حقن مستخلص الحديد فى العضل الجاموسى المصرى
وأثره على انتاج اللبن وبعض الصفات الهيماتولوجية

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حقنت حيوانات ذات معدل انتاجى منخفض من اللبن بمستخلص الحديد (Imposil-200) لزيادة مخزون الحديد فى الجسم . وكانت نتيجة الحقن أن زاد معدل انتاج اللبن فى مجموعة التجربة وذلك بالنسبة لمجموعة الحيوانات المقارنة وكانت هذه الزيادة معنوية خلال فترة الحقن واستمرت هذه الزيادة أربعة شهور أخرى خلال موسم الحليب . وقد صاحب ذلك أيضا زيادة فى نسبة الهيموجلوبين بدون أى تغير فى عدد كرات الدم الحمراء أو البيضاء . وكذلك قيم الهيماتوكريت . وبالنسبة لمكونات سيرم الدم مثل البروتين الكلى ، بيتا ـ جلوبيولين ونسبة الالبيومين للجلوبيولين لم يحدث أى اختلافات فى مجموعة حيوانات التجربة عن مجموعة الحيوانات المقارنة . هناك زيادة ملحوظة فى نسبة الكرباتنين خلال فترة الحقن بمستخلص الحديد ولكن بعد ذلك أصبحت متساوية مع نسبتها فى مجموعة الحيوانات المقارنة . لم يلاحظ أى تغير فى مستوى المحتوى القلوى لسيرم الدم واللبيدات والكولسترول فى سيرم الدم كنتيجة لحقن مستخلص الحديد عضليا .

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INTRA-MUSCULAR INJECTION OF IRON-DEXTRAN IN EGYPTIAN BUFFALOES AND ITS EFFECT ON MILK PRODUCTION AND SOME HAEMATOLOGICAL PROPERTIES

(With 3 Tables and 1 Figure)

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SUMMARY

Buffaloes with a relatively low milk yield were injected intramuscularly with an iron-dextran to replenish its body stores. This treatment resulted in increased milk production above controls ($P < 0.05$) during the period of administration of iron and for about four months after cessation of treatment. This was accompanied with a mild increase in blood haemoglobin without alterations in the RBCs and WBCs counts. Haematocrit values were not also changed. Other blood constituents, namely total proteins and beta-globulin and albumin: globulin ratio were not different from those of controls. Blood creatinine increased slightly during the period of the drug then became similar to that of control buffaloes. No changes were observed in the alkaline reserve, total lipids and cholesterol levels in the blood serum as a result of injection of the iron preparation intramuscularly.

INTRODUCTION

Little is known about the iron requirements of cattle and many other species. KOLB (1963) established the requirements of iron for some animals. It is 50-60 mg for pregnant ones. On the basis of these estimates a milking cow consuming 12 Kg dry

matter per day would satisfy its iron reqirements from a ration containing only 4 to 5 ppm. iron.

Dietary iron is principally in the F^{3+} form and occurs either as organic or inorganically bound iron. Foods containing large amount of oxalates, phytates or phosphates which bind more of this iron in the duodenum may further decrease the availability of iron absorption and also some iuminal factors affect this availability.

Obviously, absorption plays the determining role for the homeostasis of iron metabolism. Therefore, it was decided to investigate the effect of injection of iron compound as Imposil-200 Iron-Dextran (Fisons, England) to maintain body iron stores and provide a buffer against possible exposure of lactating buffaloes to iron defficiency during the dry season. The effect of such treatment on milk production and some haematological parameters of Egyptian buffaloes have been studied.

MATERIALS AND METHODS

This study was carried out on 10 buffalo cows, housed at El-Hawatka of the General Meat and Milk Establishment, Assiut Provience. The animals were selected from the big herd and they were at the 2nd to 4th lactation. Their milk yield was relatively low as compared to the average milk yield of the herd. These animals were at the second month of the lactation period. The animals were divided into two groups. The 1st group was the control group, the 2nd was the experimental group. Every animal of the experimental group received an intramusular injection of 30 ml of Imposil-200 per week for a period of 4 successive weeks.

As regards nutrition, the animals were fed a ration composed of pressed cubes of fodder which contained, cotton seed

cake 65%, rice polish 20%, wheat bran 9%, molasses 3% calcium carbonate 2% and sodium ohloride 1%. The starch equivalent and protein requirements were calculated according GHONEIM (1958).

Early in the morning before the animals were fed, blood samples were taken from the jugular vein in a two clean dry test tubes. The 1st blood sample was allowed to clot at room temperature and the separated serum was centrifuged to obtain clear serum. The 2nd sample was mixed with an anticoagulant (heparin).

