Are free-ranging horses de-domesticated? Konik polski horses as an example

Aleksandra Górecka-Bruzda PhD DSc

EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
Operační program Výzkum, vývoj a vzdělávání

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

INSTYTUT GENETYKI I BIOTECHNOLOGII ZWIERZĄT Polskiej Akademii Nauk
INSTITUTE OF GENETICS AND ANIMAL BIOTECHNOLOGY of the Polish Academy of Sciences

Institute of Genetics and Animal Biotechnology, Polish Academy of Sciences, Department of Animal Behaviour and Welfare, Poland

VÚŽV
Výzkumný ústav živočišné výroby, v.v.i.

Institute of Animal Science, Department of Ethology, Czech Republic

My main interest: horses

- Horse behaviour:
✓ Reproductive
✓ Social

- Horse personality
✓ Definitions
✓ Assessment
✓ Field implementation

- Horse welfare
✓ Behaviour
✓ Stress physiology

- Most studies: Konik polski horses

Photo by T. Jezierski

Equus caballus ferus gmelini var. silvatica?

https://upload.wikimedia.org/wikipedia/commons/1/18/Kherson_tarpan.jpg

- Konik polski – „reconstruction” of the purported Tarpan
- Tarpans descibed by Samuel Gottlieb Gmelin in 1771
- Tarpan horses from East Prussia lived until the XVIII century in the wild animals sanctuary of Polish aristocrat Zamoyski

https://upload.wikimedia.org/wikipedia/commons/thumb/2/28/Tarpan.png/330px-Tarpan.png

Konik polski horses

- Horses from Zamoyski's sanctuary were crossbred with local farmer's horses

- Reconstruction of the „tarpan" in XX century prof. Vetulani:

✓small size

✓mouse (blue dun) coat

✓no white markings

✓dorsal stripe and zebra's stripe on legs

Photos by AGB & M. Bruzda

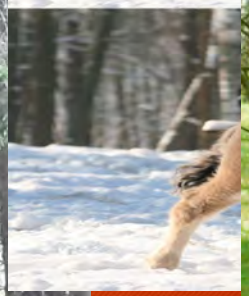
Konik polski – dual selection aims

Main aim: a reintroduction to the natural environment of East-Prussian forests

- Robustness, adaptiveness
- High reproductive performance
- Longevity

Photo by AGB

Adaptiveness, robustness, high reproductive performance, longevity



https://www.national-geographic.pl/media/cache/slider_big/uploads/media/default/0014/45/norweskie-wilki-wyginely_1.jpeg

Photos by AGB, M. Bruzda and Z. Jaworski

Konik polski – dual selection aims

- **Secondary aim:**

Maintenance of workability typical to domestic horses

Photo by T. Jezierski

http://popielno.pl/wp-content/uploads/2014/12/hubertus.jpg

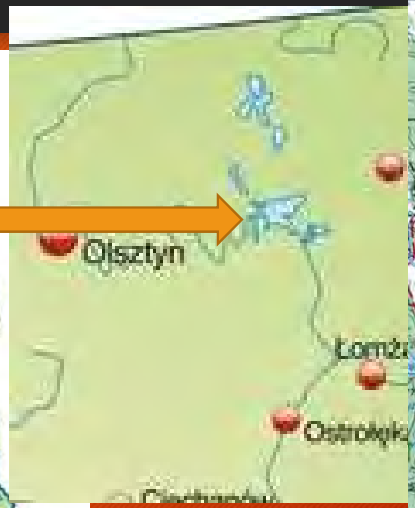
Konik horse and keeping system

- „Reserve”-keeping
- Stable-keeping

Photos by AGB

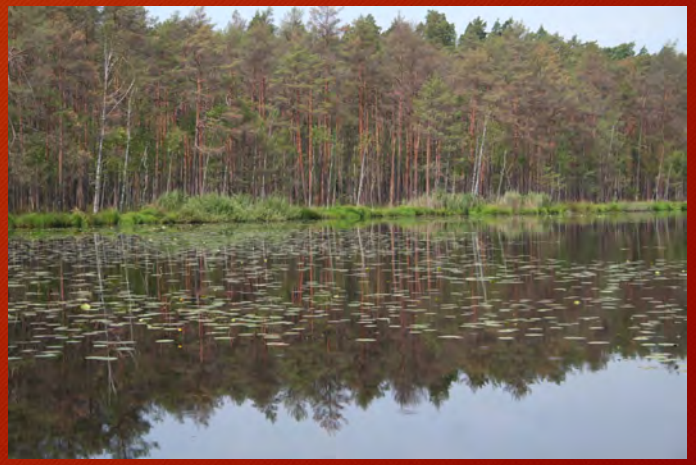
http://popielno.pl/wp-content/uploads/2018/08/zdj%C4%99cie-1.jpg

Research station in Popielno



Forest sanctuary

- 1600 ha deciduous and coniferous forest 90% of the area
- Meadows and lake borders
- Canals and swamps



Photos by AGB

Forest sanctuary

- 2 – 5 harems of 1 stallion and 1-10 mares
- At present: 1 harem of 7 mares, 1 adult stallion and 1 two-yo colt, 1 harem of 1 stallion and 9 mares, 1 bachelor band of two stallions (1 and 4 years old)

Photos by M. Bruzda

Forest sanctuary

- First horses in 1955
- Annual offspring removal around weaning
- Transfer of weanlings to the stables
- Every few years some foals remain in the sanctuary
- New horses from other sanctuaries are introduced occasionally

Photo by AGB

Stable keeping

- 16 broodmares and 3-5 stallions
- Traditional breeding and rearing of foals
- Handling, breaking and training of young horses

