

## Miniature horses in New Zealand: demographics and feeding management

SY Goh<sup>a\*</sup>, EK Gee<sup>a</sup>, DG Thomas<sup>b</sup>, PJ Back<sup>ab</sup> and CW Rogers<sup>ab</sup>

<sup>a</sup>*School of Veterinary Science, Massey University, Private Bag 11-222, 4442, Palmerston North, New Zealand;*

<sup>b</sup>*School of Agriculture and Environment, Massey University, Private Bag 11-222, 4442, Palmerston North, New Zealand*

\*Corresponding author: Email: s.y.goh@massey.ac.nz

### Abstract

An online survey on demographics and feeding management of Miniature horses in New Zealand was conducted using the Qualtrics Survey Software. There were 232 valid responses from respondents who kept 1183 Miniature horses, representing ~ 1/3rd of the New Zealand Miniature horse population. Miniature horses were kept for leisure and companionship (56%), competition (35%) and for breeding (7%). The majority (79%) of Miniature horses were kept at pasture on low (< 1000 kg DM/ha) to moderate (~ 2000 kg DM/ha) pasture masses across seasons. Pasture access was more commonly restricted by respondents during spring (60%), summer (60%), and autumn (55%) than in winter (43%). Most respondents (87%) practiced pasture-restriction strategies such as strip grazing, use of a paddock with little grass, and stabling/yarding. Respondents indicated the mode daily number of hours of stabling was 7-12 hours (n=57/195, 29%). The median stocking density was 10 horses/ha, (~1100 kg live weight/ha). The stocking density appeared high, however, on a live weight basis, it was comparable to the reported values in other classes of equine livestock.

**Keywords:** horse, Miniature horse; demographics; feeding; pasture

### Introduction

The Miniature horse is phenotypically classified by its small stature (Petersen et al. 2013). The genetic basis of the New Zealand Miniature horses is the American Miniature horse, and in some cases Shetland and Timor ponies (Rogers et al. 2006). Miniature horses present a unique management challenge due to their small body size and a thrifty phenotype. These small equines can develop obesity, insulin resistance (equine metabolic syndrome, EMS) and laminitis; excess body weight developed as a result of ration mis-estimation, overfeeding or a lack of knowledge on the total amount of feed required (Scherer-Hoock et al. 2011).

Based on published New Zealand pasture energy content of 10 MJ DE/kg DM, an adult Miniature horse weighing 110 kg would only require 2 kg (or 1.8% of body weight) of pasture DM per day to meet maintenance energy requirement of 20.2 MJ [DE<sub>m</sub> = 5.9 + 0.13 BW] (Hoskin & Gee 2004; National Research Council (U.S.) Committee 2007). However, little is known about the actual voluntary feed intake (VFI) of Miniature horses when fed *ad libitum*. Non-obese Welsh Mountain ponies were able to consume a complete, commercially manufactured chaff-based diet, comparable in nutrient profile to moderate quality hay, at 3.5 ± 0.1% (winter) or 4.6 ± 0.3% (summer) of body weight as dry matter when fed *ad libitum*, which was above maintenance requirements (Dugdale et al. 2010; 2011). As a result, their body weight increased rapidly (0.6-0.9 kg/day) (Dugdale et al. 2011). Therefore, feed intake must be restricted in ponies or small-sized horses to prevent increased body weight.

Restricting feed intake can be achieved by limiting the amount of time horses are kept on pasture (Glunk et al. 2013), or selective grazing on poor-quality pasture (Fleurance et al. 2009). Although pony breeds appear to have a better utilisation of less-nutritious feed (Cuddeford

et al. 1995), with restriction of feed intake, suitable supplementary feeding and/or supplements may be required to ensure that their nutritional requirements are met.

