Influence of Internal and External Weight on Conformation and Movement of Mature Horses

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Study 1: Effects of Late Gestation on Conformation and Movement in Mares

Abstract

Mares typically gain approximately 13% of their body weight during pregnancy, with the majority of the weight gain occurring during the last 3 months of gestation. The objective of this study was to evaluate the effects of weight gain during late gestation on conformation and movement in mares. Five Quarter Horse mares were videotaped at the walk and trot tracking both directions on a flat surface on days 270, 285, 300, 315 and 330 of gestation, within 12 hours of foaling, and on days 15 and 30 post-partum. Each horse was also photographed from the left and right lateral view along with a plantar view of the left front and rear hoof. Videos and photographs were analyzed using OnTrack Equine software for hoof width, shoulder and hip angle, maximum knee and hock angle at the walk and trot, and stride length at the walk and trot. Body weight increased with gestation length and decreased significantly after the birth of the foal and passage of the placenta (P < 0.05). There were no differences in hip or shoulder angle due to increased body weight. As gestation length increased, both the front and rear hoof width decreased. The maximum knee angle recorded at the walk and trot decreased on day 330 of gestation but increased shortly after foaling. The maximum hock angle recorded at the walk and trot also decreased on day 330 of gestation; however, increases in this measurement were not observed until 15 days post-partum. Stride length at the walk decreased at day 330 of gestation but increased shortly after foaling. There were no differences in stride length at the trot. Overall, the results of this study indicate that increased body weight due to pregnancy influences hoof shape and movement during late gestation in mares.
Introduction

Mares typically gain approximately 13% of their body weight during pregnancy, with the majority of the weight gain occurring during the last 3 months of gestation (Frape, 2004). This extra weight may have some effect on how the mare travels during gestation. While in motion, a horse carries the majority of weight on its forelimbs, which is indicated to be the primary support for a horse’s trunk (Licka et al., 2001). As weight is added to horse’s back, their natural movement can be affected (Licka et al., 2001; Benton, 2006). However, there have been no published reports on the effect of increased weight gain during pregnancy on the conformation or movement of mares. This area of research may be useful in the welfare of the mares in gestation. Therefore, the objective of this study was to evaluate the effects of weight gain during late gestation on conformation and movement in mares.

Hypothesis

Conformation and movement will be affected as body weight increases with length of gestation in mature Quarter Horse mares.

Materials and Methods

Five Quarter Horse mares were videotaped at the walk and trot, tracking both directions on a flat surface on 270, 285, 300, 315 and 330 d of gestation, within 12 hr of foaling, and on 15 and 30 d post-partum. The camera was positioned at a height of 3.0 m and 8.6 m away from and perpendicular to the line of travel. Each mare was also photographed from the left and right lateral view along with a plantar view of the left front and rear hoof. The mares’ hooves were trimmed every 30 d to maintain hoof angle and toe length. Videos and photographs were
analyzed using OnTrack Equine software for hoof width, shoulder and hip angle, maximum knee and hock angle at the walk and trot, and stride length at the walk and trot.

Results

Body weight increased with gestation length and decreased significantly after the birth of the foal and passage of the placenta (P < 0.05; Figure 1). There were no differences in hip or shoulder angle due to increased body weight (Figures 2 and 3 respectively). As gestation length increased, both the front and rear hoof width decreased (Figure 4). The maximum knee angle recorded at the walk and trot decreased on day 330 of gestation but increased shortly after foaling (Figures 5 and 6 respectively). The maximum hock angle recorded at the walk and trot also decreased on day 330 of gestation; however, increases in this measurement were not observed until 15 days post-partum (Figures 7 and 8 respectively). Stride length at the walk decreased at day 330 of gestation but increased shortly after foaling (Figure 9). There were no differences in stride length at the trot (Figure 10).
Figure 1. Average weight of mares from day 270 of gestation until 30 days post-partum.

Figure 2. Average hip angle of mares from day 270 of gestation until 30 days post-partum.
Figure 3. Average shoulder angle of mares from day 270 of gestation until 30 days post-partum.

Figure 4. Average hoof width of mares from day 270 of gestation until 30 days post-partum.
Figure 5. Average knee angle at the walk of mares from day 270 of gestation until 30 days post-partum.

Figure 6. Average knee angle at the trot of mares from day 270 of gestation until 30 days post-partum.
Figure 7. Average hock angle at the walk of mares from day 270 of gestation until 30 days post-partum.

Figure 8. Average hock angle at the trot of mares from day 270 of gestation until 30 days post-partum.
Figure 9. Average stride length at the walk of mares from day 270 of gestation until 30 days post-partum.

