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To cite this article: B. Benedetti, M. Felici, G. Pigozzi, F. Patroncini & B. Padalino (2025) Management and welfare of the Italian Heavy Draft Horse, Italian Journal of Animal Science, 24:1, 784-799, DOI: [10.1080/1828051X.2025.2470960](https://doi.org/10.1080/1828051X.2025.2470960)

To link to this article: <https://doi.org/10.1080/1828051X.2025.2470960>



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Management and welfare of the Italian Heavy Draft Horse

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ABSTRACT

The Italian Heavy Draft Horse (IHDH) is bred for multiple purposes. This study aims to investigate the husbandry and welfare issues of IHDH and their associations *via* a questionnaire. A representative sample of 92 breeders answered. They were mainly middle-aged men who personally looked after animals (70.6%). Most of them had more than 20 years of experience (73.6%), which was associated with rearing horses in groups and for multiple purposes (p -values <0.05). Respondents fed horses hay and grain, and water was offered *ad libitum*. Horses were reported to be kept in several ways, namely extensively (42.9%), in groups (79.3%), in paddocks (45.7%), or at pasture (41.3%). However, 17.4% of respondents kept their horses intensively in individual boxes. Deworming was always performed, more often in semi-intensively reared horses (p -value <0.001). More than one-third (36.3%) of respondents reported their horses experienced at least one pathology, with diarrhoea, colic, and injuries being the most common. Univariable logistic regressions with the dummy variable 'Presence of at least one pathology' showed that the odds of having an unhealthy horses were increased when respondents owned more than 10 horses, reared horses in intensive systems and in groups, and reported no dental or hoof care (all p -values <0.05). Branding was practiced (85.9%) and extensively reared horses were less likely to be halter trained (p -value <0.001). Overall, group housing and *ad libitum* water were identified as good practices while no scheduled dental and hoof checks, hot branding and lack of basic training need improvement.

HIGHLIGHTS

- A survey was carried out to investigate the management practices and welfare issues of the Italian Heavy Draft Horse and their possible associations
- Results identified some good management practices such as group housing and water always being available
- Some areas of improvement have also been identified as performing regular hoof and dental checks, reduce iron branding and improve basic training

ARTICLE HISTORY

Received 18 November 2024
Revised 16 January 2025
Accepted 17 February 2025

KEYWORDS



Survey; meat production; well-being; husbandry; equine


Introduction

In the last decades, the interest in animal welfare has exponentially increased (Lesimple 2020). Consumers, particularly in Europe, are becoming increasingly aware of animal welfare issues (Phillips et al. 2012), and 60% of them declared they are willing to pay more for products from animal welfare-friendly farming systems (European Commission 2023). Europe has therefore invested resources to produce scientific opinions that would provide the basis for solid animal protection laws (Veissier et al. 2008). Over the last decades, European laws have been therefore emanated

for farm animals in general (Council Directive 98/58/EC of 20 July 1998) and subsequently for individual animal species, including poultry (Council Directive 2007/43/EC of 28 June 2007), calves (Council Directive 2008/119/EC of 18 December 2008), and pigs (Council Directive 2008/120/EC of 18 December 2008).

However, the situation for horses is different from that of other livestock. The European Commission has only recently issued a mandate to investigate equine husbandry systems and welfare issues in Europe (EFSA 2024). Equids have a diverse role in Europe, and although most nations consider them as purely sporting or

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/1828051X.2025.2470960>.

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companion animals, there are still countries where the consumption of horsemeat has a deep-rooted tradition (Stanciu 2015). Major ones include Italy, Belgium, Spain and France (Belaunzaran et al. 2015). As a result of this complexity, ensuring the welfare of the equine species is an even greater challenge (Dalla Costa et al. 2014).

In order to better understand the main welfare concerns of the horse, it is first necessary to know the husbandry methods and practices in the different Member States. In Italy, the Italian Heavy Draft Horse (IHDH) is a stable reality (ANACAITPR website). This Italian native horse is mainly bred in Italy for meat production (De Palo et al. 2009). Despite this, the IHDH is not only bred for meat, but it is also used for heavy work in the woods, shows, and sport (Mantovani et al. 2013), and these other aptitudes have been growing in the last years. It counts around 7000 registered subjects, 5000 of which are actively involved in genetic programs for breed improvement and conservation, and it is widespread in almost all regions of Italy (ANACAITPR website). Albeit, to date, there are only a few studies on this breed, and they cover mainly the area of genetics and meat quality (Tateo et al. 2008; Dall'Olio et al. 2014; Mantovani et al. 2020). Considering the management of the breed, it is reported that is reared in indoor intensive housing systems, especially in the North of Italy, and in extensive conditions mainly in the Centre Italian regions (Mantovani et al. 2013). These systems involve different management practices and consequently different welfare risks are reported in the literature. For example, horses kept in individual boxes with little or no contact with conspecifics may develop stereotypies (Sarrafchi and Blokhuis 2013). In contrast, horses kept in extensive systems may have other welfare concerns such as thermal stress, predation, less human supervision over the health and infrequent handling (Temple and Manteca 2020). However, little is known about husbandry practices and the welfare state of IHDHs.

The authors hypothesised that 1) the management practices and welfare concerns of IHDHs are related to the breeder experience and the type of husbandry system; 2) the frequency of pathologies is related to the different management practices.

Given these premises, the objective of the present study was to collect information *via* a survey on IHDHs husbandry practices and welfare issues in Italy and to find possible associations between them.

Materials and methods

Survey

This study was based on a cross-sectional survey that was conducted from March to November 2023. The

survey was developed in collaboration with the Associazione Nazionale Allevatori del Cavallo Agricolo Italiano da Tiro Pesante Rapido (ANACAITPR). A pilot was conducted asking three breeders to fill out the survey and give their feedback on the clarity and feasibility of the questions. According to that, the survey was revised by the authors who agreed on a final version. In particular, the survey questioned: 1) respondent's and farm's details; 2) general management practice and welfare issues, divided considering the four welfare principles (i.e. Good feeding, Good housing, Good health and Appropriate behaviour) delineated in the Welfare Quality[®] (Blokhuis et al. 2010). The survey included 40 multiple-choice and 6 open-ended questions (Table S1). The survey was conducted by telephone in Italian by the Technical office employee of ANACAITPR. The respondents were breeders who were members of ANACAITPR involved in the genetic programs for the conservation of the breed and the association itself already knew and owned some of the respondents' data. For this reason, the association was authorised to conduct the telephone interview. Before starting each interview, the Technical office employee explained the aims of the survey and asked for consent to the breeder's inclusion in the study and to use the data obtained. The answers collected for multiple-choice questions and the exact words told by the respondents for open-ended questions were reported directly on a commercial data sheet (Microsoft ExcelVR, version 16.0, Redmond, WA).

