality	0.19 ^c	0.23 ^c	0.14 ^c	0.17 ^c	0.12 ^b	0.14 ^c
Foot angle	0.10 ^b	0.10 ^b	0.10 ^b	0.10 ^b	0.10 ^b	0.10 ^b
Fore udder attach.	0.20 ^c	0.18 ^c	0.22 ^c	0.24 ^c	0.24 ^c	0.25 ^c
Udder cleft	0.17 ^c	0.20 ^c	0.16 ^c	0.20 ^c	0.18 ^c	0.21 ^c
Udder depth	0.20 ^c	0.15 ^c	0.28 ^c	0.27 ^c	0.29 ^c	0.27 ^c
Front teat lenght	0.12 ^b	0.08 ^a	0.11 ^b	0.08	0.11 ^b	0.08 ^a
Front teat thickn.	-0.13 ^b	-0.01	-0.16 ^c	-0.05	-0.17 ^c	-0.06
Front teat plac.	0.17 ^c	0.18 ^c	0.18 ^c	0.20 ^c	0.19 ^c	0.22 ^c

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed

Table 7: Correlation of estimated breeding values for survival rate/days in feed with estimated breeding values for linear scored type traits. Danish Black and White. 1000 days after first calving

Trait	Corrected for					
	None		Yield		Yield and slaughter value	
	I	II	I	II	I	II
Stature	0.01	0.00	0.03	0.02	0.07	0.06
Body depth	-0.11 ^b	-0.10 ^b	-0.12 ^c	-0.13 ^c	-0.09 ^a	-0.10 ^b
Chest width	-0.10 ^b	-0.12 ^b	-0.03	-0.04	0.02	0.00
Dairy form	0.13 ^c	0.17 ^c	0.03	0.05	0.02	0.04
Top line	0.10 ^b	0.10 ^a	0.11 ^b	0.11 ^b	0.11 ^b	0.11 ^b
Rump width	-0.13 ^c	-0.15 ^c	-0.10 ^b	-0.11 ^b	-0.06	-0.07
Rump (side view)	-0.00	-0.03	0.02	-0.01	-0.00	0.03
Rear legs (side)	-0.04	-0.06	-0.04	-0.06	-0.04	-0.06
Rear legs (rear)	0.02	-0.00	0.06	0.03	0.07	0.04
Hock quality	0.16 ^c	0.20 ^c	0.13 ^c	0.18 ^c	0.12 ^b	0.17 ^c
Bone quality	0.19 ^c	0.23 ^c	0.14 ^c	0.17 ^c	0.12 ^b	0.14 ^c
Foot angle	0.10 ^b	0.10 ^b	0.10 ^b	0.10 ^b	0.10 ^b	0.10 ^b
Fore udder attach	0.20 ^c	0.18 ^c	0.22 ^c	0.24 ^c	0.24 ^c	0.25 ^c
Rear udder width	0.17 ^c	0.20 ^c	0.16 ^c	0.18 ^c	0.17 ^c	0.18 ^c
Udder cleft	0.17 ^c	0.20 ^c	0.16 ^c	0.20 ^c	0.18 ^c	0.21 ^c
Udder depth	0.20 ^c	0.15 ^c	0.28 ^c	0.27 ^c	0.29 ^c	0.27 ^c
Front teat lenght.	0.12 ^b	0.08 ^a	0.11 ^b	0.08	0.11 ^b	0.08 ^a
Front teat thickn.	-0.13 ^b	-0.01	-0.16 ^c	-0.05	-0.17 ^c	-0.06
Front teat plac.	0.17 ^c	0.18 ^c	0.18 ^c	0.20 ^c	0.19 ^c	0.22 ^c

a: $P < 0.05$. b: $P < 0.01$. c: $P < 0.001$

I: Survival rate

II: Days in feed