Photo by M. Bruzda

Youngstock weaning

Weaning of forest foals

- December/January
- Separation of adults and foals in handling enclosure
- Transportation to stables
- In pens within familial groups
- Feeding with hay and oats, tethering, leading

Weaning of stable foals

- Two weeks after forest foals
- Separation into sex groups

Photo by M. Bruzda

Weaning of forest-born foals

Photos by M. Bruzda

Weaning = strategy for preservation of the habitat

https://i.guim.co.uk/img/media/440ea2fcd61690fdb14efbfe4a60c78e729045a8/0_427_5956_3573/master/5956.jpg?width=620&quality=45&dpr=2&s=none

frontiers in Sustainable Food Systems

REVIEW
published: 18 March 2021
doi: 10.3389/fsufs.2021.550410

Domestic Livestock and Rewilding: Are They Mutually Exclusive?

Iain J. Gordon[1,2,3,4], Adrian D. Manning[2], Laetitia M. Navarro[5,6] and Julia Rouet-Leduc[5,7,8]*

[1] James Hutton Institute, Craigiebuckler, Aberdeen, United Kingdom, [2] College of Science, The Fenner School of Environment and Society, Australian National University, Canberra, ACT, Australia, [3] Commonwealth Scientific & Industrial Research Organisation Land & Water, Australian Science & Innovation Precinct, Townsville, QLD, Australia, [4] School of Graduate Research, Central Queensland University, Townsville, QLD, Australia, [5] German Centre for Integrative Biodiversity, Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany, [6] Institute of Biology, Martin Luther University Halle-Wittenberg, Halle (Saale), Germany, [7] Systematic Botany and Functional Biodiversity, Institute of Biology, Leipzig University, Johannisallee, Leipzig, Germany, [8] Department Ecosystem Services, Helmholtz Centre for Environmental Research–UFZ, Leipzig, Germany

Human influence extends across the globe, from the tallest mountains to the deep bottom of the oceans. There is a growing call for nature to be protected from the negative impacts of human activity (particularly intensive agriculture); so-called "land sparing". A relatively new approach is "rewilding", defined as the restoration of self-sustaining

Nature or nurture? Common rearing of the stable- and forest-born foals

ELSEVIER

Applied Animal Behaviour Science 62 (1999) 1–11

APPLIED ANIMAL BEHAVIOUR SCIENCE

Effects of handling on behaviour and heart rate in Konik horses: comparison of stable and forest reared youngstock

T. Jezierski [a,*], Z. Jaworski [b], A. Górecka [a]

[a] Polish Academy of Sciences, Institute of Genetics and Animal Breeding, Jastrzębiec, 05-551 Mroków, Poland
[b] Polish Academy of Sciences, Research Station for Ecological Agriculture and Preserve Animal Breeding, Popielno, 12-222 Wejsuny, Poland

Accepted 13 August 1998

Abstract

Thirty foals and young Konik horses born in 3 consecutive years and reared up to weaning either in a forest reserve (R) or conventional stable (S) were compared with respect to behavioural reactions and heart rate (HR) during handling manipulations. The foals were randomly allocated within sex and rearing group to one of two handling treatments. Intensively handled (IH) foals received a 10-min handling, 5 days/week, beginning at the age of 2 weeks (S foals) or 10 months (R foals), and lasting up to the age of 24 months. During handling IH foals were haltered, touched, rubbed and their feet were picked up; non-handled (NH) foals were not handled except for routine or emergency veterinary care. The horses were tested at the age of approximately 6 months (S only) and 12, 18 and 24 months of age. In a test comprising catching the horse on a paddock, leading away from and towards the stable, picking up feet and being approached by an unfamiliar person, the horses' behaviour was scored and the HR was recorded telemetrically. The IH horses scored better as far as manageability behaviour is concerned ($P < 0.001$) and demonstrated lower HR than the NH ones and the S horses scored better than R ones ($P < 0.001$). Fillies demonstrated higher HR than colts ($P = 0.007$). Youngstock of all groups tended to be less manageable at the

The work aimed to compare behavioural reactions and heart rate HR of the forest and stable-born young Konik's during some manipulations, depending on the intensity of previous contacts with humans.

Jezierski et al. 1999

- 30 horses (FB: N=12 and SB: N=18)
- Intensively handled (IH: N=17): individual contact with humans for 10 min, 5 days/week (haltered, touched, rubbed over all parts of their body and their feet were picked up), from 2 weeks/after weaning
- Non-handled (NH: N=13)

