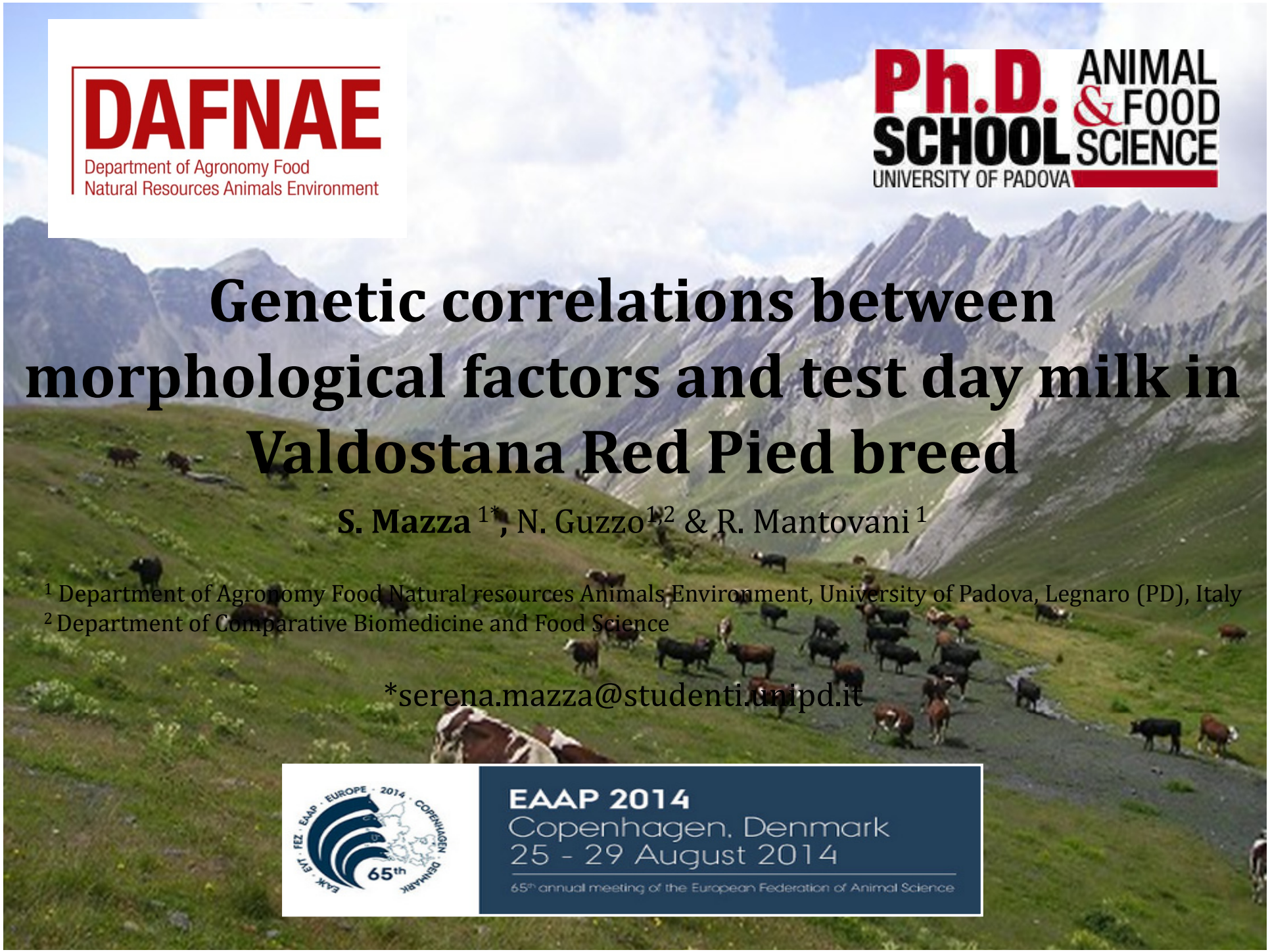

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Ph.D. SCHOOL ANIMAL & FOOD SCIENCE
UNIVERSITY OF PADOVA

Genetic correlations between morphological factors and test day milk in Valdostana Red Pied breed

