Maximun permissible load for Yonaguni ponies (Japanese landrace horses) trotting over a short, straight course

A Matsuura*, H Mano, M Irimajiri and K Hodate

Department of Animal Science, School of Veterinary Medicine, Kitasato University, 23-35-1, Higashi, Towada, Aomori, 034-8628, Japan

* Contact for correspondence and requests for reprints: matsuura@vmas.kitasato-u.ac.jp

Abstract

This study aimed to determine the load-bearing capacity of trotting Yonaguni ponies using gait analysis. The Yonaguni pony is one of the Japanese landrace horses, and has normal gait characteristics when trotting. As a breed they are small in stature and hence susceptible to the effect of the rider’s weight. It is therefore important to determine their load-bearing capacity as regards to their welfare. Ten Yonaguni ponies with a (mean ± SD) height at withers of 122 ± (2.9) cm had a marker attached to their chests, and their unridden gait was recorded using two high-resolution hybrid cameras while they trotted along a short (40 m), straight course. In total, nine tests were performed for each horse: the first with a 0-kg load; seven with randomly loaded weights weighing 10–70 kg; and then a final test again with a 0-kg load. Three-dimensional movement of the marker was analysed using a motion capture system. The time series of vertical displacement of the marker underwent spectrum analysis, and the autocorrelation coefficient was calculated. The first two peaks of the autocorrelation were defined as symmetry and gait regularity, and their sum was defined as stability. Symmetry (no unit) in the 70-kg test (0.53) was lower than that in the first 0-kg test (0.68), and stability (no unit) in the 70-kg test (1.16) was lower than that in the first 0-kg test (1.41). We concluded that the maximum permissible load for a trotting Yonaguni pony is < 70 kg, which represents 33% of its bodyweight. To promote welfare, it is important to determine the load-bearing capacity for individual types of horse.

Keywords: animal welfare, gait analysis, horse, load, symmetry, weight

Introduction

The Yonaguni pony is native to Japan, inhabiting Yonaguni Island which is the country’s westernmost point (Okinawa Prefecture, Japan, latitude 24.3°N, longitude 122.6°E). In 2012, the population of these ponies stood at only 130 (Ministry of Agriculture, Forestry and Fisheries of Japan 2014), and they now face extinction. In order to safeguard their future, attempts must be made to promote their optimum use. Their calm temperament and small size (Matsuura et al 2008) creates the potential for Yonaguni ponies to contribute in animal-assisted education and animal-assisted activities. However, so small are the ponies that they are generally considered to be incapable of bearing a heavy rider. It is important, therefore, to properly gauge their load-bearing capacity based on behavioural changes that imply temporary restriction of the freedom to express normal behaviour, ie one of the Five Freedoms of animal welfare (FAWC 1993).

Load-bearing capacity of horses is estimated at 16–17% of bodyweight by the Riding for the Disabled Association of Japan (RDA Japan 2005) and 33–50% of bodyweight by Hadrill (2002). However, such values have little scientific basis, and only four studies of this nature exist. According to Powell et al (2008), heart and respiratory rates and rectal temperature were higher in horses carrying loads representing 25–30% of their bodyweight compared to those carrying 15–20%. Sloet van Oldruitenborgh-Oosterbaan et al (1995) demonstrated that a load representing 12.6–16.3% of bodyweight influenced heart rate and blood lactate concentration compared with no load at all. Work with gait analysis (Matsuura et al 2013a,b), established that the maximum permissible load carried by native Japanese horses at trot was < 100 kg, which was 29% of bodyweight, and that of Taishuh ponies was also < 100 kg, representing 43% of bodyweight.


Walking and trotting are both symmetrical gaits. Trotting, in particular, is a two-beat diagonal gait with a regular rhythm. Therefore, symmetry or regularity of the gait is relatively high under normal conditions. However, it has been suggested that the rhythm of a gait, such as symmetry and regularity, may be altered in response to the addition of a