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Linear profiling in Lusitano horses: genetic parameters and plans for further development

A. Vicente; M. Mateus; J. Ralão-Duarte & N. Carolino







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Lusitano Horse




- Main equine native breed from Portugal
 - Others are Sorraia, Garrano and Terceira ponies;
- One of world's oldest saddle horses!
- Considered in ancient times, by Greeks and Romans as the world's best saddle horse
- Considered hotblooded horse
- Selected by the gineta combat
- Versatile, docile, agile, courageous



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Lusitano Horse




- Historically very particular conditions, favorable to horse breeding, in southwest Europe:
 - Last glaciation of Würm without full effect
 - Continued contact with man husbandry
- Historical records with thousands of years confirming the presence in the Iberian Peninsula of a fine horse, light, agile, hot-blooded
 - with continuity lines, with fine head, long, dry, slightly convex, ...
- Always indicated as fast ("son of the wind")
- Skilled for superior riding and masterly fighting in the gineta type combat.




Cordeiro, 1989 7th IWSLP GER – March 2023, A.Vicente et al



Lusitano Horse




- Result of the selection of thousands years as an horse for fieldwork, hunting and fighting:
 - wars, cattle herding, fighting the gineta
- It is the archetype of the Baroque horse
 - very typical and harmonious model, endowed with extreme courage, but at the same time, docility and sociability
 - recognized long ago as one of the world's best saddle horses
- Combining good temper and mental with easy and light movements and ability to collect.





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Distribution of the breed





- Around 4000-4500 breeding mares all over the world, distributed by (APSL, 2022):
 - Portugal (2000-2400)
 - Brazil (750-900)
 - France (350-450)
 - Spain (300-400)
 - Remaining in several other countries (MEX, GER, ITA, ...)
- Breed considered endangered by FAO (<5000 breeding ♀); < 3000 foals/year
- Main export and promotion product of rural areas from Portugal, alongside with wine, olive oil and cork;









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Lusitano world dissemination





Mateus, 2021

- Known presence of the Lusitano horse in 63 countries, with different owners (data up to 2020).

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Functional skills of the Lusitano

- Outstanding versatility:
 - Bullfighting
 - Dressage
 - Carriage
 - Working Equitation
 - Portuguese Equitation
 - Showjumping
 - Horse-ball
 - Vaulting
 - Eventing
 - TREC
 - Equestrian art
 - Fieldwork
 - Cinema
 - Conformations comp.
 - Beauty comp.

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Linear Profiling



• Since 2017:
Implementation of
Linear Profiling in the
Lusitano

Conformation
profiling
0-40 scale (5
points interval)

After several studies:
recommendation to
breeders association for
more objective data


Model	Structure	Score	Defect	
General appearance	Structure	weak 0 5 10 15 20 25 30 35 40	heavy	
	Typicity	at all 0 5 10 15 20 25 30 35 40	a bit	
	Silhouette	rectangular 0 5 10 15 20 25 30 35 40	right	
Head	Mouth	round 0 5 10 15 20 25 30 35 40	irregularly sharper	
	Profile	concave 0 5 10 15 20 25 30 35 40	convex concave profile	
	Fern	triangular 0 5 10 15 20 25 30 35 40	long	
	Eye	almost straight 0 5 10 15 20 25 30 35 40	round	
	Ear	small 0 5 10 15 20 25 30 35 40	long	
	Expression	flat 0 5 10 15 20 25 30 35 40	heavy	
	Head Neck connection	thin 0 5 10 15 20 25 30 35 40	thick	
Neck	Length	short 0 5 10 15 20 25 30 35 40	long	
	Position	horizontal 0 5 10 15 20 25 30 35 40	vertical as strike	
	Musculature	a little 0 5 10 15 20 25 30 35 40	a lot neck fitness (girth)	
	Fern part	short 0 5 10 15 20 25 30 35 40	rounded	
Shoulder	Length	short 0 5 10 15 20 25 30 35 40	long	
	Angle	vertical 0 5 10 15 20 25 30 35 40	horizontal	
Withers	Prominence	abundant 0 5 10 15 20 25 30 35 40	inconspicuous	
	Length	short 0 5 10 15 20 25 30 35 40	long	
Chest	Amplitude	narrow 0 5 10 15 20 25 30 35 40	broad	
	Thoracic depth	a little 0 5 10 15 20 25 30 35 40	a lot	
Ribs cage	Form	deep 0 5 10 15 20 25 30 35 40	shallow	
	Direction	ascending 0 5 10 15 20 25 30 35 40	descending	
Back	Back's line	sway back 0 5 10 15 20 25 30 35 40	roach back	
	Length	short 0 5 10 15 20 25 30 35 40	long side section	
Loins	Direction	ascending 0 5 10 15 20 25 30 35 40	descending	
	Loin's Line	con. downwards 0 5 10 15 20 25 30 35 40	ascending	
Croup	Orientation of coxal bone	horizontal 0 5 10 15 20 25 30 35 40	vertical horizontal right of median	
	Orientation of sacrum	horizontal 0 5 10 15 20 25 30 35 40	vertical horizontal side section	
	Length	short 0 5 10 15 20 25 30 35 40	long disproportionate	
	Width	narrow 0 5 10 15 20 25 30 35 40	broad proportioned to the size of the Lumbar region	
	Musculature	Profile	weak 0 5 10 15 20 25 30 35 40	strong irregular
		Flair	weak 0 5 10 15 20 25 30 35 40	strong without muscle
		Shape	shiny / flat 0 5 10 15 20 25 30 35 40	double square