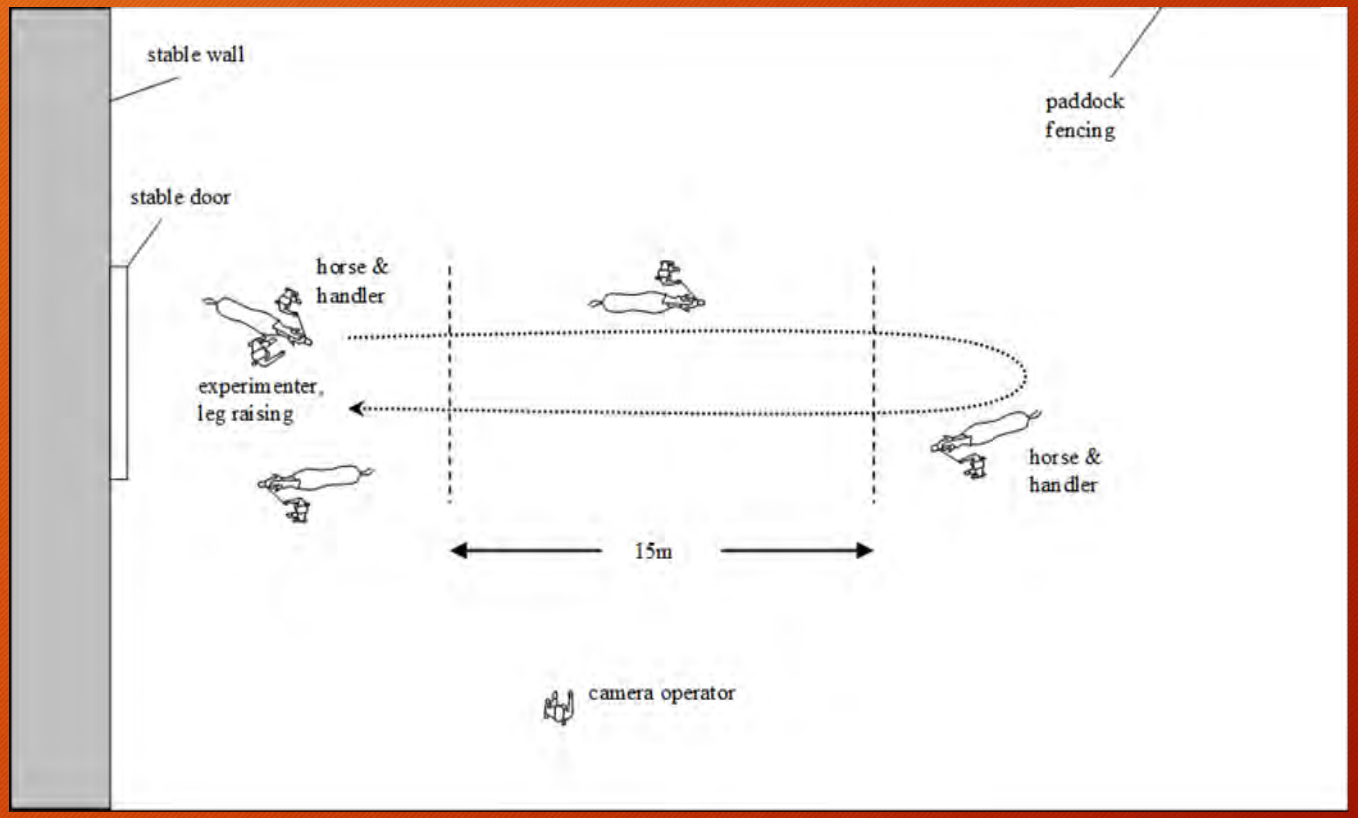
Jezierski et al. 1999

- Tests when 6 (only SB), 12, 18 and 24 mo

1. Release the individual horse on the familiar paddock for 3 minutes
2. Catching the horse
3. Leading away and towards the stable
4. Approach by an unfamiliar person
5. Picking up the legs

- Total Behavioural Score (TBS) sum of scores for each manipulation: from 5 (very well done) to 1 (not executed)
- Heart rate continuously(5-s average)

Jezierski et al. 1999



Jezierski et al. 1999

Table 2
Results of the ANOVA test of significance for TBS and HR (only significant effects are listed)

	df	TBS significance of *F*	*df*	HR significance of *F*
Rearing group	1	0.000	1	0.003
Handling	1	0.000	1	0.000
Age	2	0.000	2	0.000
Sex	1	0.394	1	0.007
Group × age	2	0.009	2	0.532
Handling × age	2	0.231	2	0.012

Jezierski et al. 1999

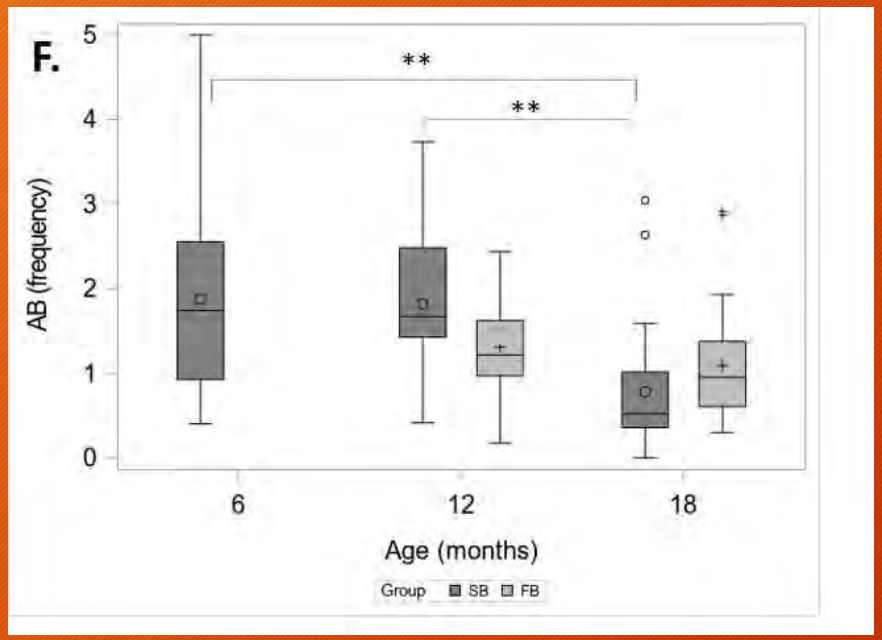
- SB horses are calmer when handled than FB horses (TBS, cardiac response)
- Do the differences found in experimental handling test exist also when horses are submitted to necessary husbandry procedures?