Respondents

The target population of the survey was the Italian breeders who were members of ANACAITPR and therefore bred the Italian Heavy Draft Horse (IHDH). Considering that in 2022 the number of breeders resulted in 748 (ANACAITPR), a power calculation (Statulator Sample Size Calculator) determined that the representative sample size was 86 breeders (i.e. 86 surveys) (confidence interval: 95%; margin of error: 10%).

Data handling

Once all answers had been collected, the respondents were anonymised from ANACAITPR by identifying them with codes. So, the authors who conducted the statistical analysis were blinded to the respondents' identity. Some questions were then re-categorised *a posteriori* for the purpose of descriptive statistics. The

Table 1. Examples of how some open-ended answers to the question ‘What does welfare of horses mean to you?’ were categorised according to the four welfare principles of good feeding, Good housing, Good health, and appropriate behaviour in a survey on management and welfare concerns of the Italian Heavy Draft Horse. The last column reports the number of welfare principles mentioned by each respondent.

Examples of the open-ended answers	Welfare principles	Welfare principles count
The physical well-being of my horses	Good health	1
When horses are healthy and fleshy	Good health/Good feeding	2
Not only physical well-being but that they are also well psychologically	Good health/Appropriate behaviour	2
When they live outdoors	Good housing	1

open-ended question ‘What does welfare of horses mean to you?’ (Q8) was categorised by one of the authors with experience in animal welfare considering the four welfare principles (i.e. Good feeding; Good housing; Good health, and Appropriate behaviour). Some examples of this categorisation are given in Table 1. The number of welfare principles mentioned by each respondent was counted (i.e. 1 principle, 2 principles, 3 principles, and 4 principles) and the variable ‘Welfare principles count’ was created (Table 1).

The answers to the question ‘In which region of Italy is your farm located?’ (Q9; variable named ‘Region’) were categorised into ‘Zones of Italy’ (i.e. North, Centre, and South). The answers to the open-ended question ‘What is the average space allowance per horse (in m²)?’ (Q25; variable named ‘Type of husbandry’) were categorised into ‘intensive’ (10–20 m²) (Farm Animal Welfare Advisory Council 2018), ‘semi-intensive’ (50–250 m²) (BMEL 2009) and ‘extensive’ (≥ 5000 m² or 2 animals/hectare) (Special Report No 5/2002). Moreover, as the answers to the question ‘What are the most frequent pathologies in the last year (even more than one answer)?’ (Q37; variable named ‘Pathologies’) were unbalanced (less than 5% of answers), a new dummy variable called ‘Presence of at least one pathology’ was created. This new variable was developed by entering 1 if at least one pathology (injuries; diarrhoea; colic; respiratory problems; overheating/sunstroke; fractures; skin problems; muscular problems; laminitis) was reported and 0 if no pathologies were reported.

Statistical analysis

Descriptive statistics were performed, and results were expressed as frequencies and percentages. Chi-square goodness of fit test (χ^2 GOF test) was used to compare the observed frequencies with the expected frequencies (assuming a uniform distribution). Table S2 shows the new variable names and categories where variables were re-categorised to test associations. Fisher’s Exact Test was used to test the associations between the variables listed in Table S2 and ‘Years of experience’ and ‘Type of husbandry’. Fisher’s Exact

Test was chosen due to the small sample size and counts below 5 in some cells of the contingency tables. The ‘*simulate.p.value*’ argument with $B = 10,000$ was used within the ‘*fisher.test*’ function to account for contingency tables larger than 2×2 (i.e. 2×3 or 3×3). Where Fisher’s exact test was significant, pairwise comparisons with Bonferroni correction were performed. Moreover, Table S2 lists the independent variables tested with the ‘Presence of at least one pathology’ (i.e. binary dependent variable) using separate unmatched logistic regression models. In the univariable models, significance was assessed using the Wald test. All the analyses were conducted in R environment (R Version 4.2.3; www.r-project.org). Significance was set at p -value ≤ 0.05 .

Result

Respondent’s details

A representative sample (confidence interval: 95%; margin of error: 9.6%) of 92 breeders was interviewed and completed the survey. Table 2 shows the respondent’s details. Respondents were mainly middle-aged males who personally cared for animals, had more than 20 years of experience, and had learned the profession from their families. About half of them declared to share the work with others, mainly one (30/49, 61.2%) or two (15/49, 30.6%) people. The concept of horse welfare was identified as ‘Good health’ by almost the totality of respondents. None embraced the totality of the concept, considering all the four welfare principles and only 8.9% of the respondents mentioned more than 1 principle (Table S3).

Farm’s details

Farm’s details are shown in Table 3. The farms were located in 16 different Italian regions (Table S3), with the majority of respondents having a farm in central Italy. Most of the farms were made up of only a few horses and one-third of the farms were not exclusive for breeding the IHDH but also different equids and animals (Table S3). Among the animals kept together

Table 2. Descriptive statistics and χ^2 GOF test p-value of respondent's details in a survey on management and welfare concerns of the Italian Heavy Draft Horse.

Variable name	Category	Frequency (n°)	Percentage (%)	χ^2 GOF test p-value*
Sex (n = 91) ^a	Male	78	85.7	<0.001
	Female	13	14.3	
Age (n = 91) ^a	20–30	8	8.8	0.051
	31–40	19	20.9	
	41–50	23	25.3	
	51–60	16	17.6	
	61–70	16	17.6	
	> 70	9	9.9	
Education (n = 89) ^a	Compulsory school	48	53.9	<0.001
	High school diploma	36	40.4	
	Degree	5	5.7	
Role	I personally take care of the animals	65	70.6	<0.001
	I do not personally take care of the animals	27	29.3	
Shared work with others	Yes	49	53.3	0.532
Years of experience (n = 91) ^a	No	43	46.7	<0.001
	≤20	24	26.4	
Learn the profession	>20	67	73.6	–
	Family	86	93.5	
	Seminars/Courses	12	13.0	
	Friends	3	3.3	
	By myself	2	2.2	
Horses welfare perception (n = 90) ^a	Good feeding	8	8.9	–
	Good housing	4	4.4	
	Good health	88	97.8	
	Appropriate behaviour	1	1.1	

Total percentages: Note that total percentages do not always sum to 100% for every characteristic due to rounding or multiple answers to the same questions.

*Null hypothesis: all categories equal.

^aMissing data: Data were missing for some variables, and the denominator for percentage calculations is based on the number of respondents for which data were available. The total number of answers with available data is indicated next to each variable name. Data were missing for Sex, Age, Years of experience (missing = 1, 1.1%), Horse welfare perception (missing = 2, 2.2%) and Education (missing = 3, 3.3%).

Table 3. Descriptive statistics and χ^2 GOF test p-value of farm's details in a survey on management and welfare concerns of the Italian Heavy Draft Horse.

