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Study on Physiological and Biochemical Evalutions of Horses Affected by Gastrointestinal Tract Disturbances

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Authors' contributions

This work was carried out in collaboration among all authors. Authors AIAB, SES and HIS conceived the study and the design. Authors AIAB, HZ and TE carried out the field works and data analysis. Authors AIAB, SEA and TE drafted the manuscript. Authors AIAB, SES, HZ and TE were involved in revising the manuscript and approved the final version.

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Case Study

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ABSTRACT

Aim: This study was carried out to investigate causes, signs, some Physiological and Biochemical Parameters, and controlling of pain in Horse Affected by Gastrointestinal Tract Disturbances.
Study Design: The number of 66 horses were used in this study. The horses were divided into two groups. Group I consist of (50 horses) showing signs of digestive system (GIT) disturbances, group II consist of (16 horses) showing normal clinical signs of digestive and used as control group.
Place and Duration of Study: Sample collection: Nyala south Darfur state – Sudan, and sample analysis: University of Nyala Faculty of veterinary science, department of physiology and biochemistry, Nyala –Sudan between December 2019 and April 2021.
Methodology: the case history and clinical examination was done to all , surveyed animals, the

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physiological parameters (respiratory rate, pulse rates, rectal temperature, eye mucous membrane colour) and biochemical parameters (plasma total protein, albumin, urea, creatinine, triecylglyceride, Creatinine, LDH,ALP,ALT, phosphate) were examined.

Results: Over feeding of bean leaves was the most common cause of GIT Disturbance, followed by over feeding of grain, clove, unknown causes, natural grazing, Babesiosis, over drinking of water (Table,1). Some cases showed signs of colic such as flank watching, strechining of the belly, rolling, and running and no signs of pain was noticed in other cases (Table,2) Nefopam injection was found better than Diclofenac Sodium in controlling of colicky horses whereas Respiration rate, puls rate, and rectal temperature were significantly increased in horses affected by GIT-Disturbances(tale,3), in addition to increasing of total Protein, Albumin, Globulin,Urea, Creatinine, Alkaline Phosphatase (ALP) and Aspartate aminotransferase (AST), but no significant changes in Triglyceride and phosphate were noticed (Table,4).

Conclusion: Causes of equine gastro intestinal disturbance are variable but most of them are related to the management. This study found that respiration rate and pulse rate in addition to rectal temperature were increased due to equine gastro-intestinal disturbance in addition to behavioral changes were recorded in some cases, so non-steroidal anti-inflammatory is needed for controlling pain, we recommend using of Nefopam injection in horses with severe pain. When usage of other drugs are necessary such as anti-biotic attention must be paid to the effect of that drugs on the liver and kidney in addition to administration of intra-venous infusions to return urea and creatinine to their normal level and to rehydrated the infected horse.

Keywords: Biochemical; colic; horse; blood; ALT; GIT.

1. INTRODUCTION

The functions of the digestive system are prehension, digestion and absorption of food and water. Most fatal diseases of equine are related to the digestive system such as colic and endotoxemia [1,2]. Colic mainly originates from gastro intestinal tract (GIT) and characterized by severe abdominal pain [3] where as endotoxemia mostly develops during colic period making the prognosis of the patient more worse [4]. Endotoxin is lipopolysaccharide (LPS) of the outer cell wall of gram negative bacteria, which means it is part of the bacterium rather than being secreted by it [5] and [6].

Causes of digestive system disturbance are wide including nutritional and managemental problems such as, type of food (hay of poor quality causes impaction colic), way of feeding the horse, when put the food on the ground the horse be more susceptible to diarrhea and sand colic [7-8] and [9]. Decreasing or over drinking of water can cause gastric distention which lead to severe colic [10] and [8]. GIT disturbance causes by internal parasite such as Strongylus vulgaris, Parascari sequorum, and Anoplocep halaperfoliata [11] and [7], teeth problems [12], [13] and microbial infection such as Salmonella, Clostridia [14].

2. MATERIALS AND METHODS

2.1 Study Area

The current study was conducted in Nyala, South Darfur state, western Sudan that is located between Latitude 13-9.30º north and Longitude 27-24.30^{o} east.

2.2 Animals

A total number of (16) control and (50) horses showing signs of digestive system (GIT) disturbances were examined in Nyala, South Darfur State, Sudan.

2.3 Treatment

All the 50 horses showed signs of GIT disturbance were put in tow groups, colic group (43) and non colic group [7] according to the cases encountered in this survey.