The effects of human handling during further husbandry manipulations

Hoof trimming on new generation of Koniks after 10 years (Górecka-Bruzda in preparation)

- Stable-born: SB, N1 =27 and forest-born: FB, N2 =26 (total: N=53)
- Avoidance behaviour (AB) observed: total number of withdrawals, jerking, head shakes and rearings
- HR and HRV
- The horses were restrained

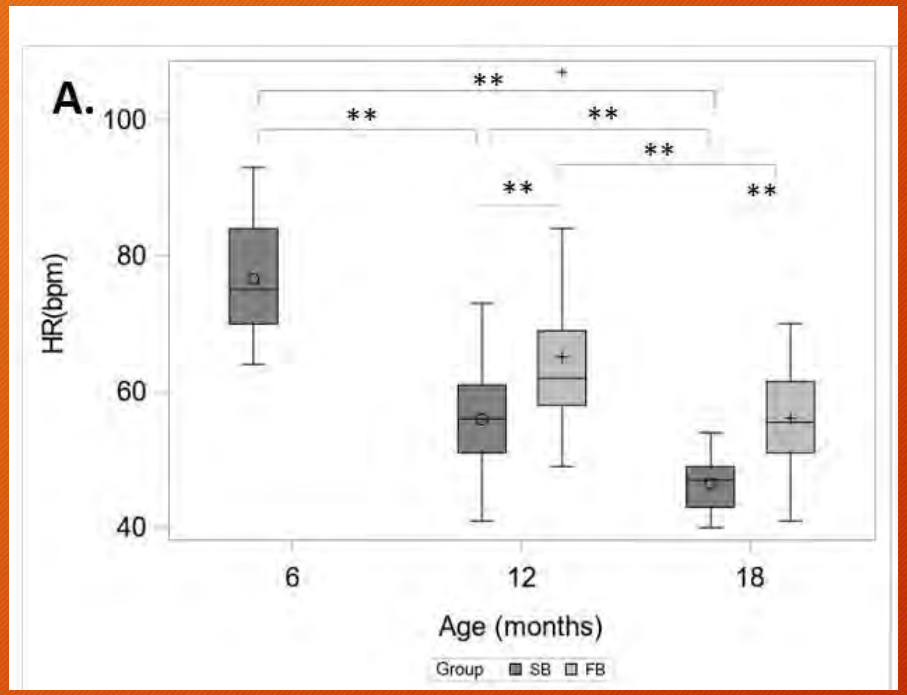
Hoof trimming – avoidance behaviour

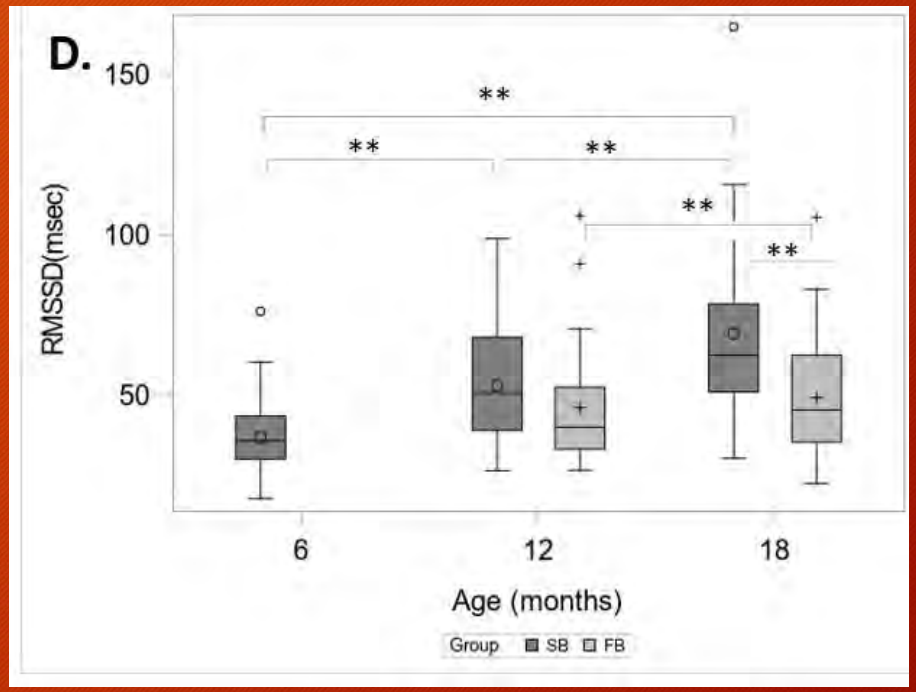


- Avoidance behaviour did not differ between restrained SB and FB horses
- AB decreased with age