Variable name	Category	Frequency (n°)	Percentage (%)	χ^2 GOF test p-value*
Zones of Italy	North	35	38.0	0.159
	Centre	35	38.0	
	South	22	24.0	
Number of horses (n = 91) ^a	1–10	62	68.2	<0.001
	>10	29	31.9	
Different equids (n = 89) ^a	No	72	80.9	<0.001
	Yes	17	19.1	
Different animals	No	61	66.3	0.002
	Yes	31	33.7	
Purpose of the farm	Reproduction	81	88.0	–
	Show	38	41.3	
	Meat production	26	28.3	
	Sport	5	5.4	
	Other (i.e. work, leisure, pet therapy)	8	8.7	

Total percentages: Note that total percentages do not always sum to 100% for every characteristic due to rounding or multiple answers to the same questions.

*Null hypothesis: all categories equal.

^aMissing data: Data were missing for some variables, and the denominator for percentage calculations is based on the number of respondents for which data were available. The total number of answers with available data is indicated next to each variable name. Data were missing for Number of horses (missing = 1, 1.1%) and Different equids (missing = 3, 3.3%).

with the IHDH, bovine (22/31, 71.0%) and ovine (8/31, 25.8%) were the most reported. The farms were mostly intended for reproduction, show and meat production, with 55.4% (51/92) having more than one purpose (Table S3). On reproduction-oriented farms, natural breeding was the main reproduction method (76/81, 93.8%), while only four respondents reported using artificial insemination (4/81, 4.9%). Stallions were

owned by 63% of the respondents who declared their farm purpose was reproduction (51/81, 63.0%). In particular, the respondents reported having one (36/51, 70.6%), two (10/51, 19.6%) or more than two (5/51, 9.9%) stallions. Moreover, in reproduction farms, the mares' delivery was reported to be assisted in 63.3% of cases (50/79) and the totality of the respondents reported weaning foals at six months of age.

Table 4. Descriptive statistics and χ^2 GOF test p-value of the housing details in a survey on management and welfare concerns of the Italian Heavy Draft Horse.

Variable name	Category	Frequency (n°)	Percentage (%)	χ^2 GOF test p-value*
Horse housing	Paddock	42	45.7	–
	Pasture	38	41.3	
	Individual box	16	17.4	
	Internal pens	6	6.5	
	Other	1	1.1	
Type of husbandry (n = 91) ^a	Intensive (10–20 m ²)	21	23.1	0.069
	Semi-intensive (21–250 m ²)	31	34.1	
	Extensive (>250 m ²)	39	42.9	
Group housing	No	19	20.7	<0.001
	Yes	73	79.3	
Number of horses per group (n = 71) ^{ab}	2–5	27	38.0	<0.001
	6–10	22	31.0	
	11–20	14	19.7	
	>20	8	11.3	
Density per group ^b	Low	50	68.5	<0.001
	Medium	21	28.0	
	High	2	2.8	
Day/night shift	No	87	94.6	<0.001
	Yes	5	5.4	
Season shift	No	83	90.2	<0.001
	Yes	9	9.8	

Total percentages: Note that total percentages do not always sum to 100% for every characteristic due to rounding or multiple answers to the same questions.

*Null hypothesis: all categories equal.

^aMissing data: Data were missing for some variables, and the denominator for percentage calculations is based on the number of respondents for which data were available. The total number of answers with available data is indicated next to each variable name. Data were missing for Type of husbandry (missing = 1, 1.1%) and Number of horses per group (missing = 2, 2.7%).

^bonly for those who answered 'Yes' to the question Q26 (n = 73).

Good feeding

Most of the horses had hay always available (79/92, 85.9%) while for the remaining 14.1% food was rationed into 2–4 times a day (χ^2 GOF test p-value < 0.001). Young and adult horses were fed 79.6% (70/88) and 80.2% (73/91) hay, 70.5% (62/88) and 52.8% (48/91) grains, and 45.5% (40/88) and 27.5% (25/91) pasture, respectively. Almost the totality of horses had *ad libitum* access to water (90/91, 98.9%), while only one respondent reported letting horses drink once a day (1.1%) (χ^2 GOF test p-value < 0.001). Finally, 47.8% of respondents (44/92) reported leaving salt blocks available for their horses, while 52.2% (48/92) did not use this type of supplement (χ^2 GOF test p-value = 0.677).

Good housing

Table 4 shows the details related to the housing. Most of the respondents reported that their horses lived outdoors, in paddocks or pastures, with only a minority living in individual boxes or internal pens. The respondents who said their horses lived on pasture declared to observe them once daily (27/32, 84.4%) or 2–3 times a week (5/32, 15.6%).

The majority of the horses were reared in extensive or semi-intensive systems, while only a quarter of the horses were housed in intensive systems. Most of the horses lived in groups of less than ten. In response to

the question, 'How do you consider the density of animals within groups?' (Q 28 of Table S1, only possible for respondents who answered 'Yes' to the question 'Do horses live in groups?'), the majority of respondents answered 'low'.

Finally, almost all the respondents reported not changing the housing management of horses, neither between day and night nor between the seasons.

Good health

Table 5 shows all the details related to health. All respondents reported that they regularly checked the health of their horses, either personally or through a veterinarian. The parameters they reported assessing when personally checking their horses were mainly the general state of the animal (83/92, 94.3%) and eating and drinking behaviour (85/92, 96.6%). None of them reported monitoring the heart rate of the horses, while only a few reported monitoring rectal temperature (1/92, 1.1%) or body weight (2/92, 2.3%). Almost all respondents reported noticing when horses are sick or in pain from their behaviour (85/88, 96.6%) and calling the veterinarian in such cases (86/90, 95.6%). Respondents reported that they mainly made their own decisions about vaccination prophylaxis for their horses, and a small proportion reported that they did not vaccinate their horses. Deworming was always performed, while 64.1% and 15.2% of respondents

Table 5. Descriptive statistics and χ^2 GOF test *p*-value of the health details in a survey on management and welfare concerns of the Italian Heavy Draft Horse.

Variable name	Category	Frequency (n°)	Percentage (%)	χ^2 GOF test <i>p</i> -value*		
Health monitoring	Myself or non-veterinary staff	88	95.7	<0.001		
	A veterinarian	4	4.3			
Vaccination prophylaxis	Myself or non-veterinary staff	77	83.7	<0.001		
	A veterinarian	12	13.0			
	Horses are not vaccinated	3	3.3			
Deworming (<i>n</i> = 91) ^a	Once a year	20	22.0	<0.001		
	Twice a year	71	78.0			
Dental care	Never	59	64.1	<0.001		
	Once a year	7	7.6			
	When needed	26	28.3			
	Never	11	12.0			
Hoof care	Once a year	20	21.7	<0.001		
	Twice a year	14	15.2			
	Four times a year	4	4.3			
	When needed	43	46.7			
	No pathologies	58	63.7			
	Diarrhoea	21	23.1			
Pathologies (<i>n</i> = 91) ^a	Colic	8	8.8	-		
	Injuries	7	7.7			
	Laminitis	3	3.3			
	Skin problems	3	3.3			
	Fractures	1	1.1			
	Muscular problems	0	0.0			
	Overheating/sunstroke	0	0.0			
	Respiratory problems	0	0.0			
	Presence of at least one pathology (<i>n</i> = 91) ^a	Yes	33		36.3	0.009
		No	58		63.7	
Painful procedures	Hot/Cold branding	79	85.9	<0.001		
	None	13	14.1			
Urgent slaughter (<i>n</i> = 91) ^a	None	80	87.9	<0.001		
	1–5	10	11.0			
	6–10	1	1.1			

Total percentages: Note that total percentages do not always sum to 100% for every characteristic due to rounding or multiple answers to the same questions.