Linear Profiling in the Lusitano



Conformation profiling: LEGS

Gaits profiling: walk, trot, canter



Model	Member	Part	Score	Defects			
Members	Foreparts	Length	short 10 8 6 4 2 10 15 20 25 30 35 40	long			
		Blot	short 10 8 6 4 2 10 15 20 25 30 35 40	long			
		Pastern	short	10 8 6 4 2 10 15 20 25 30 35 40	long		
			vertical	10 8 6 4 2 10 15 20 25 30 35 40	horizontal		
		Uprightness defects viewed from the side		level	stepped	stepped	side
		Uprightness defects viewed from the front		over-employment	insufficient	open	side
	Rear	Length	short 10 8 6 4 2 10 15 20 25 30 35 40	long			
		Blot	short 10 8 6 4 2 10 15 20 25 30 35 40	long			
		Pastern	short	10 8 6 4 2 10 15 20 25 30 35 40	long		
			vertical	10 8 6 4 2 10 15 20 25 30 35 40	horizontal		
		Uprightness defects viewed from the side		back employment	insufficient	open	side
		Uprightness defects viewed from the front		overhooked	various	open	side
General	Substance	low 10 8 6 4 2 10 15 20 25 30 35 40	thick				
	Definition of articulations	low 10 8 6 4 2 10 15 20 25 30 35 40	thick				
	Amplitude of hocks	narrow 10 8 6 4 2 10 15 20 25 30 35 40	wide				
	Length of heels	short 10 8 6 4 2 10 15 20 25 30 35 40	long				
GAITS	Walk	Amplitude	short 10 8 6 4 2 10 15 20 25 30 35 40	long			
		Correction	inwards deviation	outwards deviation			
		Regularity	a little	a lot			
		Definition of four paces	low	precise			
	Trot	Amplitude	short 10 8 6 4 2 10 15 20 25 30 35 40	strong			
		Impulsion	weak 10 8 6 4 2 10 15 20 25 30 35 40	strong			
		Regularity	a little	a lot			
		Elasticity and suspension	forced	with break			
	Canter	Amplitude	short 10 8 6 4 2 10 15 20 25 30 35 40	strong			
		Position and suspension	over the shoulder	under			
		Regularity	a little	a lot			
		Transitions (shortening and extending the stride)	weak	strong			

Linear Profiling in the Lusitano

63 TRAITS

23 DEFECTS

"Tabela Padrão"