Hoof trimming – cardiac parameters

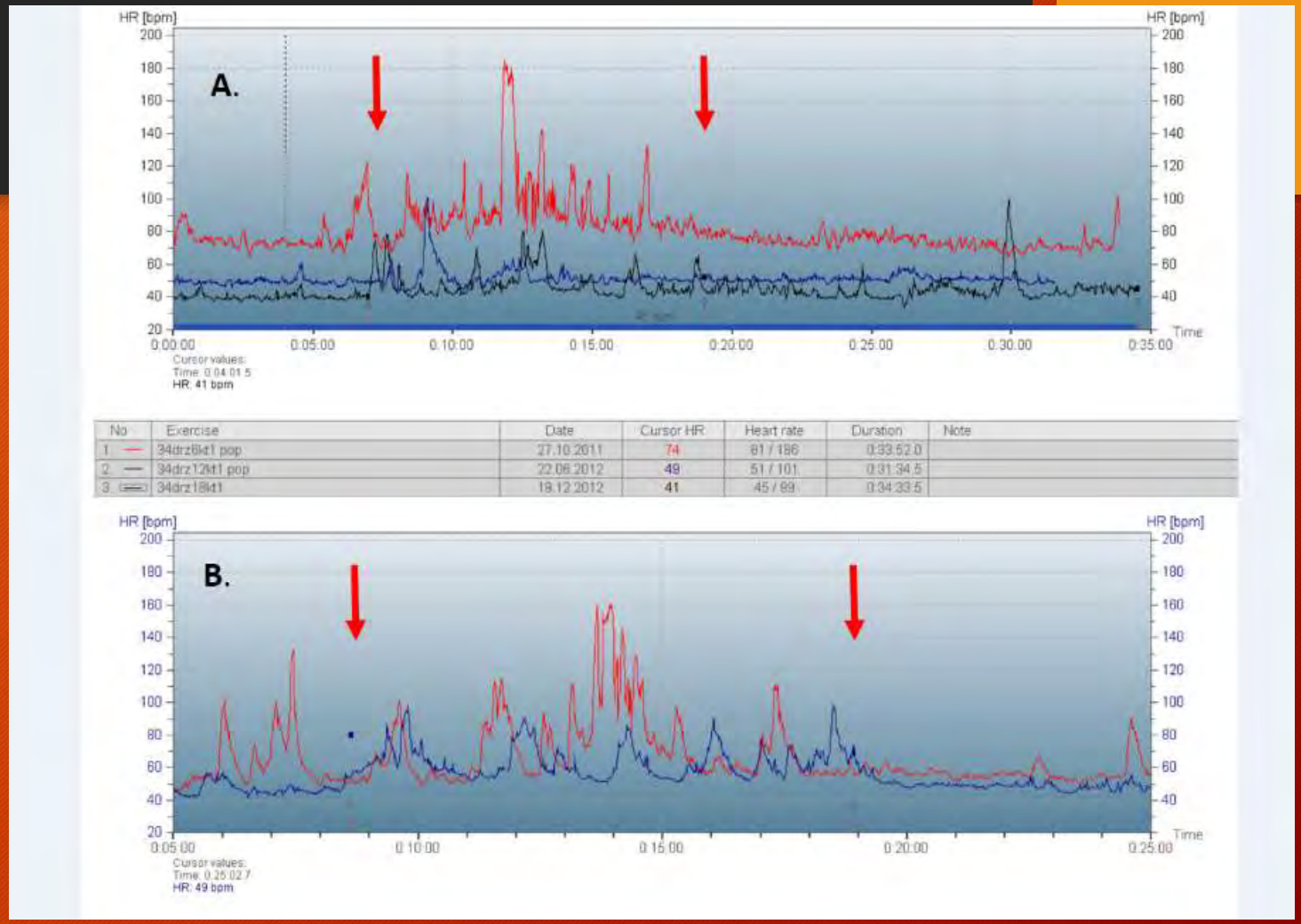
- HR was higher and RMSSD was lower in FB compared to SB horses
- Both parameters improved with age





Hoof trimming

- In both SB and FB horses the HR decreased with age
- Restraint could prevent the expression of the avoidance behaviour



No	Exercise	Date	Cursor HR	Heart rate	Duration	Note
1	34drz6kt1 pop	27.10.2011	74	81 / 186	0:33:52.0	
2	34drz12kt1 pop	22.06.2012	49	51 / 101	0:31:34.5	
3	34drz18kt1	19.12.2012	41	45 / 89	0:34:33.5	

Dedomestication

After 60 years of breeding in santuary, is this sub-population dedomesticated?

Photo by T. Jezierski

Domestication

Price, 1984 „the adaptation (…) to captive environment and is achieved by some combination of genetic (…) and environmentally induced changes in the behaviour that recur during each generation”

Photo by T. Jezierski

Quantitative hypothesis of domestication

„The process by which captive animals adapt to man and the environment he provides and, theoreticaly, does not imply qualitative but quantitative changes in behaviour" Price 1984

Can any animal become domesticated?

Can any animal be domesticated?

Józef Chełmoński, 1900 „Bociany” (Storks)

https://demotywatory.pl/uploads/202104/1619783375_opy3tj_fb_plus.jpg

Can any animal become domesticated?

Diamond (2002) “by domesticate (he means) a species bred in captivity and thereby modified from its wild ancestors in ways making it more useful to humans who control its reproduction and food supply. Domestication is thus different from mere **taming** of wild-born animals”.

Domestication

Six criteria of ‘domesticability’ (Diamond, 2002):

- the diet
- the ability to accept restrictive keeping conditions
- the ability to reproduce in captivity
- relatively quick reproduction rate
- follow-the-leader dominance hierarchy
- non-aggressive behaviour towards man

148 species of herbivore mammals (weight > 45kg)
14 domesticated

Photo by AGB

Reduction of fear of humans is most important (‚domesticated behaviour’, Belyaev 1979)

Domestication and de-domestication

- Gamborg et al. (2010) “a process, undertaken over generations, of trying to turn domestic animals into self-sustainable wild or semi-wild animals, a way of getting populations of animals to resemble their wild ancestors not only in appearance but also in terms of behaviour”.

- Behaviour = **Reactivity to humans**

Reactivity to humans

The trait of personality in animals, that embrace the direct response to a human and all behaviours related to the acceptance and searching for the proximity of humans (Lansade et al. 2008)

Górecka-Bruzda i wsp. 2017

ARTICLE IN PRESS

Applied Animal Behaviour Science xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

ELSEVIER

Longitudinal study on human-related behaviour in horses—Can horses (*Equus caballus*) be de-domesticated?