The red blood (RBC), white blood corpuscles (WBC) counts, haemoglobin and haematocrit value were estimated. Total serum proteins were determined using Abe refractometer (MACFATE, 1972). The serum protein fractions were also determined by using paper electrophoresis (BLACK, DURRAM and ZWEL G,1958) using veronal buffer at pH 8.6. The absolute concentration of protein fractions were estimated from their relative per cent concentration and the total serum protein concentration. The total cholesterol was determined after the method of ILCA (1962). The alkaline reserve was determined by the method of KONDRAKHIN (1963) modified from the method of VAN SLYKE(1922). Total lipids were estimated by the use of test kits supplied by Merk, Darmstadt (Germany). Creatininine in blood was determined by reaction with alkaline picrate in protein free filtrate to form a yellow red colour which compared with standard creatinine solution (FOLIN, and WU, 1919).

Analysis of variance was done according to SNEDECOR(1962) and also students "t" test was applied.

RESULTS

Effect of parentral iron on milk yield:

The data presented in Fig. (1) and Tables (1&2) revealed that during the period of administration of iron-dextran caused an immediate significant increase in the milk yield of buffaloes. The effect of this preparation of iron extended after cessation of treatment for 15 weeks. The effect on milk yield was even more pronounced during the later period when compared with control ones.

Effect of administration iron-dextran on some haematological parameters:

Administration of Imposil 200 to buffaloes with a low milk yield did not have an influence upon RBCs and WBCs eounts. However it caused a significant increase in the haemoglobin content of blood (Table 3). The hematcorit value showed a tendency to increase though not significantly, due to individual variations.

Introduction of an artificial iron depot to buffaloes did not modify the total serum protein, although it was accompanied with a mild decrease in the alpha-globulin fraction and a mild increase in the gamma-globulin fraction. The amount of creatinine in the blood was also increased slightly during the injection of the iron compound. Other blood parameters studied namely, alkaline reserve, total lipids and cholesterol were not changed in the two experimental groups.

Table 1: Weekly average milk yield of different months of experiment for control and experimental groups of buffaloes treated with imposil- 200.

Lactation periods	Control	Experimental *	P
	X ± SE	X ± SE	
Initial milk yield	43.8	43.6	
1st month**	40.8±1.2	44.6±1.7	0.05
2nd "	32.8±0.8	35.3±1.0	0.05
3ed "	32.7±1.3	37.8±1.2**	0.01
4th "	29.8±1.5	34.4±1.5*	0.05
5th "	22.8±1.8	29.5±1.6**	0.01
6th "	20.2±1.3	20.3±1.6	0.05

* The experimental animals.

** The 1st month at which the experimental animals received injections of 30 ml Imposil-200 weekly for four successive weeks.

Table 2: Analysis of variance to show the effect of treatment and months of lactation.

Source of variation	d.f.	S.Sq.	M.Sq.	F
Between treatments	1	2104.05	2104.050	53.321**
" months	5	13224.49	2644.898	67.020**
Error	143	9588.86	39.460	--
Total	249	24917.40	--	--

* P < 0.05

** P < 0.01

Table 3: Effects of parentral administration if iron-dextran on some blood parameters of lactating buffaloes.

Items	Control group			Experimental group		
	Initial blood analysis	Blood analysis during the injection	Blood analysis after 8 weeks	Initial blood analysis	Blood analysis during the injection	Blood analysis after 8 weeks
RBCs mill/mm^3	5.58±0.08	5.52±0.14	5.23±0.09	5.42±0.14	5.64±0.26	5.58±0.16
WBCs thous/mm^3	6.64±0.22	6.60±0.18	6.96±0.20	6.68±0.11	6.84±0.17	6.66±0.9
Hb g %	10.0±0.16	10.02±0.11	10.02±0.17	9.90±0.23	10.54±0.15*	10.56±0.10*
Haematocrit value	42.04±0.58	41.92±0.98	40.84±0.39	41.86±0.67	42.4 ±0.51	42.5 ±0.38
Total serum protein g%	7.14±0.22	6.86±0.13	6.70±0.07	7.00±0.21	6.84±0.07	6.70±0.10
Alpha-globulin g%	0.95±0.02	0.99±0.03*	0.89±0.03	0.92±0.04	0.82±0.02	0.89±0.03
Beta-globulin g%	0.94±0.06	0.94±0.02	0.91±0.03	0.99±0.02	0.91±0.02	0.88±0.03
Gamma-globulin g%	2.69±0.10	2.49±0.04	2.49±0.03	2.55±0.09	2.67±0.05*	2.54±0.03
Albumin g%	2.56±0.10	2.45±0.07	2.48±0.02	2.55±0.07	2.45±0.02	2.39±0.05
Albumin/Globulin	0.559	0.555	0.587	0.573	0.569	0.554
Creatinine mg%	1.774±0.01	1.704±0.02	1.930±0.04	1.750±0.16	1.896±0.05*	1.778±0.04
Alkaline reserve mg Co_2%	39.50±0.44	39.68±0.37	40.38±0.17	39.4 ±0.81	40.0±1.22	40.6 ±0.40
Total lipids mg%	590±16.7	582±15.9	584±6.0	588±17.7	612±13.9	594±6.9
Cholesterol mg%	126.0±16.5	139.0±14.9	130±13.3	138.6±14.4	157.0±12.2	141.0±12.0

* Significantly different from respective control at P. / 0.05.

