ANAFIJ

LATeco Progetto presentato nell'ambito della Sottomisura 10.2
PSRN-Biodiversità 2014-2020 ANAFI

"Fondo europeo agricolo per lo sviluppo rurale:
L'Europa investe nelle zone rurali" Autorità di gestione:
MIPAAF Ministero delle Politiche Agricole Alimentari e Forestali

IMPLEMENTATION OF KETOSIS BREEDING VALUE IN ITALIAN HOLSTEIN

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Research & Development

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Contents

What is Ketosis?

- **Clinical Ketosis != Subclinical Ketosis**

Veterinary diagnosis:
Breath, decreased activity and appetite, excessive weight loss, weakness, apparent blindness

Hyper-ketonemia:
High concentration of BHB (Beta-Hydroxybutyrate), acetone in the blood…
acetone in milk

- Negative energy balance
- Reduction of milk production
- Low fertility
- Less health (metritis, abomasum dysplasia, mastitis)
- Increase in involuntary eliminations

What is subclinical Ketosis?

- **BHB** data on large scale via milk control

- Various thresholds **BHB** … FOSS states > 0.20 mmol/L is subclinical ketosis

DATA:

- Test-Day with highest **BHB** value within 90 days in milk

- 3 threshold for risk of subclinical ketosis:
  - ✓ BHB < 0.10 mmol/L: **NEGATIVE**
  - ✓ BHB 0.10 – 0.20 mmol/L: **AT RISK**
  - ✓ BHB >= 0.20 mmol/L: **POSITIVE**

BHB data by origin

Area	Records	Percentage
Lombardy	**7 001 708**	**76.90%**
Veneto	1 066 378	11.71%
Emilia-Romagna	333 297	3.66%
Trentino-Alto Adige	189 381	2.08%
Apulia	135 561	1.49%
Piedmont	101 632	1.12%
Other regions	19177	3.05%
ITALIA	**9 104 948**	**100%**

Data

- Body Condition Score => indirect predictor
  - Since 2006
- Test-day records
  - First 3 lactations first 90 days (13 weeks)
  - Kg milk+fat+protein => % fat + % protein
  - Fat/protein ratio => indirect predictor
  - BHB: Beta-Hydroxybutyrate => 2+log10(BHB)
- Pedigree
  - phenotyped animals + 3 generations of ancestors

Phenotypes

Phenotype	Phenotypic correlations with BHB
F/P ratio	0.264
BCS	-0.051
MILK	-0.119

Procedure

- Programs written in Python with Pandas and using MiX99 package as solver (EBV/rel/edc …)
  - Relax2: Pedigree
  - MiX99i: Pre-processor
  - MiX99s: Solver
  - Apax99: Reliability

Animal Model

- BHB = CGbhb + week*parity + age_cl*parity*yoc + animal + pe + e
- F:P = CGbhb + week*parity + age_cl*parity*yoc + animal + pe + e

- CGbhb: Contemporary group BHB
- Week: Week of lactation (1-13)
- Parity: Lactation number
- Age_cl: Age at calving class (1-9)
- Yoc: Year of calving
- Animal: Animal genetic (random)
- Pe: Permanent environment (random)
- E: Residual (random)

Animal Model

- BCS = CGbcs + age*stage + yoc + animal + e

- CGbcs: Contemporary group BCS
- Week: Week of lactation (1-13)
- Age: Age at calving
- Stage: Stage of lactation
- Yoc: Year of calving
- Animal: Animal genetic (random)
- E: Residual (random)

