Harmonisation of Type Traits in the Simmental/Montbéliard Breeds

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Summary

This paper presents a first analysis of the harmonisation of type traits across countries in the Simmental and Montbéliard breeds. The harmonisation was assessed through the proofs correlation across countries of common bulls evaluated in 5 separate domestic evaluations (German – Austrian – Italian, Swiss, French Montbéliard, French Simmental and Dutch). The correlations obtained for many elementary traits are promising. Thus an international evaluation could be implemented, at least for the most correlated traits.

Introduction

Since 1996, Interbull has provided routine evaluations for the Simmental breed (including Montbéliard) on production traits. Presently ten European populations (country-breed) participate to this evaluation: Swiss, German and Austrian (jointly evaluated), Italian, Slovenian, Czech, Hungarian, Dutch, Irish and two French breeds (Montbéliard and Simmental) which are evaluated in France separately and thus, which are considered by Interbull as two different "countries". Eight populations are also involved in the udder health evaluation. Two countries (French Montbéliard and the Netherlands) participate also to a routine international evaluation for longevity. Even if the exchanges between populations are more limited than for Holstein breeds, connections exist and the gene flow shows that there is an interest in the development of international evaluations in the Simmental population. Fouilloux *et al.* (2006) showed for instance that 25% of the French Simmental cows have a German sire, and within the Simmental/Montbéliarde breed, 5% of the Czech, 9% of the Italian, 94% of the Dutch and 95% of the Irish cows were born from a French Montbéliard bull.

Moreover, the European Association of Simmental Breeders initiated a program of common progeny test of young bulls (Dodenhoff *et al.,* 2003) in order to increase the number of ties between countries. This Association has also worked for 13 years on the harmonisation of type traits. Here also, even if there is no international table recognized everywhere, the traits have often very close definitions. The harmonisation helped three countries (Austria, Germany and Italy) to develop a joint genetic evaluation on type traits. However the interest in genetic comparisons for type traits is much larger and until now, no international evaluation has been implemented for type traits.

The aim of this paper is to get a first assessment of the harmonisation of traits definition, through simple analyses of raw correlations between type estimated breeding values (EBVs) across countries.

Materials and Methods

Available data were the official type EBVs of five populations: Austria - Germany – Italy group (DEA), Switzerland (CHE), France Montbéliard (FRM) and France Simmental (FRA), and the Netherlands (NLD). Number of bulls, number of type traits and date of evaluation are given in table 1.

Table 1. Data available for the study.

Population	Date of eval.	# Bulls	# Traits
DEA	Feb 06	5545	23
CHE (Sim/Mon)	Jan 06	345	31
FRM	Jan 06	2503	29
FRA	Jun 05	158	27
NLD (Sim/Mon/RED)	Feb 06	1915	19

According to Interbull recommendations (Interbull, 1990), the estimation of conversion formulae between two countries should be based on a sample of at least 20 common bulls, born in the 10 most recent years, with at least 75% reliability in both countries. Raw correlations between traits should exceed 0.75 to be satisfactory.

Two subsets of data were constituted, according to different requirements on age and on accuracy of proofs. In the first sample called “High requirement” (HR), common bulls were born since 1989 and had at least 40 daughters in each country, while the second subset called “Low requirement” (LR) had no limitation on the year of birth and a minimum of 30 daughters in each country.

Bulls were selected according to their number of daughters instead of their reliability because of large differences between reliability derivation methods across countries. Indeed in France, only one global reliability value is given and 75% corresponds to 39 scored daughters on average; in Switzerland there is also a unique published reliability and 75% corresponds to about 20-25 daughters; in Germany there are as many reliabilities as traits and 75% corresponds approximately to 25 daughters for stature, 36 daughters for overall udder or muscularity and 51 daughters for overall feet and legs.

Proof correlations were computed by using the HR subsets, except when there were less than 20 bulls (table 2). In this case LR subset was used. 42 HR connecting bulls between DEA and FRM (28 FRM and 14 bulls from the European progeny testing scheme), 24 HR FRM bulls for CHE/FRM, 21 LR FRM bulls for CHE/DEA and 27 LR DEA bulls for DEA/FRA were selected for the computation of correlations. Unfortunately correlations could not be computed with the Netherlands, and between Switzerland and French Simmental because there were not enough common bulls with a type evaluation (less than 20 bulls in the LR subset).