SCALE 0-40

Lusitano Linear Profiling

Model	Member	Part	Score	Defect	
General appearance	Structure	weak	10 8 6 4 2 10 15 20 25 30 35 40	heavy	
		a little	10 8 6 4 2 10 15 20 25 30 35 40	a lot	
	Typicity	weak	10 8 6 4 2 10 15 20 25 30 35 40	a lot	
		weak	10 8 6 4 2 10 15 20 25 30 35 40	light	
	Head	Mouth	round	10 8 6 4 2 10 15 20 25 30 35 40	irregularly pointed
		Profile	convex	10 8 6 4 2 10 15 20 25 30 35 40	concave
		Form	triangular	10 8 6 4 2 10 15 20 25 30 35 40	long
		Eye	shining/sharp	10 8 6 4 2 10 15 20 25 30 35 40	round
		Ear	small	10 8 6 4 2 10 15 20 25 30 35 40	long
		Expression	calm	10 8 6 4 2 10 15 20 25 30 35 40	lively
	Neck	Head/Neck connection	low	10 8 6 4 2 10 15 20 25 30 35 40	thick
		Length	short	10 8 6 4 2 10 15 20 25 30 35 40	long
Position		horizontal	10 8 6 4 2 10 15 20 25 30 35 40	vertical	
Musculature		a little	10 8 6 4 2 10 15 20 25 30 35 40	a lot	
Shoulder	Fore part	short	10 8 6 4 2 10 15 20 25 30 35 40	long	
	Length	short	10 8 6 4 2 10 15 20 25 30 35 40	long	
	Angle	wide	10 8 6 4 2 10 15 20 25 30 35 40	narrow	
Withers	Prominence	weak	10 8 6 4 2 10 15 20 25 30 35 40	strong	
	Length	short	10 8 6 4 2 10 15 20 25 30 35 40	long	
Chest	Amplitude	narrow	10 8 6 4 2 10 15 20 25 30 35 40	wide	
	Ribcage	shallow	10 8 6 4 2 10 15 20 25 30 35 40	deep	
Back	Thoracic depth	a little	10 8 6 4 2 10 15 20 25 30 35 40	a lot	
	Form	deep	10 8 6 4 2 10 15 20 25 30 35 40	shallow	
	Direction	ascending	10 8 6 4 2 10 15 20 25 30 35 40	descending	
Loins	Back's line	even back	10 8 6 4 2 10 15 20 25 30 35 40	roach back	
	Length	short	10 8 6 4 2 10 15 20 25 30 35 40	long	
Croup	Direction	ascending	10 8 6 4 2 10 15 20 25 30 35 40	descending	
	Coxal's line	convex	10 8 6 4 2 10 15 20 25 30 35 40	concave	
	Orientation of coxal bone	horizontal	10 8 6 4 2 10 15 20 25 30 35 40	vertical	
	Orientation of sacrum	horizontal	10 8 6 4 2 10 15 20 25 30 35 40	vertical	
Whith	Length	short	10 8 6 4 2 10 15 20 25 30 35 40	long	
	Musculature	Profilic	weak	10 8 6 4 2 10 15 20 25 30 35 40	strong
		Rear	weak	10 8 6 4 2 10 15 20 25 30 35 40	strong
	Rear	Shape	shallow	10 8 6 4 2 10 15 20 25 30 35 40	deep
		Shape	shallow	10 8 6 4 2 10 15 20 25 30 35 40	deep

How it works in the Lusitano

- Collection of linear profiles since 2017:
 - With tablet directly to “R.campo” software from Ruralbit
 - Digital photo taken
 - When animals are being graded for Studbook approval
 - ✓ for males 3 judges in the grading and one for linear profiling. Mares only one judge
- Annual judges' meetings to homogenize scoring system
 - 23 judges worldwide (12 nat/11 int.)

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Lusitano Linear Profile Example

		Modelo		Valor										Defeito																																																																																									
Aspecto Geral	Estrutura	larga	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

		Modelo		Valor										Defeito																																																																																									
Conformação	Comportamento	curto	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

		Modelo		Valor										Defeito																																																																																									
Gaits	Amplitude	curto	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

		Modelo		Valor										Defeito																																																																																									
Andamentos	Amplitude	curto	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

M&M – Linear Profiling analysis

Analysis model studied for the Lusitano

Linear Profiling

➔

BLUP – Animal Model (REML)

Trait

{

Fixed effects {
Age (linear & quadratic)
Inbreeding (linear)
Year of evaluation
Gender/Presentation type