- First lactation cows: BHB, F:P, BCS
- Second+Third lactation cows: BHB, F:P

Parameter estimates

- Heritability estimates

	h2	SE	t	SE
BHB	0.093	0.01	0.179	0.01
F:P	0.090	0.01	0.209	0.01
BCS	0.157	0.02		

- Genetic and Phenotypic correlations

rG \ rP	BHB	F:P	BCS
BHB		0.276	-0.038
F:P	0.159		-0.049
BCS	-0.161	-0.140	

G	BHB	F:P	BCS
BHB	0.00823	0.00090	-0.00240
F:P	0.00090	0.00396	-0.00148
BCS	-0.00240	-0.00148	0.02690

PE	BHB	F:P	BCS
BHB	0.00770	0.00207	0.00000
F:P	0.00207	0.00529	0.00000
BCS	0.00000	0.00000	0.00000

R	BHB	F:P	BCS
BHB	0.07291	0.01453	-0.00213
F:P	0.01453	0.03492	-0.00256
BCS	-0.00213	-0.00256	0.14342

Correlations between BHB EBVs and other EBVs

Low correlations means that there are no conflicts in selection

Total Merit	BHB
PFT	0.115
IES	0.109
ICS-PR	0.108

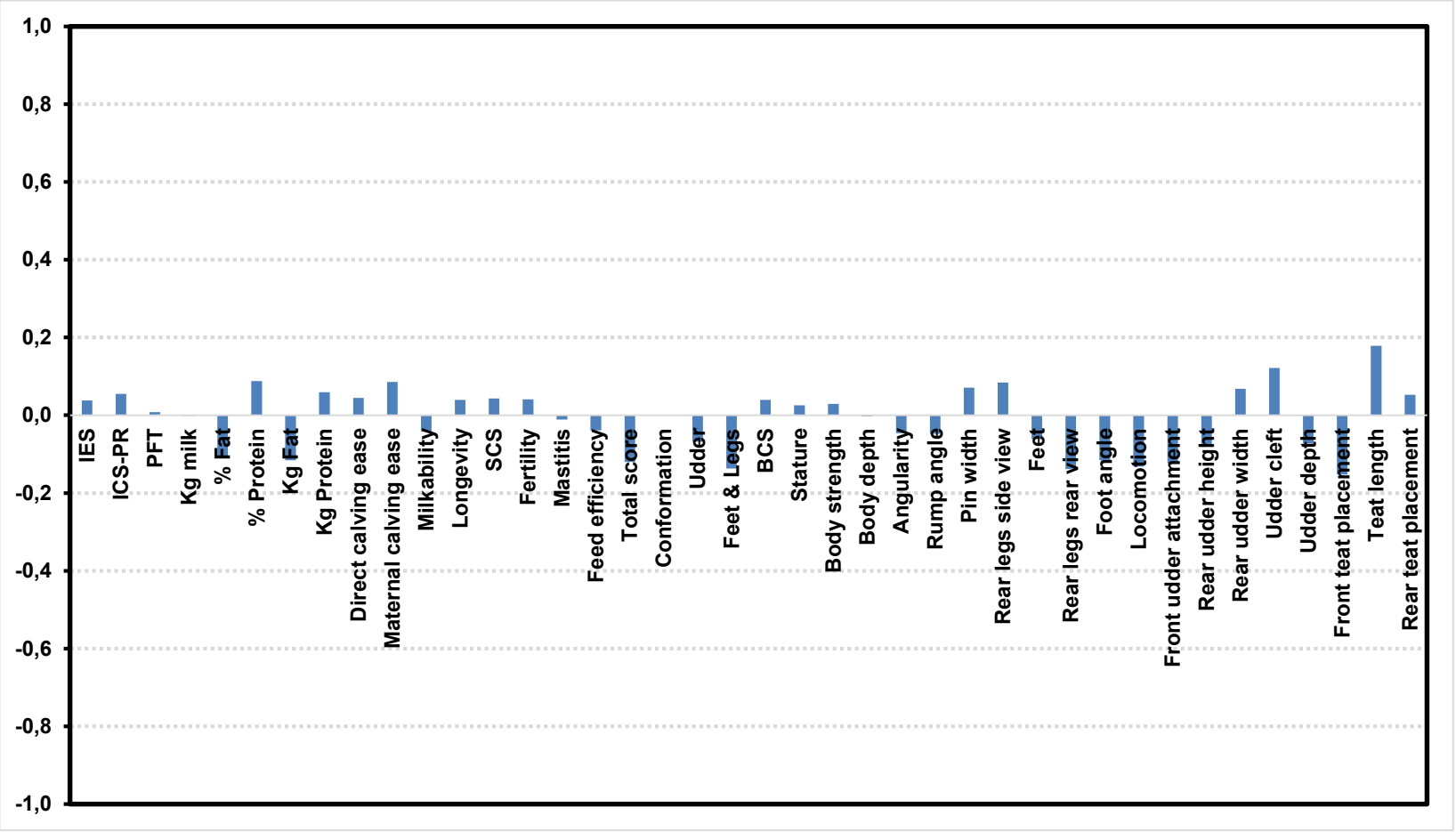
Functional traits	BHB
Longevity	0.066
Somatic cells count	0.116
Mastitis	0.088
Fertility	0.123
Calving ease	0.051
Body Condition Score	0.022

Production	BHB
Milk	-0.015
Kg Fat	-0.015
Kg Protein	0.049
% Fat	0.000
% Protein	0.111