*Null hypothesis: all categories equal.

^aMissing data: Data were missing for some variables, and the denominator for percentage calculations is based on the number of respondents for which data were available. The total number of answers with available data is indicated next to each variable name. Data were missing for Deworming, Pathologies, Presence of at least one pathology and Urgent slaughter (missing = 1, 1.1%).

reported that they had never had their horses' teeth treated and their horses' hooves trimmed, respectively. The most frequently reported pathologies were related to the gastrointestinal tract (i.e. diarrhoea and colic) followed by injuries. However, most of the respondents reported that their horses had had no pathologies in the last year (58/91, 63.7%).

Appropriate behaviour

The horses were reported to have no stereotypies (χ^2 GOF test *p*-value <0.001). Only one respondent declared that one of the horses was aggressive and injured a person (1/92, 1.1%; χ^2 GOF test *p*-value <0.001). Slightly more than two-thirds of the horses were trained to the use of the halter (70/92, 76.1%) and to be handled (70/91, 76.9%), while one-third of the horses did not receive any halter (22/92, 23.9%) or other basic training (21/91, 23.1%) (all χ^2 GOF test *p*-value <0.001). The training method reported by the respondents was mainly 'traditional' (64/69, 92.8%),

with only five people reporting the use of positive reinforcement or horse-manship methods (5/69, 7.2%). Finally, only a minority of the respondents reported that their horses were trained for transport (5/92, 5.4%; χ^2 GOF test *p*-value <0.001).

Associations with 'years of experience' and 'type of husbandry'

The variable 'Years of experience' was tested vs all the variables listed in Table S2. Only the variables 'Purpose count' and 'Group housing' were significantly associated with 'Years of experience' (Fisher's Exact Test *p*-values: 0.004 and 0.017, respectively). Respondents with more than 20 years of experience had farms with multiple purposes compared to respondents with less than 20 years of experience (Figure 1). Moreover, horses were more frequently kept in groups by respondents with more than 20 years of experience compared to their counterparts (Figure 1).

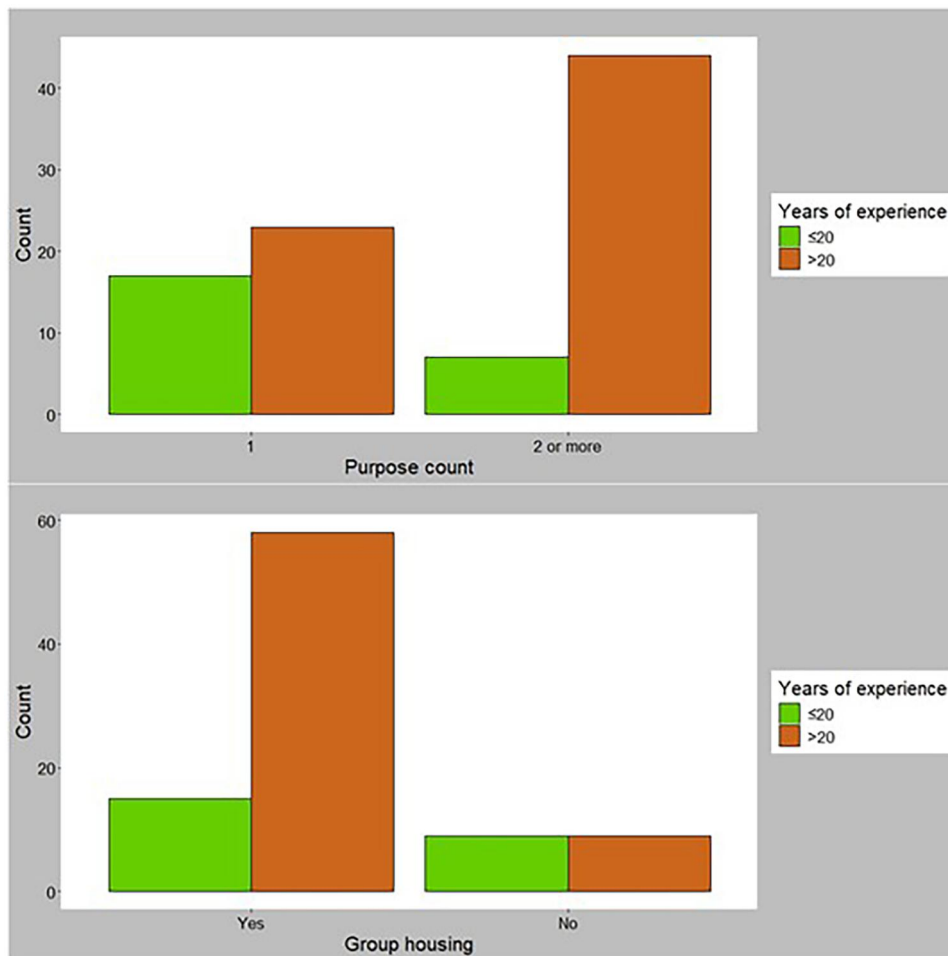


Figure 1. Clustered bar chart showing the row count for the variables 'Purpose count' (fisher's Exact test p -values: 0.004) and 'Group housing' (fisher's Exact test p -values: 0.017) when tested in association with 'Years of experience'.

All Fisher's Exact Test p -values and pairwise comparisons with Bonferroni correction for 'Type of husbandry' are reported in Table 54.

In Northern Italy, horses were mainly reared in intensive or semi-intensive systems, while in the Centre, horses tended to be reared in extensive systems (Figure 2).

Respondents rearing horses in extensive systems tended to have more horses (i.e. >10) compared to semi-intensive systems.

The feeding frequency was rationed in the intensive horse farms and was instead mainly always available in the extensive horse farms (Figure 3).

Considering the housing, respondents rearing horses in an intensive system kept their horses in individual boxes, while those rearing horses in an extensive system tended to use pastures (Figure 4). Paddocks were mainly used in intensive or semi-intensive systems.

Compared to horses kept in intensive and semi-intensive systems, horses reared in extensive systems were mostly kept in groups.

As a management practice, deworming was mainly carried out once a year in extensive systems, compared with twice a year in semi-intensive systems.