2.4 History

A detailed history of the cases was obtained from the owner and examination of source of feed, environment, and source of water when possible as described by [15].

2.5 Clinical Signs

Clinical signs were documented for each individual case according to [15].

2.6 Physiological Parameters

All animals were examined clinically for estimation of respiratory rate, pulse rates, rectal temperature, using standard methods according to [15].

2.7 Blood Collection

Five millilitre of whole blood were collected from Jugular vein of each animal by disposable syringe, after following of aseptic technique procedures, The blood samples were collected into test tubes containing the anticoagulant heparin for plasma separation. Plasma samples were collected in plastic tubes for blood biochemical measurement.

2.8 Blood biochemical parameters

The following blood biochemical parameters: plasma total protein, albumin, urea, creatinine, triecylglyceride, Creatinine, LDH,ALP,ALT, phosphate were measured using spectrophotometer (Biosystem –BTS-302) in the Physiology Laboratory, Faculty of Veterinary Science University of Nyala.

2.9 Statistical Analysis

The clinical parameters (respiration rate, pulse rate, rectal temperature) were analyzed as descriptive,where as physiological and biochemical parameters were analyzed by One-waye Anova(from SPSS statistical program, version 20 for Windows (IBMSPSS Statistics 20 IL, USA) Dunan tables were used to show the significant different and in different between groups, and showed as mean values ± standard deviation. Similar letters were used to label non-siginifance differences between groups and different letters for significant differences ANOVA from SPSS statistical program, version 20 for Windows (IBMSPSS Statistics 20 IL, USA) to evaluate the effects of colic on physiological and biochemical parameters of Sudanese Horses

3. RESULT

3.1 Etiology of GIT Disturbance in Horses

As showed in Table (1) below, over feeding large amount of bean leaves was the most common cause of GIT disturbance, followed over feeding of grain, clove, unknown causes, naturalgrazing, Babesiosis, over drinking of water, and sand.

3.2 Frequency of Clinical Signs Noticed in Colicky Horses

The most noticed clinical signs in this study were signs of colic (86%) which include flank watching, strechining of the belly, rolling, and running. The rest percentage (14%) were diarrhea, bloat of the right flank.

3.3 Response of Treated Colicky Horses to Treatment with Nefopam Injection and Diclofenac Sodium Injection

According to this study Nefopam injection was found better than Diclofenac sodium in treatment signsof colic.85% of horses infected by colic 20 responded to it, whereas 78.2% of horses with colic 23 were responded to diclofenac sodium.

3.4 Physiological Parameters of Horse Infected by Disturbance of GIT

Respiration rate, heart rate, and temperature were increased in horses infected by GIT disturbance compared to control group as in Table (3)

Table 1. The most encountered causes of GIT disturbances in horses

Cause	Frequency	Percentage % out (50)
Feeding large amount of grains	13	26
Natural pasture	2	4
Leaves of beans	16	32
Clove	8	16
Over drinking of water	1	2
Sand	1	2
babesiosis	2	4
Unkown causes	7	14

Table 2. GIT infection

Type of GIT infection	No. of cases	% oute of (50)
Colic cases	43	86
Non colic cases	7	14

Table 3. GIT disturbance compared to control group

Parameter	Control	Colic cases	Non colic cases
Respiration rate	23 ± 4.85^{A}	61.75 ± 20.23^{B}	65.75 ± 20.85^{B}
Pulse rate (beat/min.)	45.3 ± 2.65^{A}	75.3 ± 20.06^{B}	77.5 ± 23.14^{B}
Temperature (C^0)	37.3 ± 0.17^{A}	38.4 ± 1^{B}	38.7 ± 1.15^{B}

3.5 Biochemical Parameters GIT Infected Horses

Total protein: was increased significantly in horses infected by GIT disturbance comparing to control group, with in the horses infected by GIT disturbance it significantly increased in non-colic cases than in colicky horses.

Albumin: was noticed increased just in non-colic cases.

Globulin: increased in both colicky and non-colicky horse compared to the control group.

Urea and Creatinine: were more increased in non-colicky horses compared to colicky one although both of them increased in horses infected by GIT disturbance than control group.

Triglyceride and phosphate: No siginifecant changes between control group and horses infected by GIT disturbance were found.

3.6 Lactate dehydrogenase (LDH)

Alkaline Phosphatase(ALP) and Aspartate aminotransferase(AST): were significantly increased.

