Analysis of genetic aspects related to live body weight in dairy cows: determination of parameters and calculation of values.

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INTRODUCTION.

Body weight (BW) is a functional trait that has been poorly studied until now. In most countries, BW's data collection has been performed just in research stations and not in regular dairy farms. Along years, a large improvement has been achieved in yield traits. But, it may happen that the increase in production was achieved by cows that are larger, weight more and, therefore need more nutrients to supply their basic body requirements. In such case, it may happen that the production efficiency has not been improved. Many studies have shown that large animals (cows, in our case) are less efficient in productive terms than smaller ones, since a larger body has to be maintained. Former genetic studies –using very partial data sets- have determined a negative value for live body weight (LBW) in dairy cows.
The aim of the present study was to investigate genetic aspects of BW in dairy cows.

OBJECTIVES.

The objectives of the present study were:
a) To characterize changes in live body weight (LBW) for dairy cows throughout lactation, b) To determine and calculate correction factors at lactation 1, for the recorded data, c) To elaborate parameters related to LBW of interest from a managerial and genetic point of view, d) To calculate phenotypic and genetic correlations between those parameters and between those parameters and productive traits (milk, fertility, longevity), e) To calculate heritability for those parameters.

MATERIALS AND METHODS.

Data on LBW were recorded from 22 dairy farms equipped with an automatic weighing device connected to a computerized system. Cows (lactations 1-3) were weighted 1-2 times a day while exiting from the milking parlor and the daily average was calculated. Data were recorded between 1-300 days in milk (DIM) and elaborated as weekly averages.
The data on LBW was merged with data, for the respective cows, on milk yield, fertility (conception status) and productive longevity, and the cows' sire.
Six parameters, related to LBW values throughout lactation, were elaborated:
Initial Body Weight (IBW) – value for the 1st week after calving,
Minimal Body Weight (mBW) –the lowest value (nadir) for LBW along lactation,
Body Weight decrease (dBW) = IBW – mBW
Relative Body Weight decrease (%dBW) = mBW/IBW
Time to nadir in LBW (tBW) – weeks from calving to mBW,
Decrease rate in BW (rdBW) = dBW/tBW

RESULTS.

This investigation was based on information for LBW for 20,245 cows, of which 7,888, 7,097 and 5,260 in lactations 1, 2 and 3, respectively.

Mean values for LBW and associated traits, for lactations 1, 2 and 3 are presented in Table 1.

Table 1. Mean values for LBW and associated traits, for lactations 1, 2 and 3.

Lactation 3	Lactation 2	Lactation 1	Trait
631	**591**	**528**	**IBW, kg**
592	**550**	**499**	**mBW, kg**
39	**41**	**29**	**dBW, kg**
5	**4**	**4**	**tBW, weeks**
647	**624**	**573**	**LBW at 300 DIM, kg**

Factors associated ($P<0.001$) to LBW (GLM, SAS) were herd, lactation number, DIM and DIM^2. The coefficient of determination for the model (r^2) was 0.37.

Correction values for cows in lactation 1 were significant ($P<0.001$) and calculated for the following factors: age at calving, calving year, season (summer / winter), herd.

After merging the data set on LBW with records for yields, fertility (conception status), longevity and cows' sires, the final data set included information on 5,028 cows and 113 sires. Genetic correlations between traits and calculation of heritability of traits was performed using this final data set. Results are presented in Table 2.

Table 2. Heritabilities (in the diagonal) and Genetic correlations between traits.

	IBW	dBW	tBW	%dBW	rdBW	Milk yield	Conception Status	Productive Longevity
IBW	**0.38**	0.21	0.01	- 0.06	- 0.38	0.15	0.38	- 0.00
dBW		**0.09**	0.64	0.96	0.65	0.55	- 0.19	- 0.27
tBW			**0.07**	0.65	0.12	- 0.26	0.05	- 0.52
%dBW				**0.10**	0.56	0.52	- 0.09	- 0.25
rdBW					**0.04**	0.47	0.44	- 0.42
Milk yield						**0.36**	0.03	- 0.03
Conception Status							**0.03**	
Productive Longevity								**0.02**

DISCUSSION and CONCLUSION.

All the traits associated to LBW that were elaborated, were genetically positively correlated with Milk yields, meaning: the same genes that "increase" IBW, dBW (+0.55), tBW and rdBW (+0.47), also increase milk production. Therefore, genetic improvement for diminishing IBW or dBW will lead to decrease in milk yields.

Most traits associated to LBW that were elaborated, were genetically negatively correlated with Fertility (Conception Status) and with Productive Longevity, meaning: the same genes that "increase" IBW, dBW, tBW and rdBW, act negatively on Fertility and Longevity.

If reduction of LBW or of dBW was set as a goal, the correlated effects will influence for decrease in milk production and improvement in Fertility and Productive Longevity.

A economical analysis of those effects is required in order to establish the convenience of reducing the actual values for traits related to LBW, in dairy cows.