Genetic effect

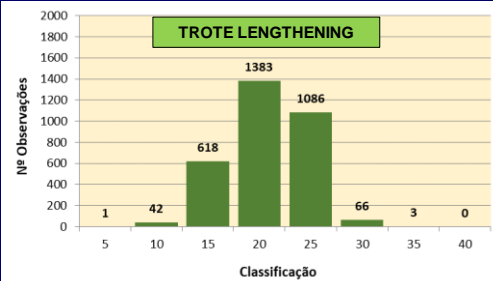
Error

Mixed Model
with single
records



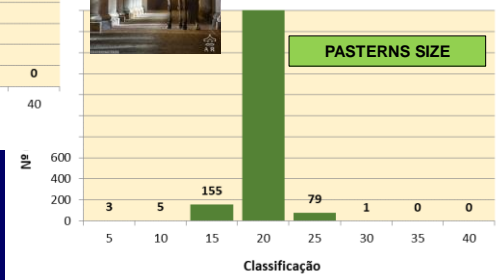
First results for the Lusitano

- 3200 evaluated animals - 2017 to 2021
 - 63 traits (0 a 40 pts; inter. 5pts) (in 2023 >5600 animals)
 - 23 descriptive defects; 63 judge's combinations



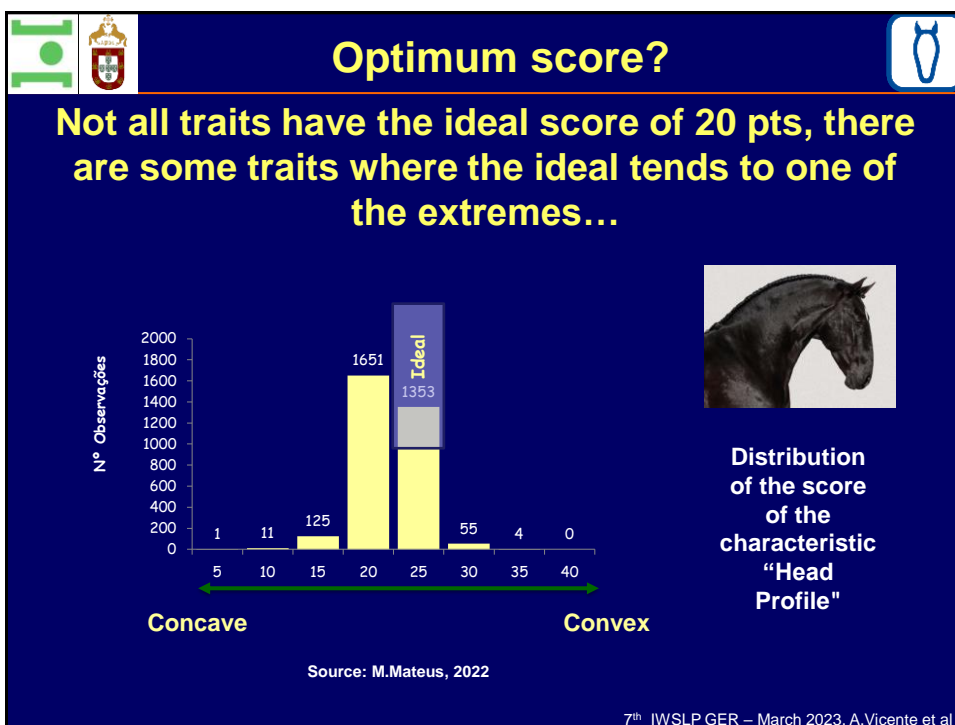
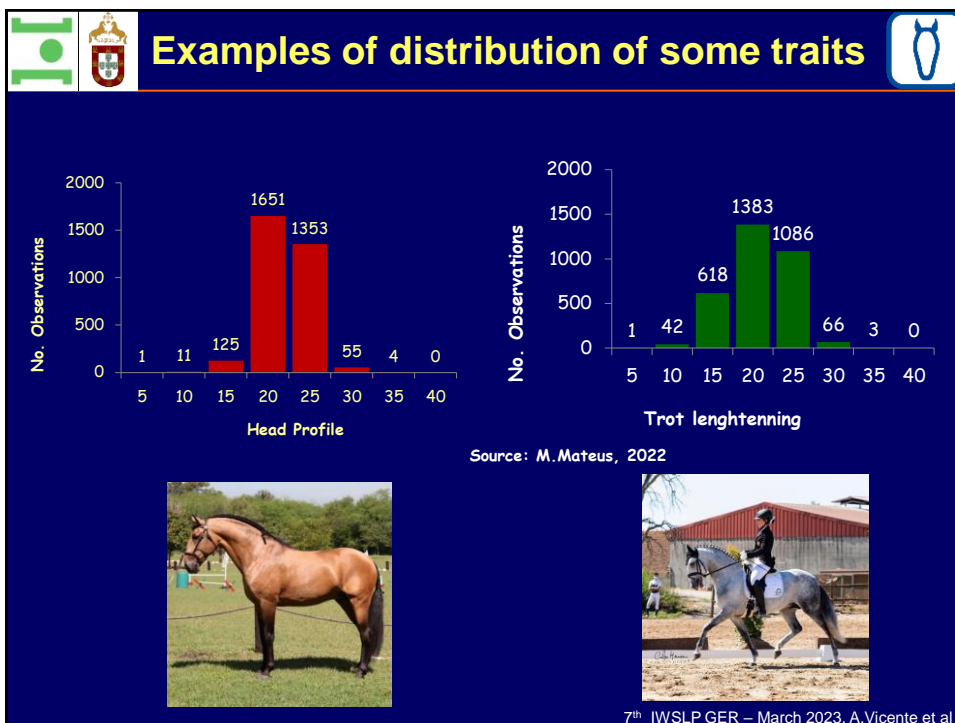
Classificação	№ Observações
5	1
10	42
15	618
20	1383
25	1086
30	66
35	3
40	0