Halter training was more commonly practised by respondents who reported that their horses were kept on semi-intensive farms rather than on extensive farms (Figure 5).

Univariable regression for the dummy variable 'presence of at least one pathology'

Table 6 shows the results of the univariable logistic regression models with 'presence of at least one pathology' as outcome.

Rearing more than 10 horses increased the odds of having horses with at least one pathology by 2.6 times compared to rearing 1–10 horses.

Keeping horses in intensive systems increased the odds of having at least one pathology by 5.9 times

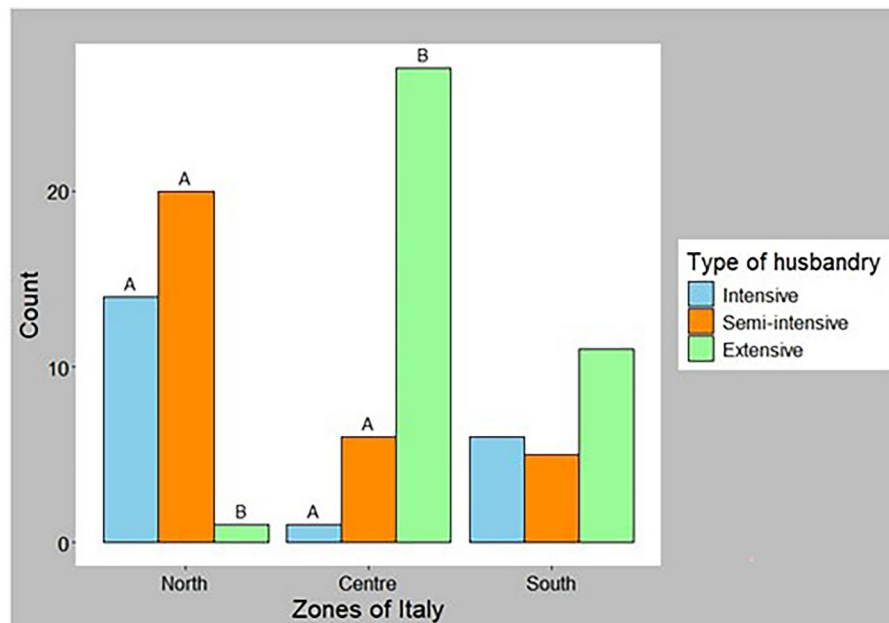


Figure 2. Clustered bar chart showing the row count for the variable 'Zones of Italy' when tested in association with 'Type of husbandry'. Statistically significant differences (A, B = p-value ≤ 0.001) were found in the national distribution of intensive and semi-intensive systems compared to extensive systems, with Northern Italy having more intensive and semi-intensive systems and Central Italy having more extensive systems.

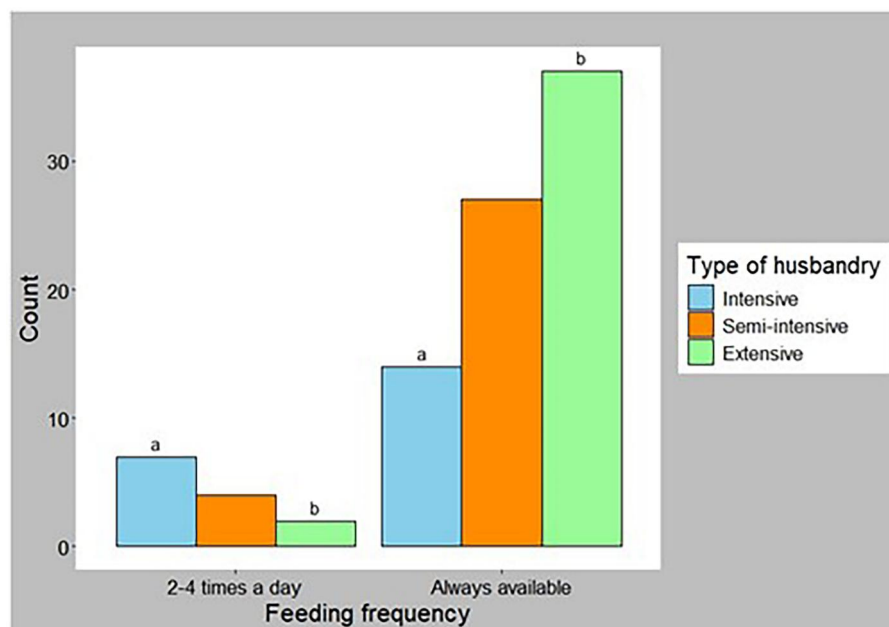


Figure 3. Clustered bar chart showing the row count for the variable 'Feeding frequency' when tested in association with 'Type of husbandry'. Statistically significant differences (a, b = p-value ≤ 0.05) were found in the feeding frequency of the horses in intensive systems compared to extensive systems, with mainly rationed feeding in intensive systems and always available feeding in extensive systems.

compared to extensive husbandry systems. In addition, horses kept in groups were 5.9 times more likely to have at least one pathology than those kept individually.

Horses that did not receive routine dental care were three times more likely to have at least one

pathology than those that received routine dental care.

Never trimming the horses' hooves increased the likelihood of having horses with at least one pathology by almost six times compared to trimming horses' hooves when necessary.

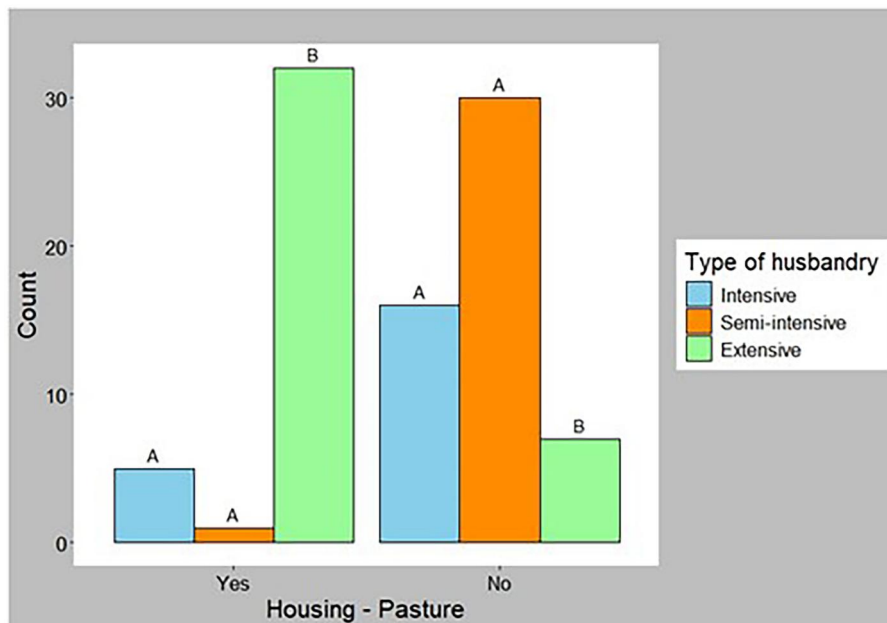


Figure 4. Clustered bar chart showing the row count for the variable 'Housing - pasture' when tested in association with 'Type of husbandry'. Statistically significant differences ($A, B = p\text{-value} \leq 0.001$) were found in keeping the horses at pasture in intensive and semi-intensive systems compared to extensive systems, with horses not being kept at pasture in intensive and semi-intensive systems and, conversely, mostly being reared at pasture in extensive systems.