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VALDOSTANA BREED

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AOSTA RED PIED

- Dual purpose breed
- Good longevity and fertility
- Resistance to common diseases
- Good adaptability to different climates

Registered Cows	12,834
Average Milk Yield	4,000 kg
-Fat	3.56%
-Protein	3.24%
ADG	1 kg/d
Dressing Percentage	63%
EUROP Score	R(+)/U(-)

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SELECTION INDEX

AOSTA RED PIED

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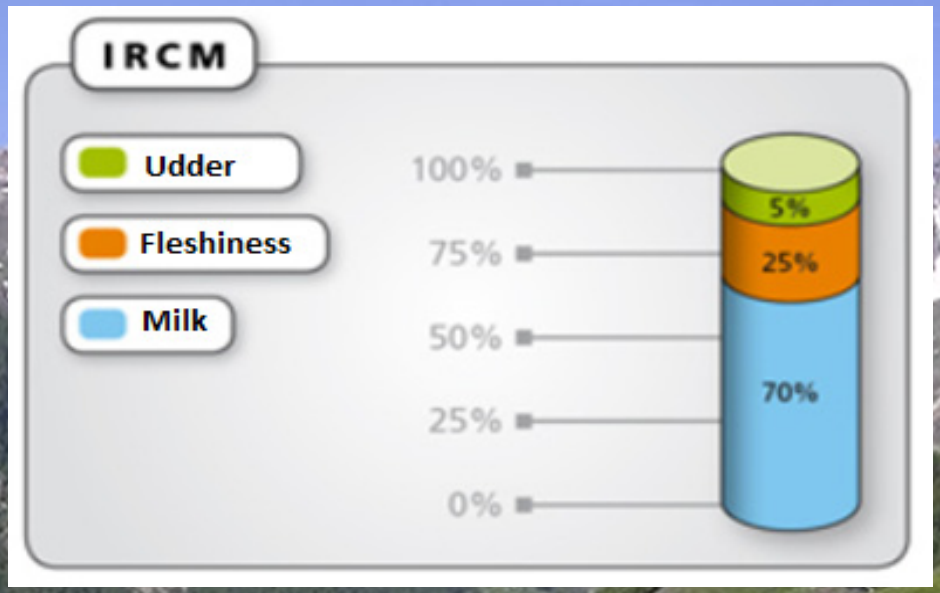

