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Original Research

Effects of Grazing Muzzles on Intakes of Dry Matter and Water-Soluble Carbohydrates by Ponies Grazing Spring, Summer, and Autumn Swards, as well as Autumn Swards of Different Heights

Annette C. Longland [a,*], Clare Barfoot [b], Patricia A. Harris [c]

[a] Equine and Livestock Nutrition Services, Pantfallen Fach, Tregaron, Ceredigion, Wales, UK
[b] MARS Horse Care UK Ltd, Old Wolverton, Buckinghamshire, UK
[c] WALTHAM Centre for Pet Nutrition, Waltham-on-the-Wolds, Leicestershire, UK

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ABSTRACT

Dry matter (DM) and water-soluble carbohydrate (WSC) intakes (DMI and WSCI, respectively) were determined in four mature ponies, grazing spring, summer, and autumn pastures on four, 3-hour occasions per pony per season when fitted with or without a grazing muzzle. Pasture intakes were determined by change in liveweight (LW) over the 3-hour grazing period, after accounting for insensible weight loss and weight of excreta. Daily pasture samples were analyzed for DM and WSC. The effect of sward height on herbage intake characteristics by muzzled or unmuzzled ponies allowed 10 single bites of short (ca. 7 to 10 cm), medium (ca. 20 cm), and long (ca. 40 cm) swards was also investigated. Grazing muzzles significantly ($P < .01$) reduced pasture DMI by 77, 77, and 83% for spring, summer, and autumn pastures, respectively. During at least one 3 hour grazing session across the seasons, the DMI of each pony when not muzzled exceeded 1% of LW. Water-soluble carbohydrate intakes (g WSCI/100 kg LW/3 hours) were significantly lower ($P < .05$) across seasons when ponies were muzzled versus unmuzzled. When unmuzzled, ponies' WSCI from summer swards were significantly ($P < .05$) lower than from autumn swards. Seasonal differences in WSCI by muzzled ponies were not significant. When unmuzzled ponies grazed swards of different heights, the first bite generally reduced sward length by approximately half. However, when muzzled, first bites of swards resulted in highly variable reductions in sward length. Ponies appeared to experience greater difficulty in accessing the longer versus the shorter swards via their grazing muzzles.

1. Introduction

In temperate regions such as the UK and Northern Europe, pasture grasses can contain significant amounts of water-soluble carbohydrates (WSCs). For example, perennial ryegrass varieties were reported to contain in excess of >250-g WSC/kg dry matter (DM) [1]. Excessive consumption of WSC fractions has been associated with the development of several equine disorders including obesity, insulin resistance (IR) [2], laminitis [3], and equine polysaccharide storage myopathy [4,5].

Obesity per se has been associated with an increased risk of developing IR [6], laminitis [7], and osteoarthritis [8]. Obesity prevalence in UK leisure equines that were pastured for at least 6 hours per day was found to be 27% in winter and 35.4% in summer, with access to grass being a major risk factor for the development of obesity [9]. It is of relevance that ponies with only 3-hour pasture access

* Corresponding author at: Annette C. Longland, Equine and Livestock Nutrition Services, Pantfallen Fach, Tregaron, Ceredigion SY256NG, UK.
E-mail address: elns.longland@btinternet.com (A.C. Longland).

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per day in the summer nearly doubled their dry matter intakes (DMIs) of grass from 0.49% to 0.91% of bodyweight (BW)/3-hour period over a 6-week trial [10]. Furthermore, it has been estimated that the daily DMI of equines living permanently at pasture may be as high as 5% of their BW [11,12], a level of some 2 to 2.5 fold, the typically reported average daily DMI of 2% to 2.5% of BW per day [13].

The WSC in grasses largely comprise simple sugars, (glucose, fructose, and sucrose) and fructans (poly- and oligo-sucrosyl fructose), and overconsumption of these may lead to laminitis, particularly in obese ponies [14]. Excessive intakes of some of the individual components of WSC (as opposed to the entire WSC fraction) have been also demonstrated to have detrimental effects on equid metabolism. Thus, fructose has been shown to reduce insulin sensitivity in IR mares [15], and inulin-type fructans have induced laminitis in equids [3]. Polysaccharide storage myopathy is associated with abnormal muscle glycogen accumulation [16], a condition thought to be exacerbated by consumption of diets high in WSC [17,18].

