IDENTIFYING TYPES OF DEHYDRATION IN POLO HORSES AT KELANTAN POLO CLUB

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Abstract: Dehydration is a concern in horses for its implication to the performance and well-being, therefore identifying the precise indicator would enable prompt and effective treatment. This study examined the changes in clinical evidence, and blood parameters of seven polo horses to determine the type of dehydration the horses suffer after a polo game. This study evaluated the clinical manifestation, packed cell volume, total protein in the serum, blood urea nitrogen, and osmolality at pre-exercise, immediately after a 4-chukkas and 12 hours after the exercise. Even though the parameters changed over the three samplings interval, there were no statistical changes, and all were within the normal values. The result shows the horses suffer from the isotonic dehydration after the game, in which evidenced by the parallel decrease of blood osmolar, BUN, and TP, and increased in PCV. The skin tenting indicates the percentage of dehydration was at 4% to 8% right after the game, however, the water and electrolytes derangement then went back to the normal level after 12 hours of rest feed and water consumption.

Keywords: Dehydration, polo event, clinical manifestation, pack cell volume, total protein, osmolality

1. INTRODUCTION

Dehydration is a condition when there is an inadequate amount of fluid in the body up to 4% to 6% lost through various reasons including exercise; with or without the presence of electrolytes imbalance [1]. Dehydration is a physiological disorder of water loss and electrolyte imbalanced, and can be classified according to the water-electrolyte ratio as in hypotonic, isotonic or hypertonic [2]. The importance of hydration to performing horses is to maintain the cellular mechanism, thermoregulatory, and cardiovascular function other than adenosine triphosphate production in the tricarboxylic acid cycle [3], [4], [5]. Untreated, prolonged dehydration and electrolyte disorder will result in multiple systemic problems including atrial fibrillation in arrhythmia; synchronise diaphragmatic flutter, and hypovolemic, in which, the later then reduced hemodynamic in the circulatory system that leads to renal failure.

1.1 Clinical Evidence of Dehydration

Assessment of dehydration in horses is commonly by physical examination, including observation of skin dryness, skin elasticity, and degree of a sunken eye. The values of blood parameters can estimate dehydration by analysing the packed cell volume (PCV), total serum protein (TP), blood urea nitrogen (BUN), and osmolality. By observation, horses have a certain degree of dehydration but show no urge or desire to drink water to replenish the fluid loss is called anadipsia. The phenomena of anadipsia are believed to be due to prolonged dehydration, and low-level electrolyte [6].

1.2 Climate Influence On Dehydration

In Malaysia, the temperature during daytime is above 30°C year-round, and during the night, it rarely drops below 20°C [7]. The humidity level in Kota Bharu was recorded at 89% ± 3% throughout the year. For athletic or working horses, high temperature and humidity will affect the perspiration rate hence dehydration status. Most horses tend to produce a significant amount of sweat during exercise, yet refused water intake consequently lead to severe dehydration, hypovolemia and electrolyte imbalance [8]. This study identified the type of dehydration and clinical manifestation of the polo horses after a vigorous 30 minutes polo game in a high humidity tropical region.

1.3 Types of Dehydration

There are three types of water and electrolyte imbalance based on the measurement of the electrolyte and osmolality [2]. The first type of dehydration is hypertonic dehydration that also called true dehydration desiccation when the osmolality of the blood is higher than 300 mOsm/kg (300 mmol/kg). The second type is hypotonic dehydration, also known as acute desalting water loss where the osmolality of the blood is less than 260mOsm/kg (260mmol/kg) occurs when there is a loss of water and sodium. The third type is isotonic dehydration where there is a parallel loss of electrolytes and water, and it is generally observed in those with the rapid loss of fluid such as excessive sweating, watery diarrhoea other than critically ill horses [9].

2. MATERIALS AND METHODS

2.1 Animal Selections

Data were taken from seven polo horses in this study. The breeds of the horses enrolled in the study were Argentine Polo pony and Local Cross Polo Pony at the age range between 10 to 16 years old of mixed gender. All horses played for four chukkas at the total duration of 30 minutes. During the game, the horses were in the motion of cantered for 70% and galloped for 30% of the 30 minutes game played. Data collections were at pre-exercise, post-exercise and 12 hours post-treatment.