Aleksandra Górecka-Bruzda[a,b,*], Zbigniew Jaworski[b], Mira Suwała[c], Marlena Boroń[c], Magdalena Ogłuszka[a], Bernadette Earley[d], Magdalena Sobczyńska[a]

[a] Institute of Genetics and Animal Breeding, Polish Academy of Sciences, Postępu 36A, 05-552 Jastrzębiec, Poland
[b] University of Warmia and Mazury, Faculty of Animal Bioengineering, Oczapowskiego 5, 10-719 Olsztyn, Poland
[c] Research Station of Ecological Agriculture and Preservation Animal Breeding, Polish Academy of Sciences, Popielno, 12-220 Ruciane-Nida, Poland
[d] Animal and Bioscience Research Department, Animal & Grassland Research and Innovation Centre, Teagasc, Grange, Dunsany, Co. Meath, Ireland

Maybe, after 10 generations of horses being kept in sanctuary, the „forest” sub-population, as being able to survive in harsh environments predisposed the horses for higher avoidance of every potential threat, including humans?

Górecka-Bruzda i wsp. 2017

- Stable-born: SB, N1 =27 and forest-born: FB, N2 =26 (total: N=53)
- Human tests at 6, 9, 15, and 18mo
- Handling tests at 12 and 18mo
- Fearfulness (startle) test