In New Zealand, Miniature horses represent a fast-growing sector of the equine industry. Recent estimates suggest there are 3000 registered Miniature horses in New Zealand, making up ~3% of the entire horse population in New Zealand, or ~7% of horses involved in other equestrian, leisure or recreational activities (Rogers et al. 2017). Only one survey on New Zealand Miniature horses (a preliminary study on congenital and reproductive disorders) has been carried out (Rogers et al. 2006). At present the demographics and feeding management of New Zealand Miniature horses have not been well described. Thus, the aim of this study is to describe the demographics and feeding management of Miniature horses in New Zealand. The information gathered will be a useful reference in identifying the unique challenges in feeding and management of Miniature horses.

### Materials and methods

An online survey was created using the Qualtrics Survey Software (<https://massey.qualtrics.com/>) and was published between 4th July 2019 and 26th November 2019. Recruitment of respondents was achieved via the snowball sampling technique. The link to the survey was published on social media pages of Miniature horse special-interest and breeder groups within New Zealand. In addition, key industry participants known to the authors were involved in disseminating the link of the survey via social media.

The survey consisted of eighty-five succinctly crafted questions, which were a combination of closed and open-text responses. The questions addressed four main subject areas; demographics, feeding, management practices and health care practices for Miniature horses in New Zealand. The survey was approved by the Massey University

Human Ethics committee as low risk (notification number: 4000021167).

The dataset from the survey was subsequently coded and cleaned for analysis within Microsoft Excel. Continuous data were examined for normality using histograms and the Shapiro-Wilk test. If data were non-parametric, the median, 1st quartile, 3rd quartile or mode frequency of the data series were reported. Differences between groups for non-parametric data were examined using Kruskal-Wallis test one-way analysis of variance, significant differences between the groups were further tested using a pairwise Mann-Whitney test. Differences in distribution between groups were tested using the Chi-square test. All statistical tests were performed, and significance was accepted at  $P < 0.05$  using the SPSS Statistics 26.0 (IBM Corp., Armonk, N.Y., USA).

## Results

### Demographics

Of the 247 survey attempts, 232 resulted in valid

responses, of which 153 had a 100% question completion rate and a further 41 responses had 97-99% question completion rate ( $n=194/232$ ). Most respondents were female ( $n=226/232$ , 97%) aged 35-64 years ( $n=152/232$ , 66%), with the highest number of respondents in the 45-54 age bracket ( $n=65$ ). Most Miniature horse owners had at least five years' experience of keeping Miniature horses ( $n=176/232$ , 76%), and kept their Miniature horses on a lifestyle block: land area ~4 hectares (ha) or ~10 acres ( $n=172$ , 74%). Responses were obtained from all regions in New Zealand: Canterbury ( $n=37$ ), Waikato ( $n=29$ ), Taranaki ( $n=28$ ), Auckland ( $n=28$ ), Manawatu-Wanganui ( $n=23$ ), Northland ( $n=18$ ), Wellington ( $n=15$ ), Bay of Plenty ( $n=13$ ), Hawke's Bay ( $n=11$ ), Otago ( $n=9$ ), Nelson-Marlborough ( $n=6$ ), Tasman ( $n=6$ ), West Coast ( $n=3$ ), Southland ( $n=3$ ) and Wairarapa ( $n=3$ ).

Most respondents ( $n=164/232$ , 71%) registered their Miniature horses ( $n=1137$ ) with the New Zealand Miniature Horse Association (NZMHA) registry. As Miniature horses can be registered with multiple breed registries or

**Table 1** Data from the survey on demographics and feeding management of Miniature horses in New Zealand: the number of Miniature horses per respondent, the number of Miniature horses according to age, and the stocking density of Miniature horses, categorized according to primary use.