2.2 Data Collection

The pre-exercise data were recorded at 7 am, 10 hours before the polo game. Post-exercise data were collected immediately after the horses completed four chukkas before water was offered. The post-treatment data were collected 12 hours after the match when the horses already treated with water and feed. The clinical evaluation recorded was the heart rate, respiratory rate, degree of the eyeball recession, and skin tenting. Blood samples were taken for the analysis of PCV and TP. The BUN, Na, K, and Glucose were analysed to calculate the blood osmolality. The clinical pathology laboratory of Universiti Putra Malaysia assessed the blood parameters.

2.3 Data Analysis

The plasma osmolality was calculated by summation of all individual solutes using the equation below to predict crude plasma osmolality [10].

Osmolality mOsm/kg = [1.86 x (sodium + potassium)] + glucose + urea nitrogen + 9]

3. Results

3.1 Pack Cell Volume

Haematocrit or packed cell volume was at 0.35 litres/litre during pre-exercise and spiked to 0.42 litres/litre immediately after exercise then later declined to 0.33 litres/litre after 12 hours resting and regaining of feed and water, see Fig. 3.1 (a). All the values are within the normal range.

3.2 Serum Total Protein

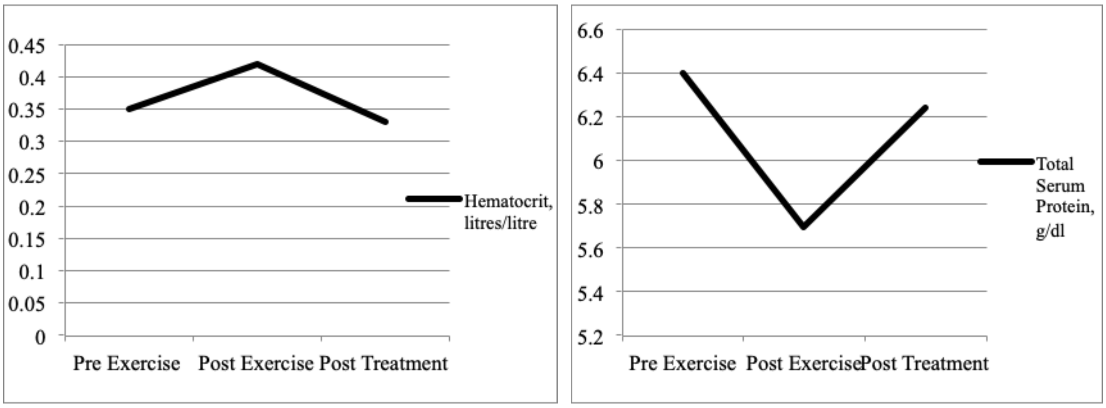
Serum total protein was at the value of 6.40 mmol/L during pre-exercise and dropped to 5.96 mmol/L immediately after exercise and later increased to 6.24 mmol/L after resting and regaining of feed and water, see Fig. 3.1 (2). The serum total protein values are within the normal range.

3.3 Blood Urea Nitrogen

The serum blood urea nitrogen concentration was at 3.72 mmol/L during pre-exercise but raised to 4.15 mmol/L, immediately after exercise then it keeps inclined to 5.26 mmol/L 12 hours later after resting, feed and water consumed, see Fig. 3.2(a). All the values are within the normal range for the serum's blood urea nitrogen concentration.