Udder
Fleshiness

Measured by linear type traits

MORPHOLOGICAL TRAITS

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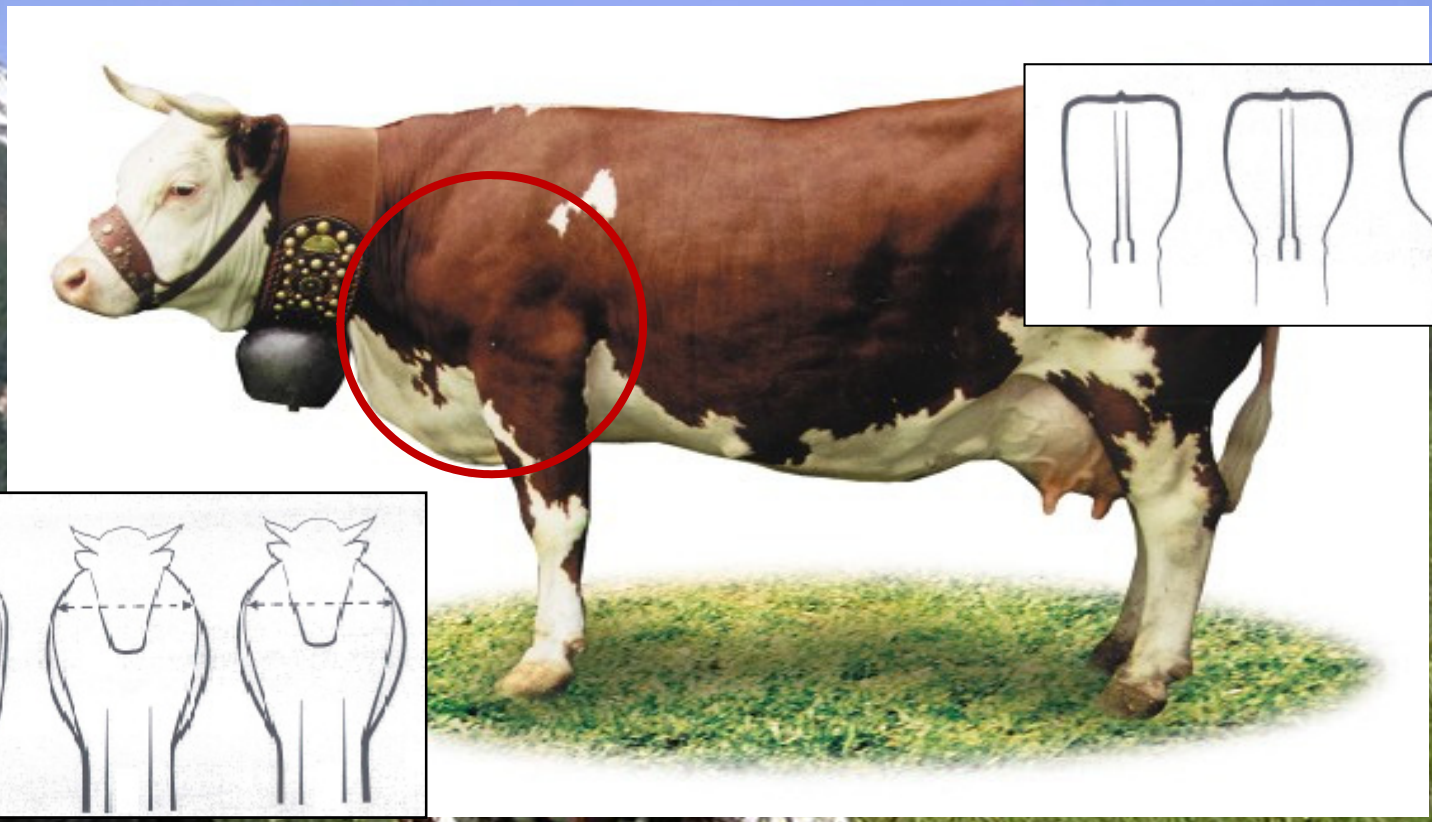
Fleshiness



