



Research

Physiological and behavioral patterns of normal-term thoroughbred foals

Pietro Medica^{a,*}, Cristina Cravana^a, Giuseppe Bruschetta^b, Adriana Ferlazzo^a, Esterina Fazio^a^aUnit of Veterinary Physiology, Department of Veterinary Sciences, Messina University, Polo Universitario dell'Annunziata, Messina, Italy^bUnit of Veterinary Biochemistry, Department of Veterinary Sciences, Messina University, Polo Universitario dell'Annunziata, Messina, Italy

ARTICLE INFO

Article history:

Received 26 May 2017

Received in revised form

21 March 2018

Accepted 19 April 2018

Available online 26 April 2018

Keywords:

ACTH

cortisol

glucose

newborn foal

APGAR score

ABSTRACT

Foaling is a crucial period in mares' life and their newborns, resulting in a number of physiological and behavioral challenges, which may have predictable effects on foal's welfare and well-being. The aim of this study was to assess the patterns of circulating adrenocorticotropic hormone (ACTH), cortisol, and glucose concentrations in newborn foals born by full-term delivery, by taking into account the potential correlations with Appearance, Pulse, Grimace, Activity, Respiration (APGAR) scores. Newborn respiratory rate, rectal temperature, birth weight, time to stand up, time to suck, and allantochorion weight were also considered. Eight thoroughbred foals, 5 colts and 3 fillies, were assessed 20 minutes (T0) and 30 days (T1) after birth. One-way analysis of variance showed a significant effect of time on ACTH ($P = 0.0024$) and cortisol ($P = 0.003$) concentrations, with the highest concentrations at T0. Significant positive correlations between ACTH and cortisol values at T0 ($r = 0.67$; $P < 0.05$) and T1 ($r = 0.67$; $P < 0.05$), and between cortisol and glucose at T0 ($r = 0.55$; $P < 0.05$), were observed. A positive and significant correlation between APGAR class and pregnancy length ($r = 0.42$; $P < 0.05$) was also recorded. All the functional parameters considered and foals' APGAR scores were within the physiological range. Our results indicate that the comparison between hormonal and metabolic data could be of major interest if correlated with APGAR score and functional parameters.

© 2018 Elsevier Inc. All rights reserved.

Introduction

Full-term delivery represents an emotional novelty and the continuation of a physical and nutritional bond between the mare and her foal; it is also the beginning of a long and substantial relationship between them. A number of studies suggest that the routine postpartum management of both mare and newborn, including early handling of foals to promote their familiarization with human contact, plays a significant role in determining the neurobehavioral development of foals (Lansade et al., 2004; Simpson, 2002). During the first stage of postnatal period, the foal copes with a number of social interactions, parental care, and new stressful stimuli. The

traditional highest adrenocorticotropic hormone (ACTH) concentrations in the foal during the perinatal period were assessed, with the consistent negative relationship between circulating ACTH values and time of delivery (Silver and Fowden, 1994). Full-term foals showed high cortisol concentrations already before delivery (Silver et al., 1991) and during the first 2 hours after birth (Silver et al., 1984). According to the physiological function of fetomaternal contact, an interaction between placental efficiency and foal's birth weight was described in thoroughbred mares (Wilsher and Allen, 2003). Likewise, the potential association between placental features and Appearance, Pulse, Grimace, Activity, Respiration (APGAR) scores after normal parturition in thoroughbred horses was assessed (Veronesi et al., 2005). The results showed a positive high correlation between length of gestation and foals' birth weight, and between APGAR score and length of pregnancy (Veronesi et al., 2005). During the postnatal period, growing foals show different values of hormonal, hematological, biochemical and functional parameters, according to their age, sex, and breed (Fazio et al., 2007, 2009). Studies carried out in human newborns report an association between the

* Address for reprint requests and correspondence: Pietro Medica, DVM, PhD, Assistant Professor, Unit of Veterinary Physiology, Department of Veterinary Sciences, Messina University, Polo Universitario dell'Annunziata, Messina 98168, Italy. Tel: +39-090-3503586; Fax: +39-090-3503575.

E-mail address: pmedica@unime.it (P. Medica).

APGAR test and the degree of peripartum hypoxia, so a modified APGAR score system was proposed to assess the health state of foals (Vaala, 1997). The modulatory effect of adrenocortical activity on the adaptive and dynamic responses in perinatal and postnatal periods is of interest, and comparative data could be of major interest if correlated with APGAR score and functional parameters.

The hypothesis was that the physiological effects of neuroendocrine, functional, and behavioral responses of newborn foals postnatally could provide complementary physiological information for the assessment of their growth, health, and well-being outcome.

The main aim of the present study was to compare the patterns of circulating ACTH, cortisol, and glucose concentrations in newborn thoroughbred foals born by full-term delivery with their APGAR scores. Newborn respiratory rate, rectal temperature (RT), birth weight, time to stand up, time to suck, and allantochorion weight were also considered.

Materials and methods

Animals

Eight thoroughbred foals born in April, 5 colts and 3 fillies, were assessed 20 minutes (T0) and 30 days (T1) after birth. The dams had an average pregnancy length of 341.22 ± 12.11 days and were observed at parturition. All of the foalings were considered non-remarkable for normal full-term delivery, without clinical assistance. The foaling data were normalized with respect to the medical history of pregnancy length and confirmed by the time of parturition that occurred for all 8 foals from 7th April to 19th April. All the foals were in anterior dorsal presentation, allantochorionic rupture was spontaneous, the second labor stage lasted a maximum of 20 minutes, and the placenta was consequently expelled within 2 hours. Each foal was evaluated using a modified APGAR score system (Vaala, 1997) within 20 minutes from birth; according to the APGAR test, all the foals only showed a minimal respiratory distress and were classified as APGAR class I.