Górecka-Bruzda i wsp. 2017

Passive human test

- Latency to approach the human
- Latency to touch the human

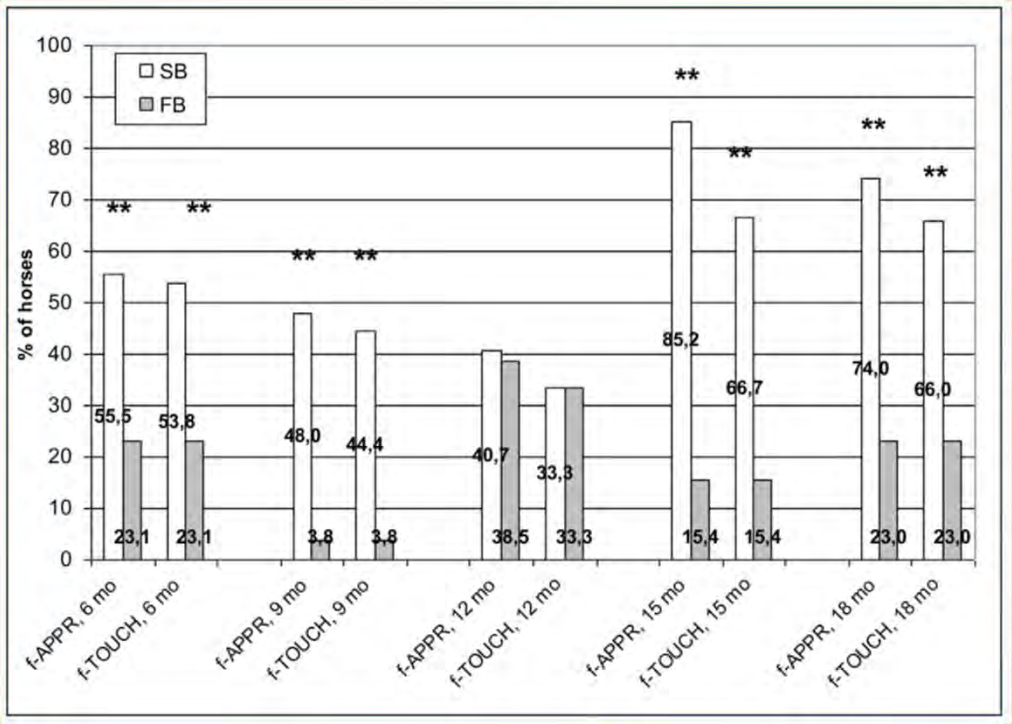
Active human test

- Time to touch the horse
- Flight distance

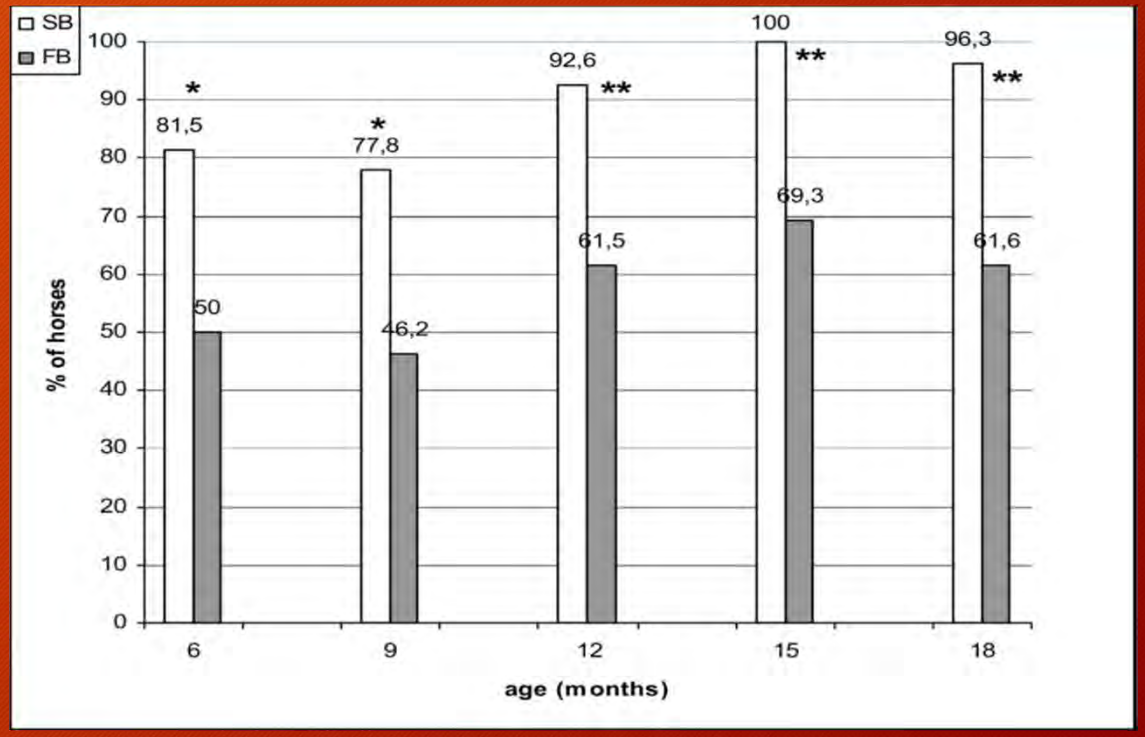
Photo by AGB

Górecka-Bruzda i wsp. 2017

% of horses approaching and touching the human



% of horses accepting to be touched by the human



Górecka-Bruzda i wsp. 2017

Table 2
Latencies to approach an experimenter (f-APPRlat; in seconds) and flight distance (DIST; in horse body lengths, cumulated from 3 trials) in SB and FB foals in human test.

Variable	Age Group	6	9	12	15	18	Group effect	Age effect
f-APPRlat* (seconds)	SB	120^{A} [25; 181] 15–181	181^{A} [50; 181] 20–181	181 [110; 181] 10–181	130^{A} [40; 180] 15–181	65^{A} [45; 181] 25–181	$Z = 6.06$ $P < 0.001$	$X = 4.415$ $P = 0.3854$
	FB	181^{B} [181; 181] 20–181	181^{B} [181; 181] 40–181	181 [80; 181] 15–181	181^{B} [181; 181] 30–181	181^{B} [181; 181] 56–181		
DIST# (body lenghts)	SB	0.63 ± 0.58^{A}	1.64 ± 0.57	0.24 ± 0.57^{A}	0.06 ± 0.58^{a}	0.35 ± 0.58^{A}	$F_{1,51} = 51.7$ $P < 0.001$	$F_{4,204} = 1.90$ $P = 0.112$
	FB	4.46 ± 0.59^{B}	2.69 ± 0.58	3.29 ± 0.58^{B}	2.00 ± 0.59^{b}	3.71 ± 0.59^{B}		

^{A,B} within each variable, SB and FB groups differ at each age (in columns) at $P < 0.01$; ^{a,b} within each variable SB and FB groups differ at each age at $P < 0.05$.
* Medians [Q1; Q3] minimum – maximum.
\# Least square means ± standard errors.