For obese animals and those at increased risk of the mentioned conditions, restricting the intake of WSC is typically recommended [19,20] and this can be achieved through the feeding of low WSC feeds and forages to stabled animals. However, for those animals where full-time stabling is not an option, alternatives are required and traditionally include the use of strip grazing and turning out on small, bare paddocks. However, an increasingly commonly used alternative is to limit overall pasture DMI, through the use of a partial “grazing muzzle.” Grazing muzzles allow small amounts of plant material to penetrate the base of the muzzle where it is bitten off and ingested by the animal. Grazing muzzles reduce bite size and intake [21], and may be preferred by owners over other means of pasture intake restriction, as they allow the animal to graze for longer periods over larger areas when compared with animals that are pastured for very short periods of time or are confined to small, bare paddocks that provide little opportunity for grazing or significant exercise. It is a generally held tenet that ponies wearing grazing muzzles spend more time involved in eating-directed behaviors than when not muzzled, yet muzzled ponies either lose weight or retain an established, appropriate body condition. However, there is limited information on (1) the extent of pasture intake restriction imposed by grazing muzzles, (2) whether the degree of restriction changes throughout the seasons, and (3) if sward length influences the degree of intake in muzzled ponies. The aim of this study was, therefore, to quantify the effects of wearing a grazing muzzle on herbage DMI and WSCI by ponies during spring, summer, and autumn and determine the relative effects of autumn sward height on ingestion of pasture by muzzled and unmuzzled ponies.

2. Materials and Methods

2.1. Animals

Four mature Welsh cross ponies, (mean age, 11.25 ± 5.4 years; mean liveweight (LW), 363 ± 129 kg) were used. Ponies were treated with an anthelmintic (Equest, or Equest Promax) and re-shod before the start of each trial period. A dental examination and any required treatment were also performed before the start of the study and before each trial period. On alternate days, ponies received light, ridden exercise mainly at walk (10 minutes) and trot (18 to 20 minutes ca. 12 km/hr) with an occasional canter (1 to 2 min ca.18 km/hr) for a total of 30 minutes. On the days when they were not ridden, ponies were allowed free exercise as a social group for 30 minutes in a sand and rubber surfaced outdoor arena (20 × 40 m).

2.2. Housing

When not being ridden or allowed access to pasture or the sand and rubber arena, ponies were housed in block and timber stables (3.6 × 4.3 m), with lightweight, rubber matting (23-mm EVA mats) covering the concrete flooring. The mats were covered with sufficient Agrisorb sawdust to soak up the urine. Stables were completely cleared of all excreta and sawdust twice daily and replenished with clean sawdust. Twice per week, the rubber mats were lifted and the mats and concrete floors were washed with a dilute solution of sodium hypochlorite.

2.3. Feeding

When stabled, ponies were offered meadow hay at 1.5% of LW as DM per day, with one third of the hay allocation being offered in the morning (8 AM) and two thirds in the evening (6 PM). Ponies were also given a vitamin and mineral feed balancer (SPILLERS Lite Balancer) fed at the manufacturer’s recommended levels of 100 g/100 kg bodyweight per day at 8 AM. When stabled, ponies had *ad libitum* access to water and salt.

2.4. Pony Equipment

A grazing muzzle (Shires Equestrian) was fitted to each pony. To prevent ponies removing the muzzles during the 3-hour grazing period, head collars were placed over the muzzles to help keep the muzzles in place, without interfering with muzzle use. The solid rubber base of the muzzles featured a 2-cm diameter aperture through which ponies could access limited amounts of pasture. Any increase in muzzle aperture size due to ponies foraging behavior was countered by fitting a new muzzle. Each pony was fitted with an equine diaper (Equisan Marketing Pty Ltd, Australia) for collection of total excreta during grazing and insensible weight loss (ISWL) measurement periods. Ponies were adapted to wearing the muzzles and diapers at pasture in the 21, 14, and 7 days immediately preceding the first, second, and third measurement periods, respectively.

2.5. Pasture Paddocks

Individual pasture paddocks were prepared for each of the ponies (four paddocks per pony, per season) by means of electric fencing. The pasture was an established meadow (>25-year-old) and contained mixed grass species including *Lolium, Agrostis*, and *Festuca* sp. and a small amount of white