

قسم : طب الحيوان •

كلية الطب البيطري - جامعة أسيوط •

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الاتزان الحمضي القاعدي وغازات الدم المصاحبة للاصابة بالنزلات الشعبية والرئوية في العجول الرضيعة

علي السباعي ، حمدي ابراهيم ، أحمد مناع*

قسمت الحيوانات المريضة حسب حالتها المرضية على النحو التالي:

- مجموعه عليها علامات النزلات الشعبية الرئوية الحادة •
- مجموعه عليها علامات أقل حدة للنزلات الشعبية والرئوية •
- والمجموعة الأخيرة والتي ظهرت عليها علامات النزلات المعوية والرئوية •

أجريت الفحوص الاكلينيكية اللازمة على جميع العجول المريضه وسجلت العلامات

المرضية •

كانت هناك علامات ضيق التنفس وارتفاع في درجات الحرارة بالنسبة للمجموعه الثانية في حين أن المجموعه الثالثة كانت العلامات المرضية أقل حدة منها في الأولى ، أما المجموعه الرابعه (التهاب رئوي معوي) فقد كانت العلامات المرضية في صورة اسهال في درجات متفاوتة •

أفادت مقاييس الاتزان الحمضي القاعدي أنعجول المجموعه الثانية الرضيعة تعاني من انخفاض ملحوظ في نسبة الأس الهيدروجيني وارتفاع في نسبة ثاني أكسيد الكربون في حين كانت هناك انخفاضات في المجموعه الثالثة في معادل الأس الهيدروجيني ولكن بدرجة أقل • أما المجموعه الرابعه فلقد تميز الاتزان الحمضي القاعدي بنقص عالي في قيمة الأس الهيدروجيني، بينما تميز بانخفاض في نسبة البيكربونات مما يدل على أن سبب الحموضة مرجعه اضطرابات الجهاز الهضمي والتنفسي معاً •

Dept. of Animal Medicine,
Faculty of Vet. Med., Assiut University,
Head of Dept. Prof. Dr. I.S. Ahmed.

**BLOOD GASES AND ACID-BASE BALANCE
IN ASSOCIATION WITH BRONCHO-PNEUMONIA IN CALVES**
(With 2 Tables & One Fig.)

By
A. EL-SEBAIE; H. IBRAHIM and A. MANAA*
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SUMMARY

One hundred and thirty newly born Freisian calves were included in this investigation valves classified according to the severity and nature of the illness into the following:

- 1- 60 clinically healthy freisian newly born bronchopneumonia.
- 2- 19 Freisian calves showing signs of severe bronchopneumonia.
- 3- 32 calves suffering from milk broncho-pneumonia.
- 4- 19 calves showing signs of pneumonia associated with enteritis.

The main clinical signs were noticed in all diseased calves. The clinical finding of acute broncho pneumonia in newly born freisian calves were dyspnoeic respirations and severe fever while in the 3rd group the clinical signs were less severe than the 1st group. In the 4th group (pneumo-enteric calves) the clinical signs were dyspnoeic and respiratory distresses which were usually associated with signs of diarrhoea in different degrees.

There were a marked decrease in mean values of blood pH in calves with acute broncho-pneumonia also in mild cases of broncho pneumonia. Marked drop in mean value of blood pH was observed in group IV. PCO_2 values were increased in all cases of broncho-pneumonia. The mean values of HCO_3 were slightly decreased in calves showed pneumo-enteritis. Also mean values of sodium and chloride were decreased.

INTRODUCTION

Calves are considered one of the most important groups of farm animals and constitute the major source of meat for human consumption in Egypt.

In neonatal periods calves are subjected, and more susceptible to may respiratory diseases. These respiratory diseases constitute the major source of losses in newly born calves (ALPERN, 1967).

The main function of the lung is oxygenation of the blood and gaseous exchange between the blood and lung tissue i.e. regulation of the oxygen tension and carbon dioxide concentration in the blood.

* : Assiut Regional Veterinary Services.

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Pathogenesis of respiratory affection in newly born calves depends mainly on the extent of alteration in the lung tissues, consequently depends on the severity of the illness.

From the clinico-anatomical point of view the lung of newly born calf is small in size and this enhances the spread of infection along the lung tissues and bronchial tree in very short time.