Table 2. Number of common bulls used to compute proofs correlations. Within brackets: subset with low requirement (LR) or high requirements (HR)

	CHE	FRM	FRA
DEA	21 (LR)	42 (HR)	27 (LR)
CHE		24 (HR)	

Results and Discussion

Correlations between traits are presented in table 4. As Germany, Austria and Italy play a major role in the Simmental population and in the harmonisation of type traits, all the comparisons were done by using the 23 DEA traits as reference (table 3). When the trait corresponding to the DEA definition was not available in another country, the traits which have a close definition were tested.

If we consider only traits with the same definition across countries, correlations vary from 0.170 for fore teats placement (between DEA and CHE) to 0.926 for width at hips (between DEA and FRA). Globally, they have rather large confidence intervals and are sensitive to small samples. Moreover, especially for low heritability traits such as feet and legs ones, expected genetic correlations should be much higher than proofs correlations (approximately by 20% to 40% for a h^2 of 0.10).

Body and muscularity traits

Correlations were very high (often over .80) for most of the elementary traits. Nevertheless results on body depth were disappointing with all correlations across countries below the 0.75 recommendation. Chest depth, instead of body depth for FRM would improve correlations with DEA body depth (0.758 instead of 0.682), but not with CHE (0.494 instead of 0.688). Moreover, body depth is missing in the French Simmental type classification and chest depth is only a partial substitute (0.609).

As expected, general characteristics showed lower or heterogeneous results in comparison with elementary traits. Overall body varied from 0.61 for DEA/CHE to 0.88 for DEA/FRA and overall muscularity from 0.39 for DEA/CHE to 0.89 for DEA/FRM.

Feet and legs traits

These traits are the most problematic ones. Some traits were missing in France and had no substitute (hocks and heels; pasterns for FRA). There was no consistency in scoring overall feet and legs (maximum correlation of 0.361 for DEA/FRM). However, some elementary traits were a bit more promising: rear leg side view (less for FRA) and pasterns (-0.76 for CHE/FRM; -0.54 for DEA/FRM increasing to -0.65 with the LR sample).

Udder and teats traits

Most of the traits showed good or acceptable agreement between populations particularly between DEA and FRM or FRA, even for overall udder (the 0.55 low level for CHE/FRM becomes 0.65 with the LR subset). The low correlations between CHE and DEA could be at least partly due to the LR subset with 21 bulls only.

The lowest correlations were mainly related to rear udder. None of the correlations for rear udder length were found above 0.60, and correlations for rear udder height were very heterogeneous (from 0.21 to 0.86). In the French Simmental population this trait is a mix between rear udder height and rear udder width, which can partly explain the low correlations with DEA (0.55 and 0.60). Correlations for fore teats placement were also slightly lower than Interbull recommendations (except for CHE/FRM). A possible explanation could be that distance is assessed in France and in Switzerland instead of placement in DEA.

Conclusion

These preliminary results from small samples have to be confirmed: the size of some sample was small, proofs correlations should underestimate genetic correlations, at least for low heritability traits. However they should be taken into account in the international training sessions in order to focus on less correlated traits across country and to share more harmonised definitions at least for the elementary traits (body depth, rear udder length, fore teats placement, rear legs side view, rear udder length and height, fore teats placement).

However an international evaluation on some traits relative to udder (udder support, udder depth, rear teats placement teat length and teat thickness) and to body (height at sacrum, rump length, rump width and rump angle) could be probably implemented without any problem. Some other traits describing feet and legs (rear leg side view and maybe pasterns), udder (overall udder, fore udder length, rear udder height fore teats placement) and body (overall body, body depth, muscularity) are less correlated but still promising, at least between some countries pairs.

References

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Table 4. Common Type traits according to the DEA definitions.