Primary purpose of Miniature horse ownership	Leisure and companionship	Competition	Breeding *	Total	P
Number of responders (%)	130 (56%)	82 (35%)	17 (7%)	232 <sup>§</sup> (100%)	-
Total number of Miniature horses	459 (data from 126 respondents)	589 (data from 79 respondents)	135 (data from 13 respondents)	1183 (data from 218 respondents)	-
Median(IQR) Miniature horses per respondent	2 (1-4) <sup>b</sup> (data from 126 respondents)	6 (3-11) <sup>a</sup> (data from 79 respondents)	10 (4-16) <sup>a</sup> (data from 13 respondents)	3 (2-7) (data from 218 respondents)	$P < 0.05$
Age distribution of Miniature horses (number of horses, n)	<3 yrs (n=28) 3-5 yrs (n=57) 6-15 yrs (n=280) >15 yrs (n=94)	<3 yrs (n=117) 3-5 yrs (n=120) 6-15 yrs (n=267) >15 yrs (n=85)	6-12 yrs (n=30) 13-15 yrs (n=81) >15 yrs (n=24)	1183 (data from 218 respondents)	$P < 0.05$
Median (IQR) stocking density or the number of Miniature horses per hectare, ha	10 (5-17) <sup>a</sup>	13 (7-22) <sup>b</sup>	12 (4-13) <sup>a</sup>	10 (5-20)	$P < 0.05$
Number of hours, h of stabling (number of respondents, n)	0 h (n=29) 1-6 h (n=17) 7-12 h (n=30) 13-18 h (n=14) 19-24 h (n=22) (data from 112 respondents)	0 h (n=13) 1-6 h (n=18) 7-12 h (n=24) 13-18 h (n=8) 19-24 h (n=10) (data from 73 respondents)	0 h (n=6) 1-6 h (n=1) 7-12 h (n=2) 13-18 h (n=0) 19-24 h (n=0) (data from 9 respondents)	0 h (n=48) 1-6 h (n=36) 7-12 h (n=57 <sup>^</sup> ) 13-18 h (n=22) 19-24 h (n=32) (data from 195 respondents)	ns
Subset data: number of hours, h of stabling for the purpose of restricting pasture access (number of respondents, n)	0 h (n=3) 1-6 h (n=10) 7-12 h (n=23) 13-18 h (n=11) 19-24 h (n=8) (data from 55/112 respondents)	0 h (n=0) 1-6 h (n=7) 7-12 h (n=16) 13-18 h (n=6) 19-24 h (n=4) (data from 33/73 respondents)	0 h (n=1) 1-6 h (n=1) 7-12 h (n=2) 13-18 h (n=0) 19-24 h (n=0) (data from 4/9 respondents)	0 h (n=4) 1-6 h (n=18) 7-12 h (n=42 <sup>^</sup> ) 13-18 h (n=17) 19-24 h (n=12) (data from 93/195 respondents)	

\* refers to broodmares only.

<sup>§</sup> includes data from three respondents with unknown primary purpose of Miniature horse ownership

<sup>^</sup> includes data from one respondent with unknown primary purpose of Miniature horse ownership

<sup>a,b</sup> denotes significant difference within row ( $p < 0.05$ ) using the Mann-Whitney pairwise comparison between three different data series.

societies, 131 respondents indicated that their horses had more than one registration. There were 23% of respondents (n=54/232) who did not register their horses with any breed society.

Respondents were provided with multiple options to describe the reasons for keeping Miniature horses: as pets (n=143), for showing (n=135), as a companion for other horses (n=81), for leisure driving (n=71), for breeding (n=64), for competitive driving (n=57), to be ridden by children (n=41), and as a therapy horse (n=25). Miniature horses were grouped into three categories i.e., leisure and companionship, competition, and breeding, according to owner's primary purpose of horse-keeping (Table 1). Some respondents who used Miniature horses primarily for competition (45%, n=37/82) or leisure and companionship (8%, n=11/130), were also involved in breeding Miniature horses.

A total of 1183 Miniature horses were kept by 218 respondents (Table 1). Over half of the Miniature horses were between 6-15 years of age (n=658, 56%), with the remainder evenly divided between the other age categories listed in Table 1. Few respondents (n=81/223, 36%) kept Miniature horses exclusively, with the majority (n=134/223, 60%) also kept horses of other breeds. The overall median number of Miniature horses kept per respondent was 3 (IQR 2-7).