In pneumonia and bronchitis, there were a marked increase in PCO_2 values, associated with drop in blood pH values (ROSENBERGER, 1979 and SODEMAN, 1961). The effect of acidosis are related chiefly to the respiratory system. The increased carbon dioxide tension of the blood and depletions of bicarbonate causes an increase in the depth and the rate of respiration by stimulation of the respiratory centre (BLOOD, et al. 1979).

Mixed cases of acidosis (as primary respiratory acidosis and primary metabolic acidosis) may occur in newly born animals, during pneumonia accompanied by diarrhoea, on the other hand the laboratory findings anticipated in this mixture of acid-base imbalances include increased PCO_2 , decreased HCO_3^- with a decrease in blood pH (DUKES, 1964). In cases of pneumonia, the blood serum sodium level is normal, while the blood serum chloride levels are decreased or become normal and the blood serum potassium level remains normal or is slightly increased (COHN and ALEXKAPLAN, 1971; KANEKO and CORNELIUS, 1971 and SIMMONS, 1962).

The aim of this investigation is to study the extent of changes in values of acid-base balance, blood gases and electrolytes in certain, respiratory diseases. In addition the study of clinical signs associated with respiratory diseases in newly born calves.

MATERIAL and METHODS

One hundred and thirty newly born freisian calves were included in this investigation. Age of examined animals ranged between 1-8 weeks. The calves were subjected to careful examination prior to the beginning of work. The animals were classified into the following groups:

- Group I:** 30 Clinically healthy calves.
- Group II:** 19 calves showing signs of severe broncho-pneumonia.
- Group III:** 32 calves with signs of mild broncho-pneumonia.
- Group IV:** 19 calves with signs of premo-enteritis.

From each animal two millilitre samples of jugular venous blood were collected anaerobically into syringe whose dead space had previously filled with 1:1000 Sodium heparin. These samples were immediately placed on ice-bath and processed within 3 hours of collection.

Blood gases measurements were performed using corning pH-blood gas analyser Model 168. The analyser directly measured at 37°C, blood pH, carbon dioxide tension (PCO_2 mmHg), oxygen tension (PO_2 mmHg), Bicarbonate (HCO_3^- mmol/L.), total carbon dioxide (TCO_2 mmol/L.) and Base excess (B.E. mmol/L.). Another blood samples were collected from each animal for serum separation serum samples were used for serum electrolytes (Sodium, Potassium and Chloride) determination.

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RESULTS

The mean values \pm S.D. of various parameters (pH), carbon dioxide, tension (P_{CO_2}), Oxygen tension (P_{O_2}), Bicarbonate (HCO_3), total carbon dioxide (TCO_2) and base excess in different groups of animals are presented in Table (1).

The signs of broncho-pneumonia in newly born calves were in the form of fever, dyspnoea, shallow and rapid breathing, opening of the mouth and extension of the head and neck. Auscultation of the chest revealed the presence of mixed dry and moist rales. The signs in mild cases were less significant specially the body temperature.

Pneumo-enteric cases were dehydrated and there were different degrees of diarrhoea.

The values of acid-base parameters of newly born calves showing severe broncho-pneumonia were 7.172 ± 0.034 , 61.67 ± 1.963 mmHg, 30.436 ± 3.80 mmHg, 26.23 ± 2.432 mmol/L., 26.44 ± 3.897 mmol/L., and -5.04 ± 3.366 mmol/L. respectively. The values of the same parameters in calves affected by broncho-pneumonia (mild forms) were 7.248 ± 0.023 , 54.84 ± 1.977 mmHg, 27.20 ± 7.381 mmHg, 24.96 ± 3.944 mmol/L., 25.418 ± 2.540 mmol/L. and -3.868 ± 1.888 mmol/L. respectively. While the obtained mean values of acid-base parameters in group showing signs of pneumo-enteritis were 7.145 ± 0.072 , 50.257 ± 2.569 mmHg, 33.78 ± 7.429 mmHg, 17.19 ± 2.033 mmol/L., 18.92 ± 2.603 mmol/L. and -11.90 ± 7.389 mmol/L. respectively see Table (1).