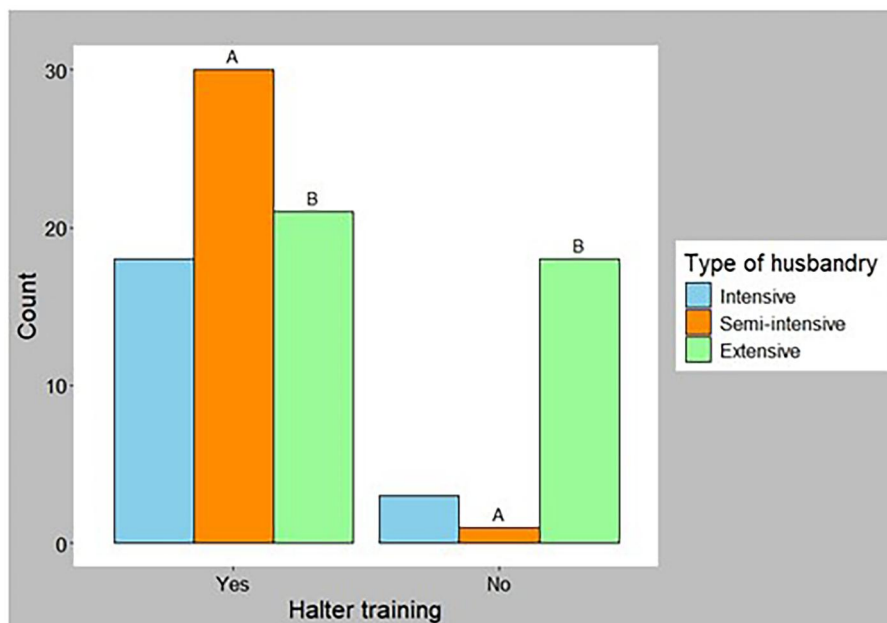


Figure 5. Clustered bar chart showing the row count for the variable 'Halter training' when tested in association with 'Type of husbandry'. Statistically significant differences ($A, B = p\text{-value} \leq 0.001$) were found in the halter training of horses in semi-intensive systems compared to extensive systems, with horses in semi-intensive systems being accustomed to the halter and horses in extensive systems not being trained to the use of the halter.

Discussion

This study surveyed 92 IHDH breeders and documented details of the respondents and their farms, management practices, behavioural and health issues of the horses, and the associations between them. As

hypothesised, breeders' experience was associated with husbandry practices, with experienced breeders keeping horses in groups and rearing them for multiple purposes, such as breeding, show, and meat production. In addition, the type of husbandry was associated with both management practices and

Table 6. Univariable logistic regression model with ‘presence of at least one pathology’ as outcome. Wald test *p*-values are reported for all the variables included in the analysis. For the variables that resulted significant, data are presented as estimate \pm standard error (SE), odds ratio (OR), confidence interval (CI), and categories’ *p*-values.

Variable	Estimate \pm SE	OR	CI	Wald test <i>p</i> -value
Welfare principle count				0.990
Zones of Italy				0.063
Number of horses				0.046
1–10		Ref		
>10	0.940 \pm 0.466	2.560	1.194-5.560	0.044
Purpose count				0.113
Feeding frequency				0.821
Salt blocks				0.050
Yes		Ref		
No	0.901 \pm 0.454	2.462	1.180-5.529	0.047
Housing – paddock				0.354
Housing – pasture				0.923
Housing – individual box				0.310
Type of husbandry				0.004
Intensive		Ref		
Semi-intensive	–2.079 \pm 0.650	0.125	0.041-0.351	0.001
Extensive	–1.782 \pm 0.604	0.168	0.060-0.441	0.003
Group housing				0.026
No		Ref		
Yes	1.776 \pm 0.787	5.905	1.864-27.195	0.024
Deworming				0.953
Dental care				0.030
Yes		Ref		
No	1.105 \pm 0.501	3.018	1.360-7.163	0.027
Hoof care				0.034
When needed		Ref		
Never	1.754 \pm 0.723	5.775	1.809-20.181	0.015
Once or more a year	0.922 \pm 0.490	2.514	1.134-5.735	0.060
Halter training				0.991
Basic training				0.751
Transport training				0.565

P-values in bold refer to the statistical significance or trend towards the significance of the predictive variables in the model; the significance of a category against the reference is reported in regular font.

Ref: reference category.

welfare concerns, with horses in extensive systems kept more frequently in groups and at pasture than those in intensive and semi-intensive systems and having a lower incidence of diarrhoea than those in intensive systems, supporting our initial hypothesis. As expected, farm details (i.e. the number of horses on the farm), feeding (i.e. availability of salt blocks), housing (i.e. type of husbandry and whether horses were kept in groups), and care practices (i.e. dental and hoof care) were associated with the presence of at least one pathology. Gathering this information has been crucial in providing evidence that could help develop the future *Equidae* welfare legislation in Europe. Moreover, our findings could be useful to promote the development and conservation of this Italian breed and subsequently to enhance the Italian equine industry.

Respondent’s details

In the current study, the IHDH breeders mainly had small family farms that they managed themselves. The

20% of breeders were young (<30 years old) or senior (>70 years old), suggesting intergenerational transfer of the farms, which are inherited from generation to generation. These types of ‘family’ farms were in line with what is reported in the ANACAITPR database (ANACAITPR website), where the breeder has 7 horses on average. Rearing traditional livestock breeds is often associated with less intensive systems (Phillips 2024), where breeders are often the only ones in contact with their animals, as in this study.