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MORPHOLOGICAL TRAITS

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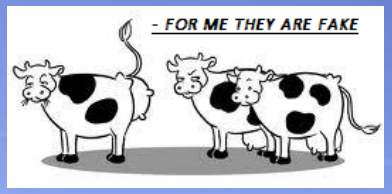
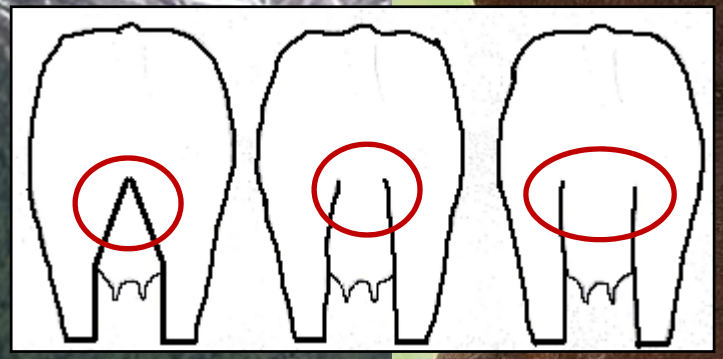
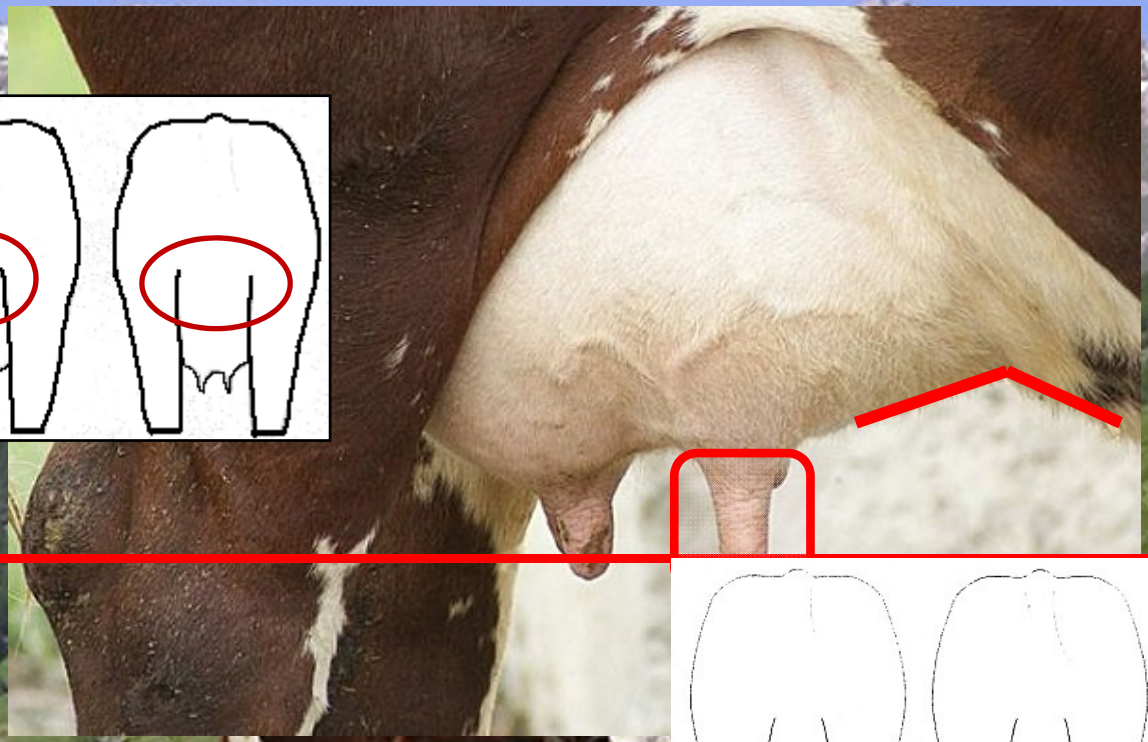
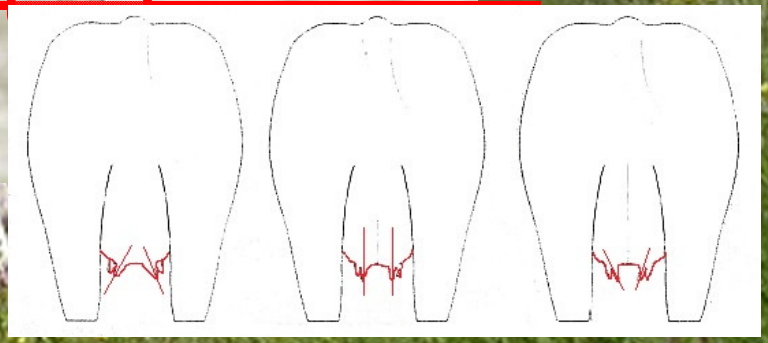
Udder









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FACTOR ANALYSIS

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The influence of type on herd life can be severaly overstimated when the estimation is based on a large number of type traits

TO AVOID THIS…

''ONLY A LIMITED NUMBER OF TYPE TRAITS SHOULD BE USED IN THE INDIRECT ESTIMATION''

(Visscher, 1994)

FACTOR ANALYSIS

To maintain the variability contributed by each trait, at the same time to reduce the number of variables to be managed

(Forabosco et al., 2005)