Type composites	BHB
TIPO (Type)	0.081
ICM (Udder)	0.091
IAP (Feet & Legs)	0.034

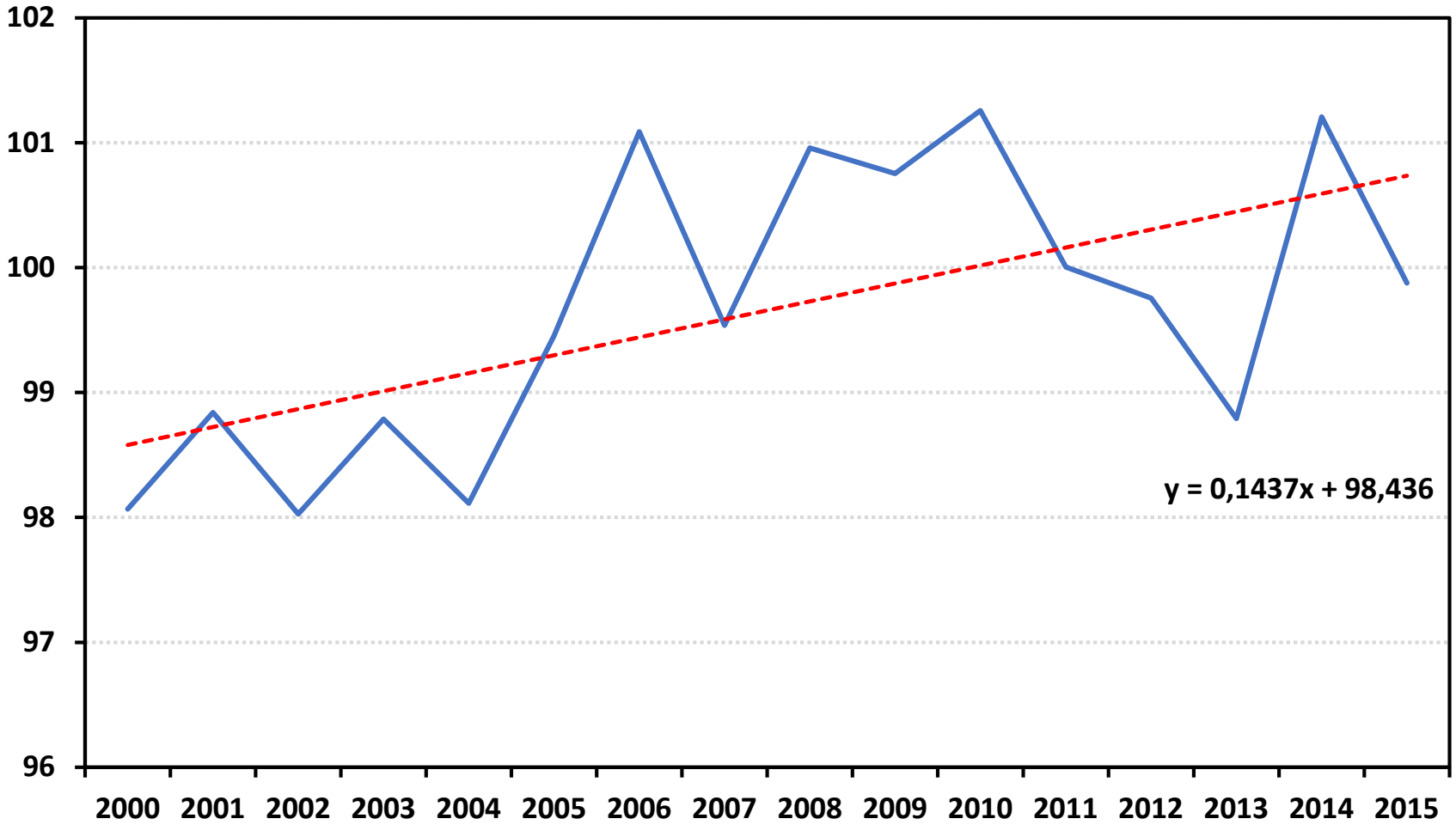
Correlations between BHB EBVs and other EBVs

- Low correlations means that there are no conflicts in selection



Genetic trend

- Modest genetic improvement in proven bulls



Stability of ketosis EBVs

- Correlations between EBVs of various index runs
- All bulls with reliability > 0.95

	2104	2012	2008	2004	1912
2104	1	0.998	0.994	0.986	0.979
2012		1	0.994	0.987	0.981
2008			1	0.992	0.985
2004				1	0.991
1912					1

Conclusions

- Ketosis breeding value has been developed for Italian Holstein
- For this breeding value three traits were considered: 1) β-hydroxybutyrate (BHB), 2) fat-to-protein ratio (FPR), both measured during routine milk recording, and 3) linear body condition score (BCS) measured by a classifier. Both FPR and BCS were used as indicator traits for sub-clinical ketosis.
- First 3 lactations were included
- Models were developed
- Parameters were estimated
- Pipeline was build
- Results were verified
- EBVs are ready to be introduced

Thank you for your attention!