In table (2) the mean values of serum sodium, potassium and chloride for different groups of calves. The values of control group calves were sodium, 146.86 ± 4.9 mmol/L., potassium, 5.71 ± 0.43 mmol/L. and chloride, 101.5 ± 4.019 mmol/L. respectively.

The mean values of serum sodium, potassium and chloride in newly born freisian calves with the signs of acute broncho pneumonia were: 148.968 ± 4.54 mmol/L., 5.978 ± 0.23 mmol/L. and 97.94 ± 3.35 mmol/L. While the values for group of calves affected with broncho-pneumonia (Mild cases) were: 147.01 ± 4.49 mmol/L., 5.89 ± 0.21 mmol/L. and 98.81 ± 3.12 mmol/L. respectively. On the other hand the mean values for serum electrolytes in calves showing signs of pneumo-enteritis were: 128.505 ± 4.91 mmol/L., 6.450 ± 0.21 mmol/L. and 92.42 ± 4.16 mmol/L. respectively.

DISCUSSION

In this investigations the mean values of acid-base balance and blood gases in healthy calves are in agreement with data previously published by (GATES, *et al.* 1971; EL-SEBAIE and HASSAN, 1984; EL-SEBAIE, *et al.* 1984).

In diseased groups II, III and IV, there were decrease in pH values such drop in pH values could be explained mainly due to respiratory acidosis in group IV in which a signs of pneumo-enteritis were observed. This finding were in agreement with data after (WOOLF, 1980 and HASKINS, 1983).

The mean values of base excess in healthy calves, calves with severe broncho-pneumonia, calves with mild broncho-pneumonia and those with pneumo-enteritis were 0.38 mmol/L., -5.04 mmol/L., -3.86 mmol/L. and -11.90 mmol/L. respectively. This drop go parallel with the observation on blood pH in the same groups and indicated more or less the occurrence of respiratory acidosis (group II and III) and/or metabolic acidosis in group IV, Such findings agreed with HASKINS (1983).

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There were a significant increase in the PCO_2 values in group II, III and IV, such elevation could be attributed to defect in oxygenation process of the lung during the course of broncho-pneumonia which leads to retention of carbon dioxide in the blood. These observations agreed with SALEH, 1983.

The mean value of oxygen tension for healthy calves 33.81 ± 5.299 mmHg was generally in agreement with these obtained by (EL-SEBAIE, et al. 1984 and KHAMIS, 1984). In group II and III there were a significant decrease in the mean value of oxygen tension. This drop could be explained the hinderance oxygenation of the lung during the course of the disease.

The mean value of bicarbonate in healthy group were 26.27 mmol/L. and this lied in range previously mentioned after EL-SEBAIE and HASSAN (1984).

On the other hand there was a significant drop ($P/ < 0.01$) in the HCO_3 value in pneumo-enteric calves. Such drop in HCO_3 was mainly due to the continuous loss of HCO_3 with intestinal secretion through faeces.

The value of TCO_2 tension in healthy calves 27.95 ± 2.685 mmol/L. lie within the data recorded by EL-SEBAIE and HASSAN, (1984) and EL-SEBAIE, et al. (1984).

There was significant decrease ($P/ < 0.01$) in values of TCO_2 in calves suffering from pneumo-enteritis (18.92 ± 2.603 mmol/L.) in comparison to the healthy calves. It was a constant finding that any alteration in HCO_3 was usually accompanied with changes in the concentration of TCO_2 because the TCO_2 values were calculation dependant.

In table 2, the mean values of clinically healthy freisian calves for serum sodium potassium and chloride were 146.86 ± 4.9 mmol/L., 5.71 ± 0.43 mmol/L. and 101.5 ± 4.019 mmol. respectively. The obtained data on sodium, potassium and chloride were agreed with data published after (ROSENBERGER, 1979).

The results showed significant drop ($P/ < 0.01$) in Na^+ , Cl^- values and significant increase in K^+ values in pneumo-enteric group. Such variations due to great loss of sodium and chloride from body in enteric calves.