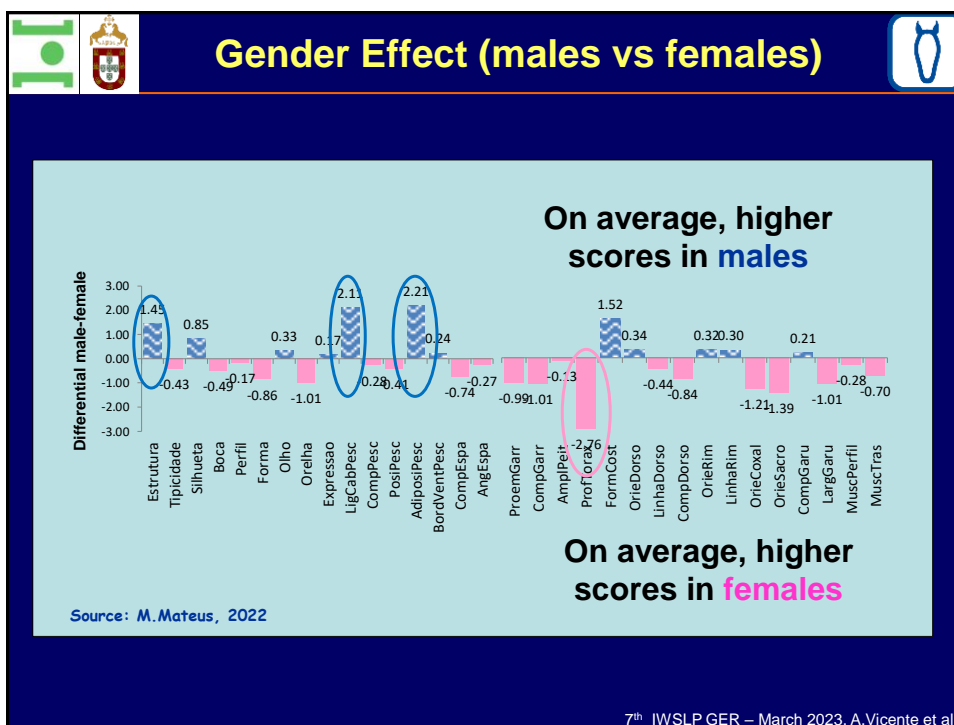
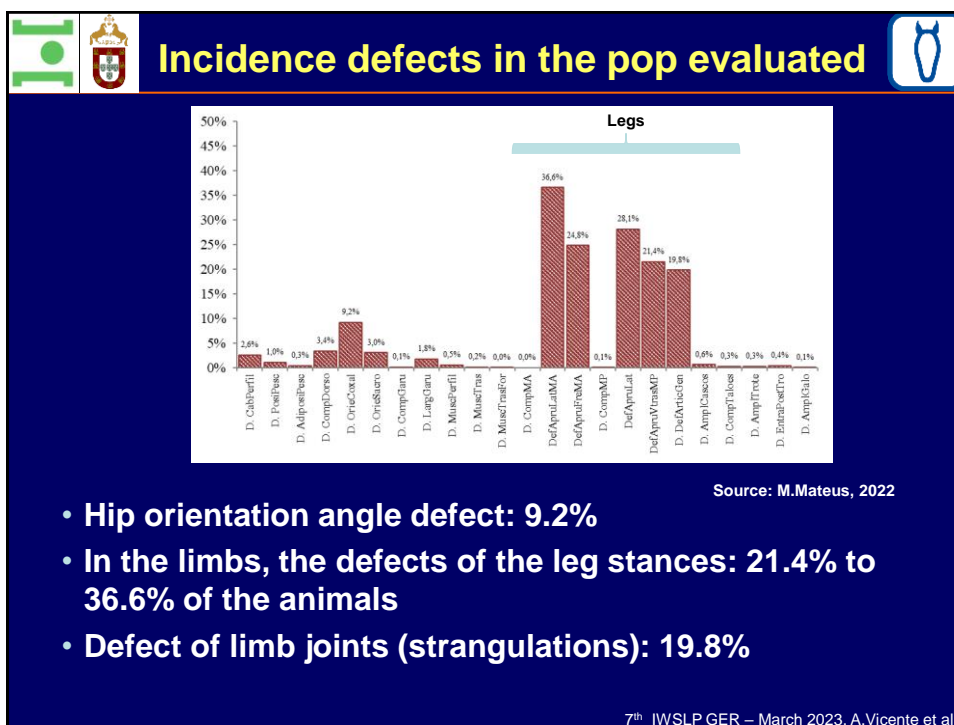
Since 2023 more than 5600 records to study