4. DISCUSSION

Identification of causes of GIT disturbance which include Over feeding horses bean leaves, grain, clove, water, and sand. unknown causes, naturalgrazing, and Babesiosis were reported [16-17].

Over feeding, over production of gas, and over drinking of water leads to over stretching of the intestinal wall which trigger the nerve ends that available in the wall resulting in abdominal pain, also changing of PH, normal flora of the hind gut in addition to the overproduction of volatile fatty acids make the opportunistic and pathogenic bacteria makes enteritis and colic [13].

Signs of GIT disturbance which seen in this study flank watching, strechining of the belly, rolling, running diarrhea, and bloat were previously reported by [16]] and [2]. Although the severity of clinical signs don't reflect directly the severity of the condition Clark,2016, but they can be used as indicators forassessment of pain [18]. In addition to the clinical response of the animal to the non-steroidal anti-inflammatory agents [16]. Haematological and biochemical parameters also help in the assessment of the pained animal [17]. Pain originate either because of tissue or nerve damage, inflammation, demyelination which is pain hypersensitivity [19]].

Respiration rate heart rate, and temperature were increased in horses infected by GIT disturbance compared to control group as in Table(3),this result agreed with muscle hyper activation leads to the increasing of body temperature, respiration rate, and puls rate [20] which also can be increased by infection [21].

Laboratory tests are aids to diagnosis and must be interpreted in conjunction with clinical and other available data, because one test does not give enough information [1].

Increasing of total protein and albumin significantly in horses infected by GIT disturbance comparing to control group this agreed by [22] and was justified because dehydration which concentrate the blood and elevate plasma protein and less there was leakage of protein through infected kidneys [23] or intestinal accidents such as torsion, strangulation, starvation, or fever which decrease the plasma protein [24].

Table 4. Different parameters showing Colic and Non-colic cases

Parameter	Control	**Colic casese**	**Non-colic cases**	**P- value**
Total protein	34.4± 5.41 ^{A}	55.57 ± 5.41^{B}	76.32 ± 21.14^{c}	0.000
Albumin	30.63 ±6.07^{A}	29.96 ± 10.19^{A}	47.13 ± 15.56^{B}	0.003
Globulin	4.2 ± 2.67 ^{A}	25.66 ± 12.67^{B}	29.18 ± 9.68^{B}	0.000
Urea	12.2 ± 1.92^{A}	39.49 ± 16.07^{B}	64.97 ± 11.62^{C}	0.000
Creatinine	6.16± 3.31^{A}	22.7± 8.96^{B}	36± 19.56^{C}	0.000
Triglyceride	55± 21.8^{A}	74.90 ± 58.24 ^{A}	82.88 ± 45.88^{A}	0.593
LDH	31.5±36.1^{A}	216.57±136.6^{A}	572.71±321.95^{B}	0.001
ALP	592.83±357.46^{A}	139.86±15.9^{B}	85.57±28.18^{B}	0.000
AST	234.17±68.41^{A}	12.29±6.65^{B}	11.71±3.94^{B}	0.104
Phosphate	2.03±0.52^{A}	2.07±0.56^{A}	1.74±0.299^{A}	0.394

Values with different letters in the same row are significantly different (P<0.05)

Increasing of Urea and Creatinine in horses infected by GIT disturbance compared to the control group was also documented by [25-26] who justified the increasing of urea and creatinine due to dehydration and secondary renal dysfunction which may develops specially in cases of colic.

No significant change was reported in level of triglyceride between horses infected by GIT disturbance and control group in this study, that was agreed by [27-28].

Increasing of triglyceride level in horses infected by GIT disturbance depends on degree of stress of pain, anorexia, or feed restriction and time needed to mobilization of triglyceride from its storage to the blood stream that time is about 40 hours of food deprivation [29], increasing of triglyceride in horses infected by impaction colic was documented [30] [28].

Hypertriglyceridemia in horses is treatable by dextrose infusion with or without parental nutrition [27-28].

Phosphate is an important element in metabolism pathways, it is major mineral in bones, and is controlled with in the body by parathyroid hormone and vitamin D [31] phosphate also makes up cell membrane as phospho-lipid bilayer so when severe cell damage occurs it increases in the blood [1]. Also it increases due to chronic renal failure. Decreasing of phosphate was due to stress, or excitement, some enzymes such as glycogenolysis and lipolysis enzymes to be activated need phosphorylation [31]. In this study no change in concentration of phosphate level in the plasma was reported.