Blood collection

All blood samples for ACTH, cortisol, and glucose analysis were taken from the jugular vein using vacutainer tubes (Venject, Terumo Europe N.V., Leuven, Belgium). Blood samples were taken at 20 minutes after the birth (T0) and 30 days later (T1).

ACTH, cortisol, and glucose analyses

Immediately after withdrawal, blood samples were refrigerated at 4°C and were subsequently (within 1 hour) centrifuged for 15 minutes at $1,500 \times g$. Serum was harvested and stored in polystyrene tubes at -20°C and assayed for ACTH and cortisol.

Serum ACTH concentrations were analyzed in duplicate using a commercially available radioimmunoassay kit (ELSA-ACTH, CIS-Bio International, Gif-sur-Yvette, France) suitable for equine use (Ferlazzo et al., 1998). The justification for use of ACTH RIA, designed for humans, was based on publications that describe equine ACTH as very similar to human ACTH (Livesey et al., 1991), as human and horse ACTH peptides have the same amino acid composition and biological activity (Ng et al., 1981). The hormone assay used has a range for the amount of ACTH detected of 0–440 pmol/L. The sensitivity of the assay ACTH was 0.44 pmol/L. The intra-assay and inter-assay coefficients of variation were 6.0% and 15.0%, respectively.

Total serum cortisol concentrations were analyzed in duplicate using a competitive enzyme-linked immunoassay (RADIM, Rome, Italy) by a commercial test kit and a BRIO automated analyzer (SEAC, Rome, Italy). During the first incubation, the cortisol sample

competed with cortisol conjugated to horseradish peroxidase for the specific sites of the antiserum coated on the wells. Following incubation, all unbound material was removed by aspiration and washing. The enzyme activity bound to the solid phase was inversely proportional to cortisol concentration in standards and samples and was detected by incubating the wells with a chromogen solution (tetramethylbenzidine) in substrate buffer. Colorimetric reading was carried out using a spectrophotometer at 450 and 405 nm wavelengths (Sirio S, SEAC, Florence, Italy). Assay sensitivity was 13.80 nmol/L. The intra-assay and interassay coefficients of variation were 4.0% and 6.9%, respectively.

Serum glucose levels were measured calorimetrically (glucose oxidase/peroxidase) by a spectrophotometer at 530-nm wavelength (Sirio S, SEAC, Florence, Italy).

Functional measurements

Respiration rates (RRs, breaths/minute) were obtained before the measurement of the RTs by counting the flank movements for a 30-second interval while the foals were in a resting state. RT ($^\circ\text{C}$) was taken using a digital electronic thermometer (model HI92704, Hanna Instruments) that emitted an acoustic signal when the temperature remained stable for >15 seconds. Foals were weighed, using an equine weight scale, following blood sampling.

Statistics

Data are presented as mean \pm standard deviation. Statistical analysis was done by one-way repeated measures analysis of variance (ANOVA) to evaluate timing effect on hormonal, metabolic, and functional changes at different time points. The a priori level of significance was set at $P < 0.05$. All calculations were performed using the PRISM package (GraphPad Software Inc., San Diego, CA). Correlations among endocrine, metabolic, and functional parameters were evaluated by linear regression (r) calculated by using Pearson's method analysis.

Results

Serum ACTH concentrations averaged from 6.71 ± 0.88 pmol/L at T0 to 4.35 ± 1.07 pmol/L at T1, respectively (Figure 1), with the lowest values at T1 ($P < 0.05$). One-way ANOVA showed a significant timing effect on ACTH changes at T0 ($P = 0.0024$).

Serum cortisol concentrations averaged from $129.49.74 \pm 42.72$ nmol/L at T0 to 64.33 ± 10.36 nmol/L at T1, respectively (Figure 2), with the lowest values at T1 ($P < 0.05$). One-way ANOVA showed a significant timing effect on cortisol changes at T0 ($P = 0.003$). Significant positive correlations between ACTH and cortisol values at T0 ($r = 0.67$; $P < 0.05$) and at T1 ($r = 0.67$; $P < 0.05$) were observed.

Serum glucose concentrations averaged from 90.50 ± 22.72 mg/dL at T0 to 69.22 ± 9.16 mg/dL at T1, respectively (Figure 3), with the lowest values at T1 ($P < 0.05$). One-way ANOVA showed a significant timing effect on glucose changes at T0 ($P = 0.006$). A significant positive correlation between cortisol and glucose values at T0 ($r = 0.55$; $P < 0.05$) was observed.

Physical/physiological parameters and behavioral patterns were reported in Table 1. Newborn RRs averaged from 15.85 ± 1.22 breaths/minute at T0 to 22.38 ± 2.56 breaths/minute at T1, respectively, with the highest values at T1 ($P < 0.05$). RT averaged from $37.5 \pm 1.00^\circ\text{C}$ at T0 to 38.2 ± 0.5 at T1, respectively, with the highest values at T1 ($P < 0.05$). Body weight averaged from 35.8 ± 4.22 kg at T0 to 92.33 ± 8.53 kg at T1, respectively, with the highest values at T1 ($P < 0.01$).

The time to stand up averaged from 120 to 150 minutes at T0. The time to suck averaged from 120 to 190 minutes at T0. The

Download English Version:

<https://daneshyari.com/en/article/8484015>

Download Persian Version:

<https://daneshyari.com/article/8484015>

[Daneshyari.com](https://daneshyari.com)