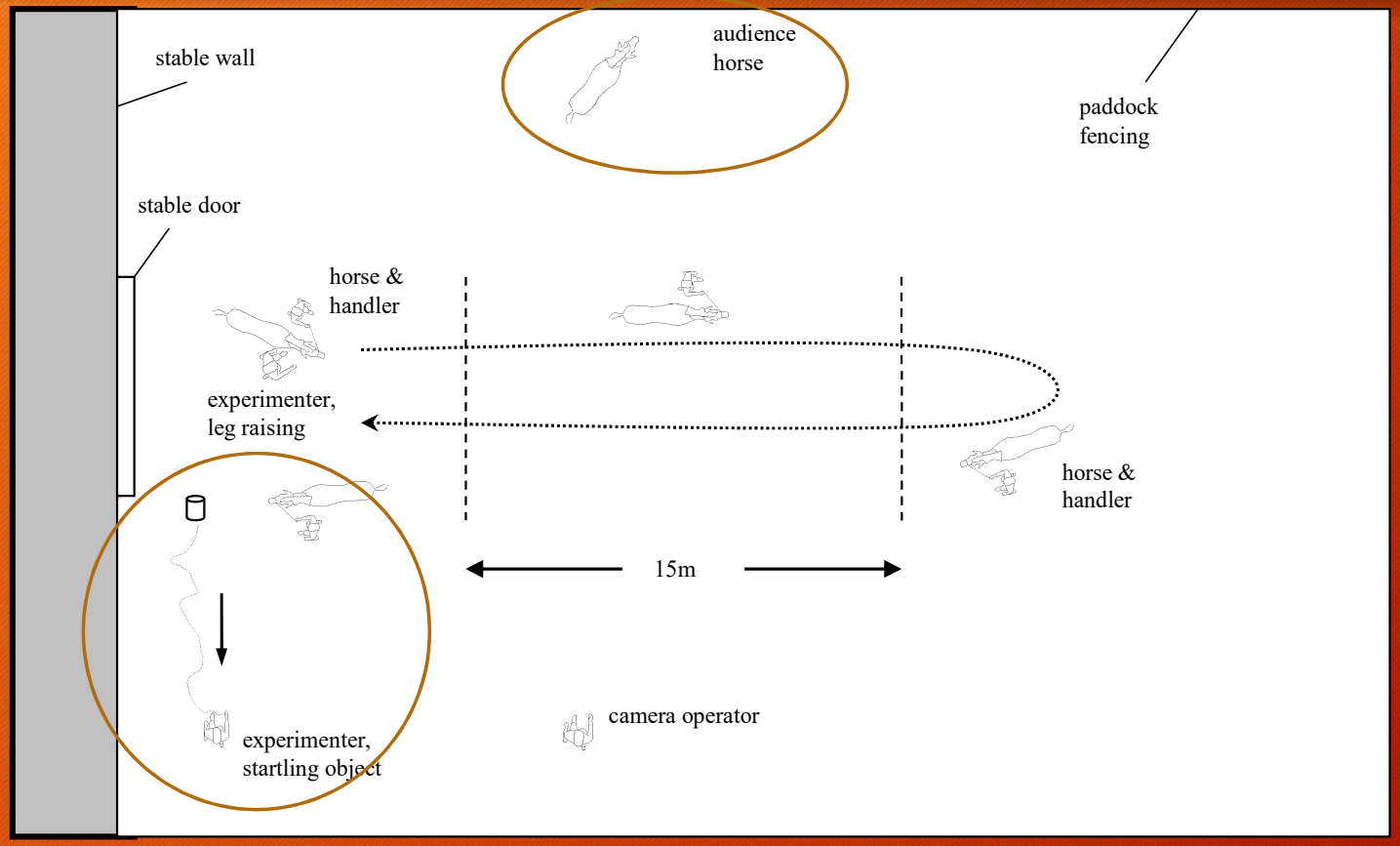
Górecka-Bruzda i wsp. 2017

FB horses presented higher avoidance behaviour than SB horses

So, are the Koniks from the sanctuary de-domesticated?

Photo by M. Bruzda

Górecka-Bruzda et al. 2017



Handling test:

- reactivity to human approach
- latency to pick up the leg
- time to cover the distance of 30 m
- startle reaction score
- halt time

HR and HRV

Górecka-Bruzda et al. 2017

Table 3
Behavioural and physiological variables in SB (N1) and FB (N2) foals in handling test at 12 and 18 months of age.

Variable	Age Group	12	18	Group effect
REACT-h* (score)	SB	0 [0; 3]^{A} 0–3	0 [0; 0]^{a} 0–1	$Z = 3.92$ $N_1 = 27$,
	FB	0.5 [0; 2]^{B} 0–2	0 [0; 1]^{b} 0–2	$N_2 = 24$, $P < 0.001$
LEGtime# (s)	SB	40.1 ± 53.6	59.0 ± 30.4	$F_{1,49} = 0.17$
	FB	50.4 ± 25.5^{X}	74.8 ± 40.1^{Y}	$P = 0.684$
TIME30 m# (s) czasbutel	SB	29.4 ± 9.4 ^{A}	30.9 ± 18.1	$Z = 2.63$,
	FB	59.0 ± 30.4^{BX}	35.8 ± 18.0^{Y}	$N_1 = 27$,
				$N_2 = 24$, $P = 0.0086$
SR (score)*	SB	3 [2; 3] 1–3	3 [3; 3] 2–3	$Z = 1.77$ $N_1 = 27$,
	FB	3 [2; 3] 2–3	3 [2; 3] 1–3	$N_2 = 24$, $P = 0.079$
HALTtime# (s) czas15m	SB	10.5 ± 11.0^{x}	7.4 ± 11.7^{yA}	$Z = -1.56$
	FB	12.3 ± 8.7	14.3 ± 12.1^{B}	$N_1 = 27$,
				$N_2 = 24$, $P = 0.118$
HR# (bpm)	SB	54.9 ± 5.0^{AX}	45.9 ± 5.8^{AY}	$F_{1,49} = 39.1$
	FB	62.1 ± 7.5^{BX}	54.6 ± 7.7^{BY}	$P < 0.001$
HRmax# (bpm)	SB	139.0 ± 36.8^{AX}	116.9 ± 40.3^{aY}	$Z = -0.57$
	FB	175.0 ± 33.1^{BX}	164.8 ± 43.8^{bY}	$N_1 = 27$,
				$N_2 = 23$, $P = 0.5657$
RMSSD# (ms)	SB	43.3 ± 12.1^{AX}	58.6 ± 22.5^{AY}	$F_{1,49} = 13.9$
	FB	34.7 ± 12.0^{BX}	45.3 ± 13.8^{BY}	$P = 0.005$

Górecka-Bruzda et al. 2017

- SB horses calmer in human approach and when handled than FB horses (reactivity to human, cardiac response)
- Consistent within time

- Startle response (fearfulness): no differences!

➢ **SB and FB horses don't differ in fearfulness**

➢ **Experience with human during first 6 months affect reactivity to humans**

Reactivity to humans – personality concept

- Domesticated behaviour = reduction of **fear** of **humans**

FEAR

PREDATOR
NOVELTY
HUMANS

+

EXPERIENCE
(with humans)

Instinctive inherited/genetic component

Environmental component

Reactivity to humans PERSONALITY

Reactivity to humans – personality concept

SB foals – habituation to humans from birth

~~FEAR~~

~~PREDATOR~~
~~NOVELTY~~
~~HUMANS~~

+

EXPERIENCE
(with humans)

Instinctive inherited/genetic component

Environmental component

Reactivity to humans PERSONALITY

Qualitative-quantitative hypothesis of domestication

- Only the species that fulfil all 6 criteria (qualitative hypothesis) of Diamond
- Within each of the criterion, the traits of animals evolve quantitatively
- Some species are predisposed to being „domesticable”

Photo by AGB

Tarpans/wild ancestor of domestic horse?

- Most probably, an Equine species fulfilling all six criteria of Diamonds was an ancestor of domestic horse
- Less probably, this was Przewalski horse, since this species is still very difficult to tame/use
- The ease of human acceptance/trainability depends on personality

Take-home message

Each horse has to be „domesticated" from its very birth!

Photo by AGB

Photo by M. Bruzda

Thank you for your attention!