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FACTOR ANALYSIS

SAS Institute Inc., Cary, NC (2009) SAS/STAT® 9.2

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	Factor1	Factor2	Factor3
Front fleshiness	0.85		
Back, Loins and Rump	0.88		
Thigh, Buttocks side view	0.88		
Thigh, Buttocks rear view	0.89		
Fore udder attach		0.68	
Rear udder attach		0.80	
Udder width		0.79	
Udder depth			0.74
Suspensory ligament			
Teat placement rear view			0.38
Teat placement side view			
Teat length			-0.48

Coefficient ≥|35|

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TEST DAY MODEL

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Nowadays → lactation model

REPEATABILITY MODELS

- Subsequent controls in the same lactation
- Genetic evaluations based on test-day (instead of lactation) data can account for environmental influences more accurately

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AIM OF THE STUDY

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To estimate genetic parameters and correlations between milk yield related traits and morphological factors regarding specific region of the body of animals belonging to the small autochthonous population of Valdostana Red Pied dual purpose breed

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MATERIALS & METHODS

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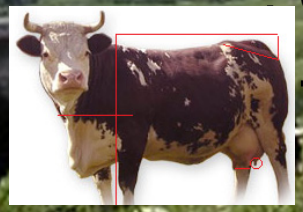
MORPHOLOGICAL DATASET

- ✓ 33,206 records
- ✓ 33,206 animals
- ✓ 61,378 animals in pedigree

TEST DAY MILK DATASET

- ✓ 169,008 test day
- ✓ 16,605 animals
- ✓ 41,991 animals in pedigree

FACTOR 1 → fleshiness traits
FACTOR 2 → dimensional udder traits
FACTOR 3 → udder conformation traits



FINAL DATASET
202,214 records
36,019 animals
(13,792 animals with both MORPH and TD)
61,912 animals in pedigree

FAT content (kg)
PROTEIN content (kg)
MILK (kg)

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Morphological Model:

$$y_{ijkl} = \mu + HYC_i + AC_j + DIM_k + a_l + e_{ijkl}$$

Where:

- y_{ijkl} = linear type trait
- μ = overall mean
- HYC_i = fixed effect of the herd-year-classifier *(7,475 levels for ARP)*
- AC_k = fixed effect of age at calving *(5 classes: from 22 to 29 mo, 30-34 mo, 35-36 mo, 37-41 mo and ≥42 mo)*
- DIM_j = fixed effect of days in milk *(7 classes: 10-30 d, from 31 to 180 d after calving using 30-d intervals and ≥181d for the last class)*
- a_l = random additive genetic effect of cow
- e_{ijkl} = random residual term

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Repeatability TestDay Model:

$$y_{ijklmno} = \mu + HTD(nl)_i + Gest_j + \Sigma\, l_x AC(nl)_k^* + \Sigma\, l_x MP(nl)_l^* + PEw_m + PEb_n + a_o + e_{ijklmno}$$

Where:

- $y_{ijklmno}$ = milk-related trait
- μ = overall mean
- $HTD(nl)_i$ = fixed effect of the herd-testday within lactation *(46,722 levels)*
- $Gest_j$ = fixed effect of days of gestation *(16 classes: from 1 to 210 d of gestation using 15-d intervals and ≥211d for the last class)*
- $AC(nl)_k$ = fixed effect of age at calving within lactation *(42 classes)*
- $MP(nl)_l$ = fixed effect of month of parity within lactation *(36 classes)*
- PEw_m = random permanent environment effect within lactation
- Peb_n = random permanent environment effect between lactation
- a_o = random additive genetic effect of cow
- $e_{ijklmno}$ = random residual term

***as covariates;**
Shape of the lactation curve described by 4th order Legendre polynomials (Strabel and Misztal, 1999):
$l_1 = 1$, $l_2 = x$, $l_3 = (3x^2-1)/2$, $l_4 = (5x^3-3x)/2$;
x lactation days on a standard scale of 5-305 DIM

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RESULTS_1
Heritability estimates

Univariate AIREML animal model analysis (Misztal, 2008)