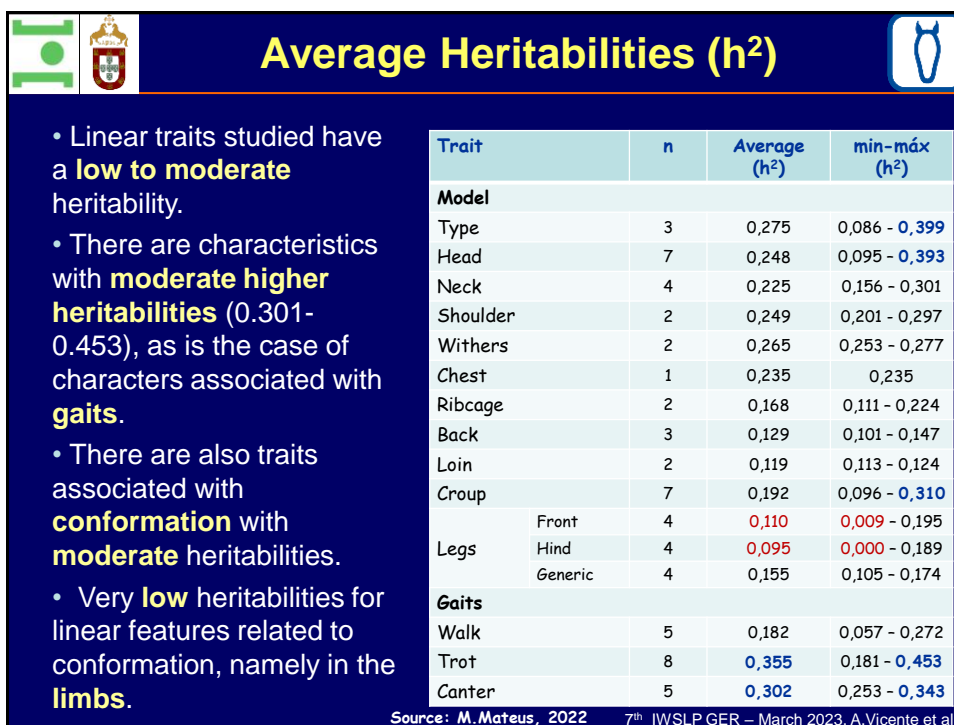
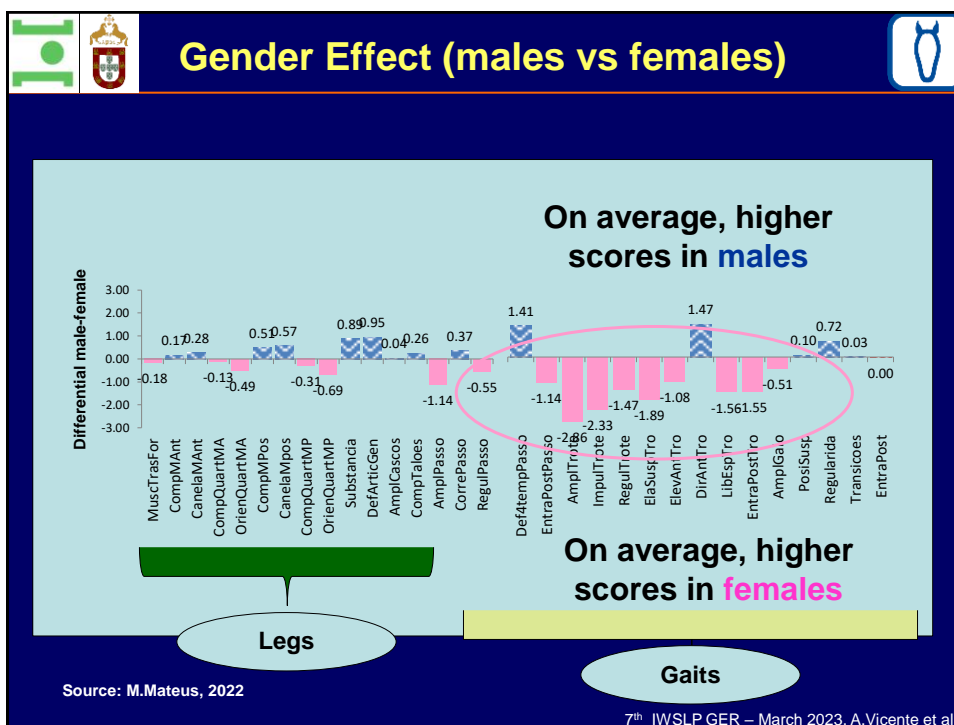