#### Feeding and management practices

The overall median stocking density of Miniature horses was 10 (IQR 5-20) horses per hectare. The stocking density differed according to the horse's primary uses

(Table 1). The majority (n=919/1119, 82%) of Miniature horses were kept at pasture; few horses had no, or limited access to pasture (n=153/1119, 14%) (Table 2). In terms of percentages, Miniature horses used for breeding (71%) were more likely to be kept exclusively at pasture across seasons, compared with horses used for leisure (28%) and competition (37%) (Table 2). The majority (n=815/1036, 79%) of Miniature horses were kept on low (< 1000 kg DM/ha) to moderate (~ 2000 kg DM/ha) pasture masses across seasons (Table 3).

Pasture access was more commonly restricted during spring (n=125/208, 60% of respondents, n=625/1119 horses, 56%), summer (n=125/208, 60% of respondents, n=632/1119 horses, 56%), and autumn (n=115/208, 55% of respondents, n=567/1119 horses, 51%) compared to winter (n=89/208, 43% of respondents, n=403/1119 horses, 36%). Approximately half (n=105/208, 50%) of the respondents kept their Miniature horses (n=656/1119, 59%) exclusively at pasture during winter.

The majority (n=173/198, 87%) of respondents practiced pasture-restriction strategies such as strip grazing (n=118), the temporary use of a paddock with little grass (n=99), confinement for part of a day in a stable or yard (n=94), turning out horses to graze in the early morning only (n=42), or fitting a grazing muzzle (n=24). Another pasture restriction strategy cited by respondents (n=15) was provision of a track system (where fencing is placed around the centre of the paddock in order that the horse(s) walk on the outside of the fences during grazing). Strategies

**Table 2** Data from the survey on demographics and feeding management of Miniature horses in New Zealand: total number of Miniature horses managed with different types of pasture management strategies across seasons, subcategorised according to primary use of Miniature horses.

Pasture-management strategies	Total number of respondents (N) (Data from 208 respondents)	Primary use of Miniature horses			Total (Data from 1119 horses) Number of horses, n (%)
		Leisure and companionship (Data from 445 horses) Number of horses, n (%)	Competition (Data from 580 horses) Number of horses, n (%)	Breeding (Data from 94 horses) Number of horses, n (%)	
Always on pasture all seasons	59	124 (28%)	212 (37%)	67 (71%)	403 (36%)
Have variable access to pasture in spring, summer and autumn, but always on pasture in winter	45	86 (19%)	165 (28%)	0 (0)	251 (22%)
Mostly on pasture all seasons	37	92 (21%)	117 (20%)	22 (23%)	231 (21%)
Either mostly on pasture or mostly stabled/yarded all seasons	12	22 (5%)	12 (2%)	0 (0)	34 (3%)
Mostly stabled/yarded all seasons	33	51 (11%)	58 (10%)	5 (5%)	114 (10%)
Always stabled/yarded all seasons	8	37 (8%)	2 (0.3%)	0 (0)	39 (3%)
Other strategies	14	33 (7%)	14 (2%)	0 (0)	47 (4%)
<b>Total</b>	<b>208</b>	<b>445</b> (~100%)	<b>580</b> (~100%)	<b>94</b> (~100%)	<b>1119</b> (~100%)
Unknown strategies	24	-	-	-	64
<b>Grand total</b>	<b>232</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1183</b>

**Table 3** Data from the survey on demographics and feeding management of Miniature horses in New Zealand: seasonal pasture mass or seasonal pasture availability for three groups of Miniature horses.