FACTOR	TRAITS	σ^2_a	σ^2_r	h^2 (SE)
1	- Front fleshiness - Back, Loins & Rump - Thigh, Buttocks side view - Thigh, Buttocks rear view	0.250	0.550	**0.31 (0.02)**
2	- Fore udder attach - Rear udder attach - Udder width	0.130	0.650	**0.17 (0.01)**
3	- Udder depth - Teat placement rear view - Teat length	0.163	0.667	**0.20 (0.01)**

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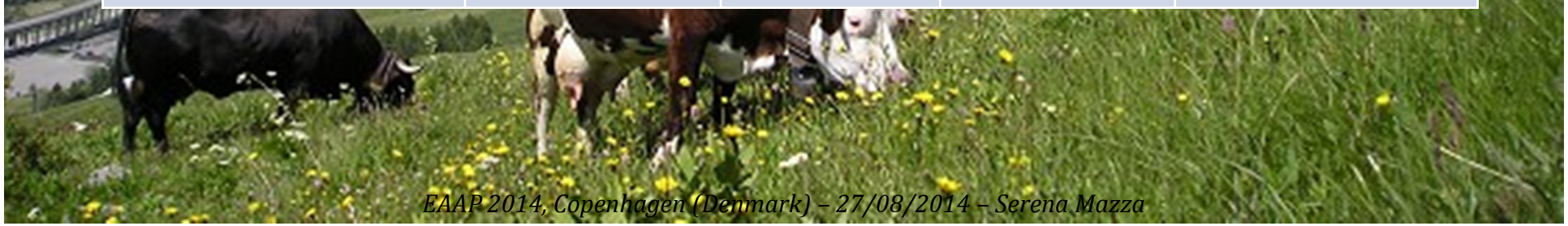
RESULTS_2
Heritability estimates

Univariate AIREML animal model analysis (Misztal, 2008)

TRAIT	σ^2_{pe}	σ^2_{a}	σ^2_{r}	h^2 (SE)
MILK (kg)	0.004	0.002	0.006	**0.20 (0.02)**
FAT (kg)	0.003	0.001	0.002	**0.13 (0.02)**
PROTEIN (kg)	3.554	1.311	1.740	**0.17 (0.02)**



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RESULTS_3

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Genetic (above) and phenotypic (below) correlations between factors

	Factor 1 Fleshiness	Factor 2 Udder size	Factor 3 Udder conformation
Factor 1		-0.38	0.21
Factor 2	-0.09		-0.12
Factor 3	0.06	0.08	

0.03≤ SE ≤0.06

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RESULTS_4

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Genetic (above) and phenotypic (below) correlations between milk yield traits

	MILK (kg)	FAT (kg)	PROTEIN (kg)
MILK (kg)		0.79	0.87
FAT (kg)	0.79		0.86
PROTEIN (kg)	0.91	0.77	

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RESULTS_5

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Bivariate genetic correlations between factors and milk yield

	MILK (SE)	FAT (SE)	PROTEIN (SE)
Factor 1 Fleshiness	-0.53 (0.11)	-0.44 (0.13)	-0.41 (0.11)
Factor 2 Udder size	0.89 (0.03)	0.83 (0.04)	0.86 (0.09)
Factor 3 Udder conformation	-0.34 (0.09)	-0.23 (0.10)	-0.31 (0.09)

CONCLUSIONS

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Fleshiness factor (F1) is the most heritable trait (31%)

Milk yield related traits for the Valdostana Red Pied breed showed low but normal heritability values (from 13% to 20%)

Negative genetic correlations of Udder size factor (F2) with both Fleshiness factor (F1) and Udder conformation factor (F3)

- Positive and high genetic correlations (≥83%) between F2 and milk related traits
- Medium negative genetic correlations of F1 and F3 with all the milk related traits

Aknowledgements

National Association of Breeders of Valdostana cattle

A.N.A.Bo.Ra.Va.
Associazione Nazionale Allevatori Bovini di Razza Valdostana

Regional Association of Valdostana breed

AREV

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THANKS FOR YOUR ATTENTION

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