The concept of horse welfare given by IHDH breeders was based primarily related on ‘good health’ and ‘good feeding’. In fact, the perception of a horse’s welfare in terms of good health or a good body condition score (BCS) is common among horse owners, as already found in other studies (Visser and Van Wijk-Jansen 2012; Hausberger et al. 2021). In a survey conducted by Visser and Van Wijk-Jansen (Visser and Van Wijk-Jansen 2012), 99.6% of respondents considered good health to be an indicator of good welfare. Hausberger et al. (Hausberger et al. 2021) also reported that owners often underestimate the BCS of

their horses and that in Western countries, owners tend to consider the BCS of overweighted horses to be 'optimal'. For IHDHs destined for meat production, the owners' consideration of a high BCS as a positive welfare index could be even more pronounced. None of the respondents in our study considered all four principles (i.e. good feeding, good housing, good health, appropriate behaviour) when describing the meaning of welfare and only one respondent considered behaviour as an indicator of animal welfare. This suggests that the concept of welfare is still little known in all its aspects (Hausberger et al. 2021) requiring more education among breeders and owners. The difficulty in recognising all aspects of animal welfare has already been pointed out for farmers breeding other species (Hansson and Johan Lagerkvist 2012) that usually consider only the health and comfort of the animals. One possible solution to this common problem could be making welfare certification compulsory for all livestock farmers, thus facilitating the dialogue between the policymakers and the farmers themselves. As farmers become more aware of all aspects of animal welfare, they will be able to carry out self-assessments of their farms to understand which critical points need to be improved (Wilkins et al. 2024). In this regard, it is worth highlighting that, even if any certification is compulsory, ANACAITPR provides free educational seminars and workshops for its members every year. These courses focus on breeding management, horse welfare and training with the aim of improving the welfare of IHDHs (ANACAITPR website).

Farm's details

This survey reported the IHDH as a multipurpose breed, widespread throughout Italy. Indeed, over the years the breed has spread throughout the country thanks to its robustness and adaptability (Mancin et al. 2020). This breed can graze on difficult and poor pastures (Miglio et al. 2019), making it useful in managing environmentally sensitive areas. This could open interesting scenarios for environmental sustainability. Also, some breeders reported keeping horses with other species, particularly bovine and ovine. Multi-species livestock farming is an approach that is currently being investigated with the aim of optimising resources and reducing environmental impact (Martin et al. 2020; Raspa et al. 2024). This type of farming has been shown to improve the three dimensions of sustainability, namely environmental, social and economic. However, when keeping more species together, the

farmer must be careful to provide appropriate stocking density to avoid potential competition for resources during grazing and ensure the mental welfare of the species involved (Martin et al. 2020). In addition, attention must be paid to biosecurity, as some diseases have cross-species transmission (Martin et al. 2020). Therefore, IHDH preservation as a breed could also benefit the future conservation and protection of the environment. To preserve the breed, the original function of working horses was then implemented to a dual purpose, with the introduction of meat production (Centoducati et al. 2012; Dall'Olio et al. 2014). In recent years, however, these horses have also taken on a role in organic farms and leisure activities (Mancin et al. 2020). This versatility could be an incentive to maintain and improve the breed (Mancin et al. 2020) and to invest resources in its conservation which could bring environmental, sustainability, and agrotourism benefits.

Good feeding

In our study, a quarter of respondents provided pasture to their horses in addition to hay and grain, similar to the feeding management of local breeds in southern Europe (Fioretti et al. 2004; Mantovani et al. 2005). Even though pastures in Italy are not particularly rich, some local breeds, such as the Bardigiano (Fioretti et al. 2004) or the IHDH (Mantovani et al. 2005), can make good use of resources, making them indispensable for the preservation of the landscape (Fioretti et al. 2004; Mantovani et al. 2005). Access to pasture is different for IHDH than for other sport or leisure horses, which often do not have the opportunity to graze freely (Dalla Costa et al. 2017). This is probably because grazing is not considered to provide sufficient nutrition for sport horses (Hoskin and Gee 2004) or because of owners' fear of injuries (Dalla Costa et al. 2017). However, access to pasture has the dual function of feeding the horses and ensuring their psycho-physical welfare (Hoskin and Gee 2004), which should also be considered in contexts other than local breeding, with management adaptations where necessary.

Good housing

IHDHs were mostly kept in semi-intensive and extensive systems, in line with the management of other local autochthonous breeds in Europe (Bodó et al. 2005) and in contrast with the most common way of keeping sport horses, namely individual box

(Søndergaard and Ladewig 2004). In addition, the type of husbandry was zonal, with intensive and semi-intensive systems more common in the North and extensive systems in the Centre of Italy. These differences have already been reported in the literature and are compatible with the warmer winter in the Centre, which allows IHDHs to be kept outdoors for most of the year (Mantovani et al. 2013; 2020). In addition, most of the land in northern Italy is devoted to cattle and pig farming (VETINFO; Di Bartolo et al. 2008), which may limit the extensive breeding of horses. In the south ANACAITPR reports an intermediate situation with horses often kept in individual loose boxes at night and in large group paddocks during the day (ANACAITPR website).

Extensive systems were also associated with the good practice of keeping horses in groups. In Europe, the proportion of livestock reared extensively in low-density groups is increasing (Veissier et al. 2008). Moreover, horses were more frequently kept in groups if the breeders were more experienced (i.e. >20 years). Keeping horses in groups can be beneficial to their welfare, but it is of paramount importance that the group is properly created and managed to avoid negative outcomes (Hartmann et al. 2012; Noble 2023). Hence, breeders should be aware of this if they wish to keep horses in groups. Given the low number of aggressive behaviours reported by IHDH breeders, it is believed that they are aware of how to manage group horses appropriately. Although extensive systems have many welfare benefits, they are by no means free of welfare issues such as difficult thermal comfort and limited health monitoring (Temple and Manteca 2020). For this reason, experience in horse management and regular inspection of animals in extensive systems is recommended.

Good health

Most respondents reported personally monitoring the health of their horses and deciding on vaccination prophylaxis. For this reason, in-depth training of equine professionals and breeders, as proposed in other European countries, is certainly necessary (Liljenstolpe 2009). However, it would be always advisable for the horses to be regularly inspected by veterinarians. Most respondents reported that their horses had not had any pathologies in the last year. This could be interpreted as optimal management but could also be a possible respondent bias in reporting the presence of pathologies or a superficial observation of the horses. The most reported pathologies

were gastrointestinal (i.e. diarrhoea and colic) or injuries, while no respiratory pathologies were reported. In our study, the high prevalence of gastrointestinal problems and the complete absence of reported respiratory problems may indicate that pathologies are only recognised and treated when horses are showing evident clinical signs rather than at subclinical-early stages. Deworming was regularly carried out by respondents, and this could be considered a good practice that is regularly performed by IHDH breeders.

Most of the breeders (85.9%) still branded their horses to identify purebred subjects and this is a heritage of a strong tradition that IHDH breeders have. In the past, horses were marked with hot branding as a matter of identification, whereas nowadays, horses are regularly microchipped for this reason (Lindegard and Andersen 2012). Among IHDH breeders, the tradition of identifying IHDH with branding has remained. For the breeder, branding has the meaning to identify the horse as a purebred subject that has been selected for its morphological and attitudinal characteristics to become part of the breed's preservation. Lindegard and colleagues (Lindegard et al. 2009) reported that hot branding compared to microchipping seemed to have similar long-term cortisol levels but caused local inflammation, edoema and pain. However, Aurich and colleagues pointed out that the nature and extent of the local alterations caused by hot branding have not been studied patho-physiologically, requiring further studies on this aspect (Aurich et al. 2013).