Liver enzymes: total amount of all enzymes in the plasma is less than one gram, measurement of enzymes is method- dependent than other measurements, the international unit (IU) of enzyme activity is defined as the amount of enzyme which catalyze 1mmol of substrate under certain conditions which vary between laboratories, substrate, starter, temperature… etc and they have short half-life [31]. For accuracy and more specific diagnosis liver biopsy or ultrasound are needed [32]. Generally increasing of enzyme levels occur mainly due to damage or necrosis of the cell that contain the specific enzyme or due to it is proliferation which mean this enzyme increases because of acute inflammation but no changes may be noticed in the chronic inflammation. Decreasing of enzyme level is not frequent but can happen mostly because of bad handlining and stroing of the sample or because of organ hypoplasia, atrophy or destroying [31].

Lactate dehydrogenase (LDH) and ALT are significantly increased in this study, LDH is abbreviation of isoenzymes available in erythrocytes, liver, muscles, renal tissue and intestinal tissues it is increasing agreed by [17], who justified that due to the damage might happen in intestine .

(ALP) and (AST) were significantly increased in horses infected by GIT disturbances compared to control group, this result agreed by [33]. They also justified that increasing of liver enzymes in GIT disturbance by either ascending infection through bile duct, absorption of inflammatory mediators or endotoxin from portal circulation to liver or hepatic hypoxemia.

ALP is found in the intestinal mucosa rental tubules, bile measuring of ALT from peritoneal fluids helps in diagnosis of ischemia or ulcerative diseases or peritonitis in horses with colic and it was found increase significantly in peritoneal fluids where as it was low in plasma [34].

5. CONCLUSION

Causes of equine gastro intestinal disturbance are variable but most of them are related to the management. This study found that respiration rate and pulse rate in addition to rectal temperature were increased due to equine gastro-intestinal disturbance so non-steroidal anti-inflammatory is needed, diclofenac sodium can be used in control of pain in horses but we recommend using of Nefopam injection in horses with severe pain. When usage of other drugs are necessary such as anti-biotic attention must be paid to the effect of that drugs on the liver and kidney in addition to administration of intra-venous infusions to return urea and creatinine to their normal level and to rehydrated the infected horse.

DISCLAIMER

There is absolutely no conflict of interest between the authors andproducers of the products used in this study.

ETHICAL APPROVAL

Animal Ethic committee approval has been taken to carry out this study.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Radostits O, Blood D, Gay C. A text book of diseases of cattle sheep, pig, goats and horses 10th edition. Bailliere Tindall, London (1210-1230); 2007.
2. Bland SD. Equine colic: a review of the equine hindgut and colic. Veterinary Science Development. 2016;6(1).
3. Bryan J, David F, Duggan V. Investigation of acute colic in the adult horse. Ir Vet J. 2009;62:541-7.
4. Morris DD. Endotoxemia in horses: a review of cellular and humoral mediators involved in its pathogenesis. Journal of Veterinary Internal Medicine. 1991;5 (3):167-81.
5. Lee AK, Chan CK, Fang M, Lau AP. The 3-hydroxy fatty acids as biomarkers for quantification and characterization of endotoxins and Gram-negative bacteria in atmospheric aerosols in Hong Kong. Atmospheric Environment. 2004;38(37): 6307-17.
6. Kallapura G, Pumford NR, Hernandez-Velasco X, Hargisand B, Tellez G. Mechanisms involved in lipopolysaccharide derived ROS and RNS oxidative stress and septic shock. Journal of Microbiology Research and Reviews. 2014;2(1):6-11.
7. Gonçalves S, Julliand V, Leblond A. Risk factors associated with colic in horses. Veterinary research. 2002;33(6):641-52.
8. Archer D, Proudman C. Epidemiological clues to preventing colic. The Veterinary Journal. 2006;172(1):29-39.
9. Husted L, Andersen M, Borggaard O, Houe H, Olsen S. Risk factors for faecal sand excretion in Icelandic horses. Equine veterinary journal. 2005;37(4):351-5.
10. Hillyer M, Taylor F, Proudman C, Edwards G, Smith J, French N. Case control study to identify risk factors for simple colonic obstruction and distension colic in horses. Equine veterinary journal. 2002;34(5):455-63.
11. Reinemeyer CR, Nielsen MK. Parasitism and colic. Veterinary Clinics: Equine Practice. 2009;25(2):233-45.
12. Du Toit N, Gallagher J, Burden F, Dixon P. Post mortem survey of dental disorders in 349 donkeys from an aged population (2005–2006). Part 2: Epidemiological studies. Equine Veterinary Journal. 2008; 40(3):209-13.
13. Scantlebury C, Archer D, Proudman C, Pinchbeck G. Recurrent colic in the horse: incidence and risk factors for recurrence in the general practice population. Equine Veterinary Journal. 2011;43:81-8.
14. Ferraro G. Colic: An age-old problem. CEH Horse report. 2008;26(1):3-16.
15. Kelly W. The blood and blood forming organs. Bailliere Tindal, London Veterinary Clinical Diagnosis, Kelly, ER Ed. 1984;312-37.
16. Ismail SH, Suliman SE. Clinical, Haematological and Biochemical Studies of Colic in Draught Horses and Donkeys in Nyala; 2014.
17. Alsaad K, Nori A, editors. Clinical, hematological and biochemical studies of