Figure 10. Average stride length at the trot of mares from day 270 of gestation until 30 days post-partum.
Discussion

It was hypothesized that the increased weight of the foal may cause the mares’ hoof width to increase during gestation. However, hoof width tended to decrease with increased length of gestation. The trend of decreased hoof width may be attributed to environmental conditions as the mares were housed outside in often muddy conditions. The trend of decreased hoof width may also be attributed to the lack of movement of the mares as gestation progressed; however, the lack of movement was observational and not measured. In a study done by Arabian et al. (2001), the center of mass and solar width on a horse’s hoof were shown to be related. There were only five mares used in the first study. If more mares were measured, then there may be less variation in the data.

Study 2: Influence of Weight Distribution on Movement in Mature Riding Horses

Abstract

Horses often carry riders with different skill levels who may distribute their weight differently. The objective of this study was to determine the effects of weight distribution on the movement of mature riding horses at the walk and trot. Fifteen mature riding horses of various breeds were fitted with a surcingle and increasing amounts of weight (13.6 kg, evenly distributed; 27.2 kg, evenly distributed; and 27.2 kg, unevenly distributed). Each horse was videotaped in hand at the walk and trot tracking both directions on a flat surface every 15 days for a period of 15 weeks. The camera was positioned at a height of 3.0 m and 8.6 m away from and perpendicular to the line of travel. Videos were analyzed using OnTrack Equine software for stride length, maximum knee angle and maximum hock angle at the walk and trot. The average stride length at the walk
and trot for horses fitted with the surcingle only was 2.19 m and 2.21 m, respectively. There were no differences in average stride length at the walk for horses carrying 13.6 kg or 27.2 kg evenly distributed across their back compared to horses carrying no additional weight. However, a shorter stride length at the walk was observed for horses carrying 27.2 kg unevenly distributed across their back (P < 0.05). At the trot, average stride length and hock angle decreased in response to increasing amounts of additional weight and uneven distribution of that weight (P < 0.05). Average knee angle at the trot decreased in response to uneven weight distribution but not due to increasing amounts of weight. Overall, the results of this study indicate that additional weight placed on a horse’s back and the distribution of that weight can influence the movement of the horse at both the walk and trot.

Introduction

Horses often carry riders with different skill levels. With horses carrying the majority of their weight on their front legs, the leg motion of a horse changes as weight is added to the horse’s back (Benton, 2006). The added weight to a horse’s back can cause a change in the horse’s natural movement (Licka et al., 2001). In a study performed by Peham and Schobesberger in 2004, approximately 2/3 of the pressure of a rider showed an increase in lateral stiffness in the horse’s movement. The objective of this study was to determine the effects of external weight distribution on the movement of mature riding horses at the walk and trot

Hypothesis

The horse’s movement at the walk and the trot will be affected as the weight it carries is increased.
Materials and Methods

Fifteen mature riding horses of various breeds were fitted with a surcingle and increasing amounts of weight (13.6 kg, evenly distributed; 27.2 kg, evenly distributed; and 27.2 kg, unevenly distributed). Each horse was videotaped in hand at the walk and trot tracking both directions on a flat surface every 15 days for a period of 15 weeks. The horses’ hooves were trimmed every 45 days in order to maintain hoof angle and toe length. The video camera was positioned at a height of 3.0 m and 8.6 m away from and perpendicular to the line of travel. The videos taken were analyzed using OnTrack Equine software for stride length, maximum knee angle and maximum hock angle at the walk and trot. Statistics were analyzed using the PROC MIXED procedure of SAS.

Results

The average stride length at the walk and trot for horses fitted with the surcingle only was 2.19 m and 2.21 m, respectively. There were no differences in average stride length at the walk for horses carrying 13.6 kg or 27.2 kg evenly distributed across their back compared to horses carrying no additional weight. However, a shorter stride length at the walk was observed for horses carrying 27.2 kg unevenly distributed across their back (P < 0.05) (Figure 11). At the trot, average stride length and hock angle decreased in response to increasing amounts of additional weight and uneven distribution of that weight (P < 0.05) (Figures 12 and 13, respectively). Average knee angle at the trot decreased in response to uneven weight distribution but not due to increasing amounts of weight (Figure 14).
Figure 11. Average stride length at the walk (P < 0.0001).

Figure 12. Average stride length at the trot (P < 0.0001).
Figure 13. Average hock angle at the trot with varying amounts of weight added to the horse’s back (P < 0.05).

Figure 14. Average knee angle at the trot with varying amounts of weight added to the horse’s back (P < 0.05).
Discussion

In this study, additional weight placed on a horse’s back and the distribution of that weight was shown to influence the movement of the horse at both the walk and trot. These findings are supported by previous research in which external weight carried on a horse’s back affected the basic gaits of the horse, including the walk and the trot (Rivero, 2007). In another study, swing phase was shown to decrease with increased weight (Benton, 2006). Knee angle changes tend to be more significant at the trot than at the walk (Kirbow and Duberstein, 2011); therefore, this could correlate to the findings of decreased knee angle as weight is added.

References