Hence, horse breed associations that still apply this type of marking should find other innovative alternatives to easily identify the purebred selected subjects without affecting their welfare (Lindegard and Andersen 2012). It would therefore be advisable to find other options to recognise these purebred subjects or, if branding is desired for 'aesthetic' reasons of breed recognition, at least the reduction of the number of brandings (currently two for IHDH, on the left thigh and neck) should be considered. The ANACAITPR, as a first step, has already made the branding non-compulsory for the breed, which, therefore, remains up to the breeder.

Management practices such as rearing more than 10 horses or keeping horses in groups increased the odds of having horses with at least one pathology. Owning a larger number of horses or keeping them in groups, may have reduced the accuracy with which the animals were checked, thus exacerbating initially mild pathological situations. In addition, keeping horses in groups may have exposed them to injury

(Kjellberg et al. 2025), especially if the group was not hierarchically stable. In our study, keeping horses in intensive husbandry systems increased the likelihood of having horses with at least one pathology. This is in line with the literature, where intensive husbandry systems in the form of tie-stalls or individual boxes resulted in higher frequencies of colic and respiratory problems (Yngvesson et al. 2019).

The care routine of the horse also had an impact. Horses that did not receive regular dental care were more likely to have at least one pathology, which is consistent with the gastrointestinal problems associated with sharp teeth and uneven wear (Dixon and Dacre 2005). However, it is worth highlighting that horses kept on pasture could potentially need less frequent dental care than those kept in stalls. In fact, free-grazing horses have been reported to have fewer dental problems compared to stable-kept horses, and this was mainly related to the difference in their diet that allows a more adequate wear of the teeth in case of pasture (Masey O'Neill et al. 2010; Hain et al. 2023). Hence, the frequency of dental care should be planned also according to the general management of the horses.

The same result found for dental care was true for hoof trimming, with horses that had never had their hooves trimmed being more likely to develop at least one pathology than horses that had had their hooves trimmed when necessary. Lack of regular hoof care and hoof trimming can lead to laminitis, lameness, and injury (Pollitt 2004). Regular hoof care, even if less frequent in horses kept on pasture, is always necessary. Our results should be considered with caution, as the variable 'presence of at least one pathology' combined pathologies of different types in the same variable and this may have reduced the accuracy of its association with the tested factors. Nevertheless, this study is the first to use univariable logistic regression to identify management and care issues impacting the health of IHDHs.

Appropriate behaviour

In terms of behaviour, our results showed that no horse exhibited stereotypies, which is consistent with the way this breed is reared, i.e. mainly extensively. Stereotypies typically develop under conditions of intensive housing and social isolation (Sarrafchi and Blokhuis 2013), which is not typical for this breed. However, the authors also believe that there is a need to further investigate this topic, especially in relation

to IHDH stallions, which are mostly housed in isolated conditions.

The study found that about one-third of horses lack halter and handling training, with nearly all untrained for transport. This issue was most common among extensively bred horses, representing one of the major welfare concerns found in this study. Also considering the breeding purposes reported by breeders, these horses will be handled and transported multiple times during their lives (either for shows, breeding or towards the slaughterhouse). The lack of training constitutes a stressful factor for the horses that are not used to the human presence, consequently impairing their welfare (Menchetti et al. 2021). At the same time, low level of taming can cause fear and flight response in stressful situations, and this could affect the safety of the operators, thus also constituting a major risk for horse-related human injuries (Marsbøll and Christensen 2015). Once again, it is therefore crucial to educate breeders and to implement positive training practices. For this purpose, a preliminary study on horses destined for slaughter showed that performing positive reinforcement-based training for self-loading on the truck reduced the horses' stress during this transport phase (Dai et al. 2019). Furthermore, it is important to point out that this is a cold-blooded breed and therefore generally has a placid and composed nature and a less reactive temperament to new stimuli (Kołodziejczyk et al. 2020), which should be an incentive for breeders to perform basic training to manage horses without affecting their mental state. It is worth highlighting that ANACAITPR is already working to improve this point by providing courses and workshops to IHDH breeders on the aspect of handling and basic training (ANACAITPR website).

Limitations of the study

Although this study provides important preliminary findings, there are some limitations. Firstly, as the study is based on a survey, it has biases common to this type of research (Christley 2016). An accountability bias could be related to the fact that the interview was conducted by telephone and therefore not completely anonymous, which may have led respondents to be reluctant to reveal some aspects of their answers (Christley 2016). A recall bias could also be present, as respondents' answers were based solely on their memories. In addition, due to the small sample size, the Chi-square Test could not be performed. To overcome this limitation, Fisher's Exact Test was performed, but it was necessary to estimate the p-value

when the contingency tables were larger than 2×2 cells. Finally, some variables such as 'Type of husbandry' or 'Pathologies' required an *a posteriori* recategorisation that, for this reason, may not have been perfectly balanced. Despite these limitations, this study is the first to highlight the husbandry practices and main welfare issues of IHDHs, providing evidence of what needs to be improved to ensure a good quality of life for these horses.

Conclusion

This study provided preliminary results on the housing and management practices of IHDHs in Italy and their main welfare concerns. In general, good housing, feeding and care practices were found, with horses mainly kept in groups and extensively, having hay and water almost always *ad libitum*, and always provided with deworming treatments. On the other hand, some welfare issues and practices that need to be improved were highlighted. Health checks by veterinarians were not frequent, dental care was often never performed and hoof trimming was performed only when needed but not scheduled. As expected, experienced farmers had farms with multiple purposes and more frequently bred horses in groups. Intensive systems increased the likelihood of having horses with at least one pathology and were also associated with having horses with diarrhoea, confirming our second hypothesis. In addition, branding was still widespread, while halter training was not always performed, especially in horses reared in extensive systems. Hence, investing on breeders' education and promoting courses on horses welfare and training seems a possible solution to improve the critical points of this breed management. Our results are preliminary, but this first overview can provide important information on the practices and critical points of IHDH breeding and provides a window into the national reality of local breed management, which could be useful in the European context to gathering information on the welfare of horses on farms.

Acknowledgments

The article was written within the framework of the programmatic initiatives of the ASPA Commission for Animal Behaviour and Welfare. The authors want to thank ANACAITPR director and all the IHDH breeders who participated in the survey.

Ethical approval

The study was conducted according to the guidelines of the Declaration of Helsinki. The interview was conducted after receiving a consent form from each participant and all data were anonymised for the subsequent analyses. At the time the research was performed there was no need for the application for human ethics at the University of Bologna in case of anonymous questionnaires. Similarly, no animals have been used to perform the study, so no animal ethics approval was needed.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data presented in this study are available on the AMSActa Institutional Research Repository at the link <https://amsacta.unibo.it/id/eprint/8252>.

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