REFERENCES

- Alpern, D. (1967): Pathologic physiology pp. 153-155. Mir Publishers, Moscow.
- Blood, D.C.; Handerson, J.A. and Radostits, D.M. (1979): Veterinary Medicine pp: 224-227. 5th Ed. English language Book Society and Bailliere, Tindall, London.
- Chon, C.M.D. and Alexkaplan (1971): Textbook of clinical pathology, pp: 252 (254). The Williams & Wilkins Co., Baltimore Scientific book.
- Dukes, H.H. (1964): The physiology of Domestic Animals. pp: 476-483. 5th Ed, Baillare, Tindall and Lox. London.
- El-Sebaie, A. and Hassan, N.K. (1984): Some observations on acid-base balance and blood gases in association with diarrhoea in Egyptian buffalo calves. First. Vet. Scientific conf. Assiut.
- El-Sebaie, A.; N.K. Hassan, A. Mottielb and A. Amer (1984): Blood gases, acid-base balance and electrolytes in healthy sheep and goats. Assiut Vet. Med. J. 14 (27), 180-185.
- Gates, J.B.; Botta, J.A. and Teer, P.A. (1971): Blood gas and pH determinations in cattle anesthetized with halothane J.A.V.M.A., 158: 1678.

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- Haskins, S.C. (1983): Current Vet. Therapy. 6th Ed. W.B. Saunders company philadelphia, London, Toronto and Mexico City.
- Kaneks, J.J. and Carnelius, C.E. (1971): Clinical biochemistry of domestic animals pp: 98-106. 2nd, Ed. Vol. II, Academic press, New York and London.
- Khamis, G.F.A. (1984): Blood gases and acid-base balance in healthy buffalo-calves M.V.Sc. Thesis Assiut University.
- Rosenberger, G. (1979): Clinical examination of cattle pp: 138-141. Roughton, 2nd Ed., Berlin and Hamburg.
- Saleh, F.M.K. (1983): A contribution to the acid-base balance in normal and diseased sheep. M.V.Sc. Thesis, Cairo, Univ., Egypt.
- Simmons, D.H. (1962): Clinical disorders of fluid and electrolyte metabolism. McGraw-Hill Book company, INC. New York, Toronto and London.
- Sodeman, T.A. (1961): Pathologic physiology pp: 114-121. 3rd Ed., W.B. Saunders company, philadelphia and London.
- Woolf, C.R. (1980): Applied biochemistry of clinical disorders. 94-102. Harper & Row, Publishers Cambridge. New York. London and Mexico City.

Table (1)
Mean values of acid-base balance, blood gases in healthy and diseased calves

Groups of animals	Number of animals	Mean values	Parameters					B.E.
			pH	Pco ₂ mm Hg.	Po ₂ mm Hg.	Hco ₃ m mol/L.	Tco ₂ m mol/L.	
I Clinically healthy frisian	60	\bar{X}	7.336	46.89	33.81	26.27	27.95	0.38
		+SD	0.05	2.20	5.299	4.282	2.685	1.64
II Calves with severe broncho-pneumonia	19	\bar{X}	7.172**	61.67**	30.436*	26.23	26.44	-5.04**
		+SD	0.034	1.963	3.80	2.432	3.897	3.366
III Calves with broncho-pneumonia (Mild cases)	32	\bar{X}	7.248**	54.84**	27.20*	24.96	25.418	-3.868**
		+SD	0.023	1.977	7.381	3.944	2.540	1.888
IV Calves with pneumo-enteritis	19	\bar{X}	7.145**	50.257	33.78	17.19**	18.92**	-11.90**
		+SD	0.072	2.569	7.429	2.033	2.603	7.389

\bar{X} : Mean
S.D. : Standard deviation
* : Significant (P/ 0.05)
** : Highly significant (P/ 0.01)

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Table (2)
Serum electrolytes (sodium, potassium and chloride) in healthy and diseased calves

	Groups of animals	Number of animals	Mean values	Sodium m mol/L.	Potassium m mol/L.	Chloride m mol/L.
I	Clinically healthy frisian calves	60	\bar{X}	146.86	5.71	101.5
			+SD	4.9	0.43	4.019
II	Calves with severe bronco-pneumonia	19	\bar{X}	148.968	5.978*	97.94
			+SD	4.54	0.23	3.35
III	Calves with broncho-pneumonia (Mild cases)	32	\bar{X}	147.01	5.89	98.81
			+SD	4.49	0.21	3.12
IV	Calves with pneumo-enteritis	19	\bar{X}	128.505**	6.450**	92.42**
			+SD	4.91	0.215	4.16

\bar{X} : Mean
SD : Standard deviation

* : Significant
** : Highly significant.