colic syndrome in draught horses in Mosul. Proceedings of the 14 th Scientific Conference Faculty of Veterinary Medicine Assiut University, Egypt; 2010.
18. Sharkey LC, DeWitt S, Stockman C. Neurologic signs and hyperammonemia in a horse with colic. Veterinary clinical pathology. 2006;35(2):254-8.
19. Vinuela-Fernández I, Jones E, Welsh EM, Fleetwood-Walker SM. Pain mechanisms and their implication for the management of pain in farm and companion animals. The Veterinary Journal. 2007;174(2):227-39.
20. Wallsten H, Olsson K, Dahlborn K. Temperature regulation in horses during exercise and recovery in a cool environment. Acta veterinaria scandinavica. 2012;54(1):1-6.
21. Freeman K, Southwood L, Lane J, Lindborg S, Aceto H. Post operative infection, pyrexia and perioperative antimicrobial drug use in surgical colic patients. Equine Veterinary Journal. 2012; 44(4):476-81.
22. White NA, Edwards GB. Handbook of equine colic: Butterworth-Heinemann; 1999.
23. Radostits OM, Gay CC, Hinchcliff KW, Constable PD. Veterinary Medicine E-Book: A textbook of the diseases of cattle, horses, sheep, pigs and goats: Elsevier Health Sciences; 2006.
24. Reed SM, Bayly WM, Sellon DC. Mechanisms of infectious disease. Equine Internal Medicine. 2004;59.
25. Seanor J, Byars T, Boutcher J. Renal disease associated with colic in horses. Modern veterinary practice. 1984;65(5): A26-9.
26. Geor RJ. Acute renal failure in horses. Veterinary Clinics of North America: Equine Practice. 2007;23(3):577-91.
27. Dunkel B, III HM. Severe hypertriglyceridaemia in clinically ill horses: diagnosis, treatment and outcome. Equine veterinary journal. 2003;35(6):590-5.
28. McKenzie HC. Equine hyperlipidemias. Veterinary Clinics: Equine Practice. 2011; 27(1):59-72.
29. Gomaa N, Koeller G, Schusser GF. Triglycerides, free fatty acids and total bilirubin in horses with left ventral colon impaction. Pferdeheilkunde. 2009;25(2): 137-40.
30. Waitt LH, Cebra CK. Characterization of hypertriglyceridemia and response to treatment with insulin in horses, ponies, and donkeys: 44 cases (1995–2005). Journal of the American Veterinary Medical Association. 2009;234(7):915-9.
31. Kerr M. Veterinary Laboratory Medicine: clinical biochemistry and hematology/ Morgan. G. Kerr.–. W. Sussex; 2002.
32. Ambrojo KS, Poggi JCG, Juzado AM. Use of laboratory testing to diagnose liver and biliary dysfunction in the horse. Journal of Gastroenterology and Hepatology Research. 2013;2(10):807-13.
33. Davis JL, Blikslager AT, Catto K, Jones SL. A retrospective analysis of hepatic injury in horses with proximal enteritis (1984–2002). Journal of veterinary internal medicine. 2003;17(6):896-901.
34. Saulez MN, Cebra CK, Tornquist SJ. The diagnostic and prognostic value of alkaline phosphatase activity in serum and peritoneal fluid from horses with acute colic. Journal of veterinary internal medicine. 2004;18(4):564-7.

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