Classificação	№
5	3
10	5
15	155
20	79
25	1
30	0
35	0
40	0

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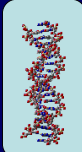



Classical gradings h^2 & σ_A



TRAIT		$h^2 \pm SE$	σ_A
Height Withers		0.61±0.015	2.98 cms
Total Score	Coef.	0.18±0.015	1.78 pts
Head and Neck	1	0.18±0.015	0.32 pts
Shoulder & Withers	1	0.13±0.014	0.22 pts
Chest & Ribcage	1	0.12±0.014	<u>0.21 pts</u>
Back & Loins	1.5	0.15±0.015	0.40 pts
Croup	1	0.14±0.014	0.26 pts
Legs	1.5	<u>0.07±0.012</u>	0.24 pts
Overall Impression	1.5	0.14±0.014	0.36 pts
Gaits	1.5	0.16±0.015	0.42 pts

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Lusitano selection strategy




- Routine genetic evaluation (2022) for:
 - Morphology and gaits – scores from breeders' approval grid
 - Linear Evaluation – for chosen traits
- Sporadic genetic evaluation:
 - Functionality in Dressage, Working Equitation and Model and Movements competitions
- Missing: genomics and phenomics






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Plans for the future



- Selection and genetic improvement in horses with greater complexity
 - Need to collect more objective data!
- Breeders' guidance with selective matings
 - Using information from linear profiling
- Refine models of analysis in use
 - Alternatives?
- Estimation of genetic correlations
 - Between linear data and results from breeders gradings and functional traits (Dressage, Working Equitation)

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