DEA	abbr.	CHE	abbr.	FRM	abbr.	FRA	abbr.
Stature	ST	Overall type	OTY	Overall body	OBD	Overall body	OBD
Height at sacrum	HS	Height at sacrum	HS	Height at sacrum	HS	Height at sacrum	HS
Rump length	RL	Rump length	RL	Rump length	RL	Rump length	RL
Width at hips	WH	Rump width	RW	Width at hips	WH	Width at hips	WH
Body depth	BD	Body depth	BD	Body depth	BD		
				Chest depth	*CD*	*Chest depth*	*CD*
Muscularity	MU	Muscularity	MU	Overall muscularity	OMU	Overall muscularity	OMU
Rump angle	RA	Rump angle	RA	Rump angle	RA	Rump angle	RA
Overall feet & legs	OFL	Overall feet & legs	OFL	Overall feet & legs	OFL	Overall feet & legs	OFL
Rear legs side view	RLS	Rear legs side view	RLS	Rear legs side view	RLS	Rear legs side view	RLS
Hock development	HO	Hock quality	HO				
Pasterns	PA	Pasterns	PA	Pasterns	PA		
Heel depth	HE	Heel	HE				
						Rear legs rear view	*RLR*
Overall udder	OUD	Overall udder	OUD	Overall udder	OUD	Overall udder	OUD
Fore udder length	FUL	Fore udder	FU				
		Fore attachment	FA	Fore attachment	FA	Fore attachment	FA
Rear udder length	RUL	Rear udder	RU	Rear attachment width	RAW	Rear attachment	RU
Rear udder height	RUH	Rear udder height	RUH	Rear udder height	RUH	Rear attachment	RU
Udder support	US	Medium ligament	US	Ligament	US	Ligament	US
Udder depth	UD	Udder depth	UD	Udder depth	UD	Udder depth	UD
Rear teats placement	RTP	Teats position	TPO	Teats direction	TDI	Teats direction	TDI
Teat length rear teats	TL	Fore teats length	TL	Teat length	TL	Teat length	TL
Teat thickness	TT	Teat form	TF	Teat form	TF	Teat form	TF
Fore teats placement	FTP	Fore teats placement	FTP	Fore teats placement	FTP	Fore teats placement	FTP
Udder purity	UP						

In italics: other used traits

Table 3. Correlations of type breeding values between countries
(_D for DEA, _C for CHE, _M for FRM, _F for FRA)

Body and muscularity traits

Overall body	OTY_C	OBD_M	OBD_F
ST_D	0,611	0,676	0,882
OBD_C		0,730	

Height at sacrum	HS_C	HS_M	HS_F
HS_D	0,853	0,831	0,901
HS_C		0,820	

Rump length	RL_C	RL_M	RL_F
RL_D	0,806	0,886	0,909
RL_C		0,824	

Rump width	RW_C	WH_M	WH_F
WH_D	0,744	0,874	0,926
RW_C		0,625	

Body depth	BD_C	BD_M	CD_M	CD_F
BD_D	0,436	0,682	0,758	0,609
BD_C		0,688	0,494	

Ov. Muscularity	MU_C	OMU_M	OMU_F
MU_D	0,389	0,888	0,640
MU_C		0,593	

Rump angle	RA_C	RA_M	RA_F
RA_D	0,846	-0,816	0,765
RA_C		-0,904	

Feet and legs traits

Ov. feet & legs	OFL_C	OFL_M	OFL_F
OFL_D	0,145	0,361	0,266
OFL_C		0,101	

Rear legs side	RLS_C	RLS_M	RLS_F
RLS_D	0,838	0,627	-0,468
RLS_C		0,730	

Hock	HO_C	RLS_M	PA_M	RLS_F	RLR_F
HO_D	0,569	0,481	0,319	-0,133	-0,154
HO_C		0,490	0,345		

Pasterns	PA_C	PA_M	RLS_F	RLR_F
PA_D	0,495	-0,540	0,378	-0,124
PA_C		-0,756		

Heel	HE_C	RLS_M	PA_M	RLS_F	RLR_F
HE_D	-0,208	-0,309	-0,307	0,292	0,379
HE_C		0,224	-0,052		

Udder traits

Overall udder	OUD_C	OUD_M	OUD_F
OUD_D	0,256	0,707	0,760
OUD_C		0,550	

Fore ud. length	FU_C	FA_C	FA_M	FA_F
FUL_D	0,361	-0,142	0,736	0,809
FU_C		0,249	0,376	
FA_C			0,386	

Rear ud. length	RU_C	RAH_M	RAW_M	RU_F
RUL_D	0,405	0,608	0,615	0,549
RU_C		0,315	0,179	

Rear ud. height	RUH_C	RUH_M	RA_F
RUH_D	0,213	0,882	0,605
RAH_C		0,697	

Udder support	US_C	US_M	US_F
US_D	0,590	0,826	0,797
US_C		0,774	

Udder depth	UD_C	UD_M	UD_F
UD_D	0,724	0,844	0,822
UD_C		0,871	

Rear teats plac.	TPO_C	TDI_M	TDI_F
RTP_D	0,610	0,844	0,866
TPO_C		0,617	

Teat length	TL_C	TL_M	TL_F
TL_D	0,715	-0,775	0,854
TL_C		-0,835	

Teat thickness	TF_C	TF_M	TF_F
TT_D	0,774	0,795	0,907
TF_C		0,753	

Fore teats plac.	FTP_C	FTP_M	FTP_F
FTP_D	0,170	0,626	-0,689
FTP_C		0,871	