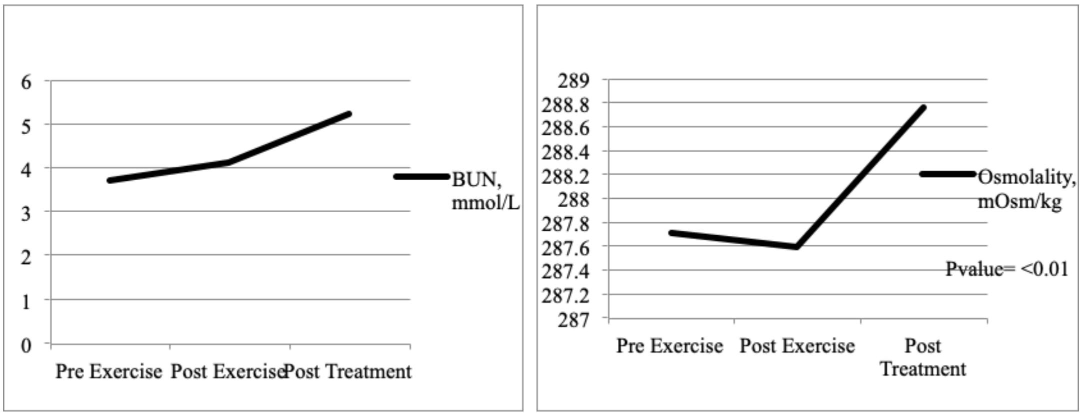
3.4 Osmolality And Serum Chemistry

Serum sodium (Na) concentration was at 135.43 mmol/L during pre-exercise, later raised to 140.29 mmol/L, immediately after exercise. The sodium concentration maintained at 140.29 mmol/L, after 12 hours of resting and regaining of feed and water. Serum potassium concentration value was higher at 3.83 mmol/L during pre-exercise but fall to 3.77 mmol/L, immediately after exercise then the level decreased slightly to 3.67 mmol/L 12 hours later after resting, feed and water. The osmolality value was at a lower volume of 287.71 mOsm/kg during pre-exercise and reduced further to 278.59 mOsm, immediately after exercise. The osmolality increased to 288.76 mOsm/kg, after resting and regaining of feed and water, see Fig. 3.2 (b). All the values are within the normal clinical range.



(a) (b)

Fig. 3.1. Graph (a) the packed cell volume in haematocrit value and (b) the serum total protein of pre-exercise, post-exercise and 12 hours post-treatment.



(a) (b)

Fig. 3.2. Graph (a) the blood urea nitrogen and (b) the blood osmolality of pre-exercise, post-exercise, and 12 hours post-treatment.

3.5 Clinical Evaluation

The clinical physical examination shows the heart rate, respiratory rate, capillary refill time, degree of sunken eye and skin tenting increased in value at the post-exercise compared with the samples taken at pre-exercise. However, the parameters returned to their standard value after the horses had access to water for 12 hours of post-treatment. The median value shows the horses experiencing 4% to 8% of dehydration.

4. DISCUSSION

This study revealed a contradict result compare to the findings in previous studies on racing horses over long distances that showed a reduced in sodium and potassium concentration [11]. A similar study conducted on jumping horses in the ambience close to event field condition; revealed a finding of hypernatremia and hypokalaemia [12], which not shown in this study. The different or changes of this electrolyte depended on the type, duration and intensity of physical exercise.

Osmolality is an indicator to measure osmotic pressure of plasma depending on the amount of solute; electrolyte, and the solvent; water present. The standard plasma sodium osmolality ratio in horses is 0.49 [2]. The changes of water and electrolytes ratio give a clue on types of disorder thus indicates the types of dehydration the horses may have suffered at the time of sampling.

Isotonic dehydration is when both electrolyte and osmolality levels are lower than the normal value in a parallel manner [9], as seen in this study. There were increased in PCV and serum TP concentration at the time of post-exercise, due to loss of sodium-containing fluid and simultaneously cause decreased in plasma volume [13]. Nevertheless, all values were still in the normal range even though it shows increased in value at post-exercise compared to the pre-exercise and drops to the original levels after post-treatment

The increased in the PCV at post-exercise is due to loss of body fluid through sweating during the exercise. The water consumption during 12 hours of restoration has compensated the water lost and brought back the value to normal. Thirst centre can be triggered by two factors that are sodium concentration and volume depletion. When the serum sodium concentration level decreased below than 256mOsm/kg (260mmol/kg), it caused the impairment of water intake and resulted to the reluctances to drink in horses [14].

From the clinical assessment; heart rate, respiratory rate, capillary refill time, degree of eyeball recession, and skin-tenting increased at post-exercise compared to those taken at pre-exercise and after 12 hours post-treatment. The result shows that some of the horses experienced with 6-8% dehydration, manifest by increased in eyeball recession, and loss of skin elasticity. Whereas others had 8-10% dehydration, manifested with markedly sunken eyes and prolonged skin tenting for up to10 seconds [1].

In conclusion, this study proves that the polo horses experiencing the isotonic dehydration, manifest by increasing value of PCV, TP, and BUN, but normal levels sodium and osmolality after post-exercise. Fluids with electrolytes are the appropriate treatment for these horses to keep fit for the following event. For future study, bigger sample size and different type of exercise aggressiveness shall be conducted to stretch the physiological limit for a significant result.

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