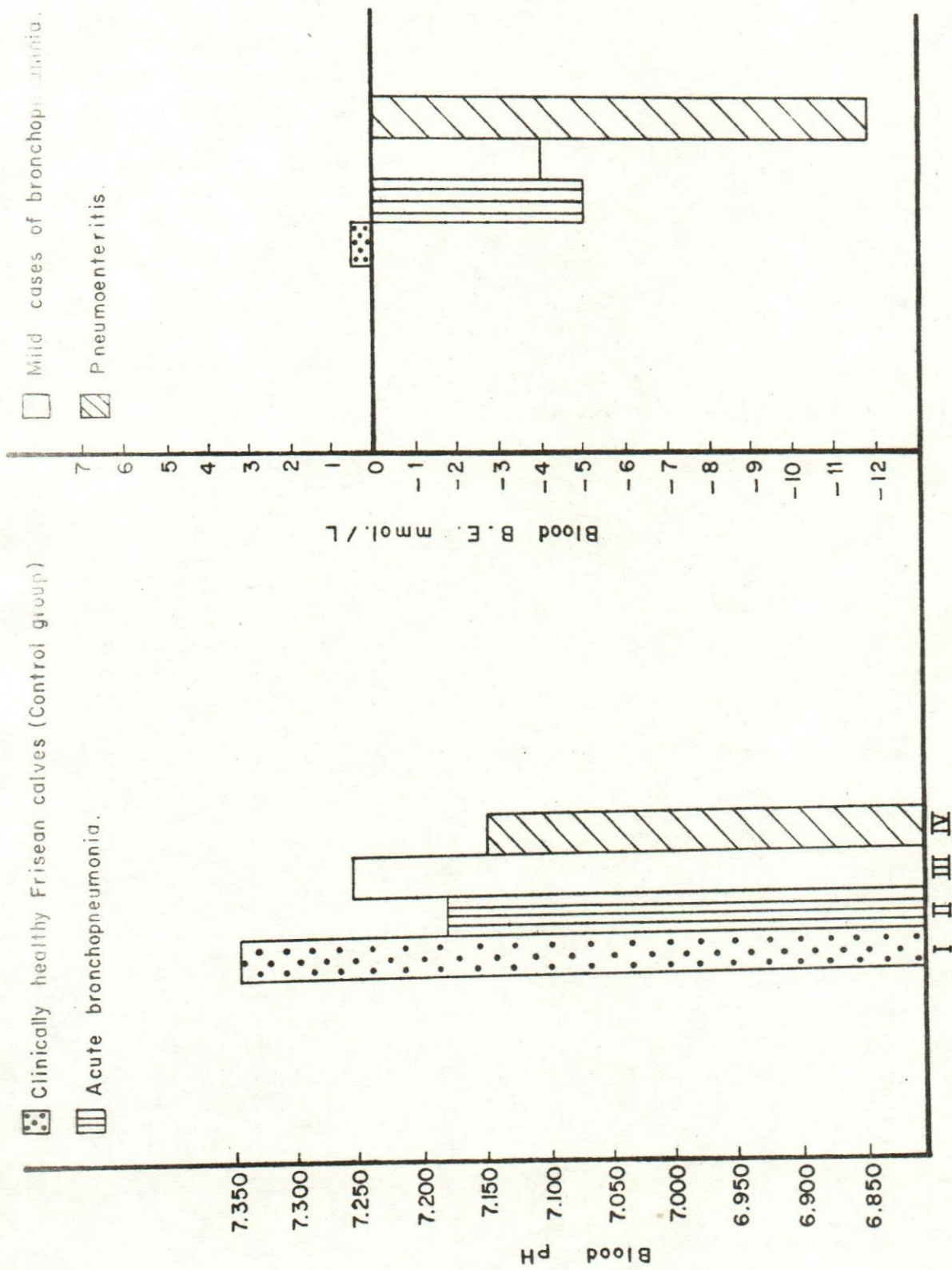


Fig.(I): Blood pH & B.E. values in all examined groups of calves.

Figure 1: Comparison of the number of cases in the two groups.