Seasonal pasture mass or seasonal pasture availability				Total number of respondents (N)	Primary use of Miniature horses			
Spring	Summer	Autumn	Winter		Leisure and companionship	Competition	Breeding	Total
				(Data from 196 respondents)	(Data from 381 horses) Number of horses, n (%)	(Data from 555 horses) Number of horses, n (%)	(Data from 100 horses) Number of horses, n (%)	(Data from 1036 horses) Number of horses, n (%)
Low	Low	Low	Low	35	49 (13%)	65 (12%)	0 (0)	114 (11%)
Moderate	Moderate	Moderate	Moderate	20	20 (5%)	82 (15%)	18 (18%)	120 (12%)
Mostly low	Mostly low	Mostly low	Mostly low	35	101 (27%)	81 (15%)	13 (13%)	195 (19%)
Mostly moderate	Mostly moderate	Mostly moderate	Mostly moderate	22	55 (14%)	99 (18%)	16 (16%)	170 (16%)
Low or moderate	Low or moderate	Low or moderate	Low or moderate	19	70 (18%)	33 (6%)	5 (5%)	108 (10%)
Low or moderate	Low or moderate	Low or moderate	High	11	16 (4%)	44 (8%)	0 (0)	60 (6%)
High	Low or moderate	Low or moderate	Low or moderate	5	3 (0.8%)	8 (1%)	4 (4%)	15 (1%)
Low or moderate	Low or moderate	High	Low or moderate	3	2 (0.5%)	11 (2%)	0 (0)	13 (1%)
Low	No pasture (barren) or low	Moderate	Low or moderate	3	1 (0.3%)	19 (3%)	0 (0)	20 (2%)
Other pasture masses combination across seasons				19	19 (5%)	85 (15%)	4 (4%)	108 (10%)
Incomplete information on seasonal pasture masses, respondents kept their horses on pasture at certain seasons only (their horses were not kept on pasture all seasons)				24	45 (12%)	28 (5%)	40 (40%)	113 (11%)
Total				196	381 (~100%)	555 (~100%)	100 (~100%)	1036 (~100%)
Unknown pasture availability				36	-	-	-	147
Grand total				232	-	-	-	1183

used for pasture maintenance included picking up horse manure from pasture (n=138/198, 70%), rotational grazing (n=125/198, 63%) or mixed grazing (n=92/198, 46%), harrowing pasture (n=77/198, 39%) or topping or mowing pasture (n=57/198, 29%).

Respondents that stabled their horses used varying hours of confinement per day (1-6 hours, 7-12 hours, 13-18 hours and 19-24 hours), with the highest number of respondents stabling their Miniature horses for 7-12 hours/day (n=57/195, 29%) (Table 1).

In addition to pasture, most owners provided the horses with additional feed (n=194/232, 84%). Additional feedstuffs were hay (n=180), chaff (n=130), premixed concentrates (n=117), fermented forages (n=51), and other types of feed (n=33) such as oats, copra, soy, molasses, sugar beet pulp. Respondents (n=131) would offer up to six different types of supplements to their Miniature horses, however, respondents (n=38, 37) usually offered either one or two different types of supplements. The most common

categories of supplements reportedly fed were vitamin and mineral supplements (n=114) and hoof and coat supplements (n=55).

Most respondents did not objectively assess their horse's weight using either a weighbridge (n=198/213, 93%) or a weight tape (n=170/214, 79%). A few respondents (n=15/213, 7%) used the weighbridge at least once annually to monitor their Miniature horses' weight, and almost one-fifth of respondents (n=44/214, 21%) used a weight tape once or twice annually to monitor their Miniature horses' weight. Half (n=102/202, 50%) of the respondents indicated they observed body condition of their horses frequently but may not have used a formal quantification process.

## Discussion

The respondents to this survey were mostly women, which is in agreement with other studies that have shown they tend to be over-represented in both equestrian sport and breeding (Fernandes et al. 2014; Agar et al. 2016; Burbage

& Cameron 2018). Additionally, most respondents were semi-experienced, or experienced, horse owners who have also kept horses of other breeds. This was similar to the profile described in other surveys, where the majority of the survey respondents and their families had many years of experience working with horses in general (Fernandes et al. 2014; Agar et al. 2016). The highest number of responses was gathered from respondents residing in the upper North Island (Waikato and Auckland), in the Central-West of the North Island (Taranaki), and in Central-East of the South Island (Canterbury). The greater number of responses received from these regions reflected the estimates of the distribution and density of horses in New Zealand (Rosanowski et al. 2012; Bolwell et al. 2017).

The majority (97%) of Miniature horses were kept at pasture (Table 2), with owners generally utilising some form of confinement as a method to restrict pasture access. Pasture restriction is seen as necessary; pony breeds had been reported to consume between 2.6 to 4.9% of BW as DM/day (Ralston et al. 1979; Dugdale et al. 2011), which is greater than their nutritional requirements. Assuming a moderate pasture-energy content (10 MJ DE/Kg DM), a typical Miniature horse requiring only 20.2 MJ of digestible energy for maintenance could consume their ration requirement of ~2 kg DM of pasture (~1.8% of BW as DM/day) in as little as six hours of grazing (Dugdale et al. 2011).

From the survey results, respondents have incorporated a variety of ingredients as supplementary feeds into the diet of their Miniature horses. Data on quantities fed were not collected, and the assumption from the answers was that supplementary feeds were provided in a manner like that reported by Fernandes et al. (2014) where concentrates and premixes were provided at low levels to “balance the ration” or to provide additional energy. Approximately half the respondents provided mineral or vitamin supplements to their Miniature horses. This level was similar to a report for sport horses in New Zealand (Verhaar et al. 2014). Data on quantities of minerals supplements provided were not collected; nevertheless, care must be taken by horse owners to avoid excess mineral supplementation. An online survey on the mineral supplementation for horses reported that the calculated intake of minerals was higher than the intake recommended by the National Research Council (NRC) (Grimwood et al. 2016).

The median stocking density for Miniature horses from this study was ten (IQR 5-20) horses per hectare, with the assumption of a mature weight of 110 kg  $\pm$  21 kg (Catalano et al. 2019) equating to approximately 1100 kg LWT/ha. This value is similar to the typical stocking density of full-sized horses (~500 kg each): ~1000 kg LWT/ha or ~2 horses per hectare, ha (or 0.8 horses per acre) (Singer et al. 2001; Cohen et al. 2005; Rogers et al. 2007; Bengtsson et al. 2018). As the majority of horses were kept on pasture with low (< 1000 kg DM/ha) to moderate (~2000 kg DM/ha) pasture masses, pasture growth of 20 kg DM/ha/day would meet maintenance requirement for ten Miniature horses (2 kg DM/horse) kept on a hectare of land (Baars' et al. 1990).

A high proportion of respondents from this survey indicated that they have undertaken mixed grazing as a pasture-management practice. This is not surprising as Thoroughbred and Standardbred breeding farms in New Zealand commonly utilise mixed-grazing practice with cattle and/or sheep (Bolwell et al. 2015). Most likely, Miniature horses were mixed-grazed with small-sized ruminants and other livestock. Mixed grazing of horses with sheep or cattle has recently been reported to have benefits in controlling strongylosis in horses (Eysker et al. 1986; Forteau et al. 2019).

Although weight monitoring was regularly practiced, very few Miniature horse owners used weight scales to monitor their horses' body weight; body condition scoring and weight tape were used more frequently, similar to data reported by Murray et al. (2015). Instead, respondents preferred a non-structured, daily “visual appraisal” to gauge their Miniature horses' body condition or described estimating their Miniature horses' body weight by experience. Both methods lack the precision of the formal body condition scoring. However, even on commercial farms there is often limited use of formal body condition scoring or weighing to monitor growth and body weight. The lack of body weight monitoring may be a risk factor for obesity, over-conditioning or severe clinical diseases such as equine metabolic syndrome (EMS) and laminitis.

There are several limitations with online surveys, one of the main ones being the non-response bias and the social-desirable bias from this survey. Respondents were gathered using the snowball sampling technique, a reflection of the “convenience sampling” technique where samples are drawn from a pool that is close at hand. As the responses were mostly gathered from respondents actively involved in social media pages for Miniature horses, there is a small risk that the data gathered in this survey are skewed towards respondents who are cognizant of the suitable/appropriate management practices or strategies for their Miniature horses. However, this sampling methodology provided an efficient method of targeting the population of owners/keepers of Miniature horses in a timely and cost-effective manner.

Across the non-commercial equine sector there is limited documentation of feeding and management practises. This lack of information makes it difficult for regional councils to understand land management use and for Veterinarians and industry consultants to provide targeted advice on feeding and management practices. The information gathered from this survey provides a useful reference point for further investigations on the inter-relationship between feeding management practices and the body weight of Miniature horses in New Zealand.

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