DISCUSSION

Tropical and subtropical environmental condition have adverse effects on the productive capacity of native and introduced European breeds of farm animals. Efficiency of milk production in cattle is closely linked with ability of adaptation and heat tolerance (PANDEY and ROY, 1969). These authors found that under such conditions one of the means of adaptation of buffaloes is an increase in RBCs count, haemoglobin concentration and haematocrit value. This leads to a draw of iron from its storage sites in the liver and other tissues.Administration of artificial depots of iron excludes the limitations of intestinal mechanisms involved in its absorption. In the present study parentral administration of iron resulted in a mild increase in blood haemoglobin without any changes in RBCs count and haematocrit value. This suggests that the mean corpuscular haemoglobin value is increased.This would beneficially increase the blood oxygen carrying capacity and releif the respiratory efforts (DALE and BRODY, 1954 and HOWES, SHIRLEY and HENTGES, 1963). This is supported by the present findings which showed no changes in the alkaline reserve of control and iron-treated buffaloes. All these factors favour increased milk production, a fact which has been reported in the case of cows (RUSOFF, FRYE and SCOTT, 1951).

It was noticed that during the period of administration of iron-dextran there was a mild increase in blood creatinine which is linked with endogeneous nitrogen catabolism (BLINCOE and BRODY, 1951). Although YOUSF and JOHNSON (1965) found that improvement of milk production by administration of thyroxine was accompanied with increased haematocrit value, but did not

influence significantly nitrogen metabolism. This was evident during increased milk production which was persistant after cessation of administration of iron. This was also evident from the presistance of total proteins, total lipids and chloesterol.

REFERENCES

Black, R.J., Durram,E.L. and Zwelg, G. (1958): Annual of paper chromatography and paper electrophoresis. 2nd Ed., Acad. Press, New York.

Blincoe,C. and Brody, S. (1951): Environmental physiology with reference to domestic animals.XVII. The influence of temperature on blood composition of cattle. Res. Bull. Mo. Agric. Exp. Sta. No. 488.

Dale, H.E. and Brody, S. (1954): Environmental physiology and shelter engineering with special reference to domestic animals.XXX Thermal stress and acid-base balance in dairy cattle. Res. Bull. Mo. Agric. Exp. Sta.,No. 562.

Folin, O. and Wu,H. (1919): A system of blood analysis.J.Biol. Chem. 38, 81.

Howes,J.R., Shirley,R.L. and Hentges, J.J. (1963): Comparative gas carrying capacities of blood from Brahman and Herford cattle. J. Anim. Sci., 22: 58 - 585.

Ilca,Z.(1962): Express method for determination of total serum cholesterol. Ges. Inn. Med. 17, 83.

Kolb, E. (1963): Advan. Vet. Sci, 8, 49. (Cited by Underwood, E.J., 1971).

Kondrakhin, E.P. (1963): New method for determination the alkaline reserve. Moskovski Vet. Acad. Vol. 47.

Macfate,R.P. (1972): "Introduction to the clinical laboratory" 3rd Ed. Year Book Medical Publishers. Inc. Chicago, USA.

Pandey,M.D. and Roy,A. (1969): Variations in cardiorespiratory rates, rectal temperature, blood haematocrit and haemoglobin as measures of adaptability in buffaloes to a hot environment. Brit. Vet. J. 125: 463 - 471.

Rusoff, L.L., Frye, J.B. Jr. and Scott, G.W.J. (1951): Blood studies of Red-Sindhi-Jersey crosses. I-Haemoglobin, haematoorit, plasma calcium and plasma inorganic phosphorus values of Red-Sindhi- Jersey daughters and their Jersey dams. J. Dary Sci., 34: 1145-1150.

Snedecor, G. (1962): Statistical Methods (5th Ed.) Iowa State University Press, Ames. Iowa, U.S.A.

Underwood, E.J. (1971): Trace elements in human and animal nutrition. 3rd Ed. Acad. Press, New York and London.

Van Slyke, D.D. (1922): Determination of the bicarbonate concentration of the blood and plasma. J. Biol. Chem. 52 : 495.

Yousf, M.K. and Johnson, H.D. (1965): Some blood constituents of dairy cattle: Influence of thyroxine and high environmental temperature. J.Dairy Sci.48:1074-1078.

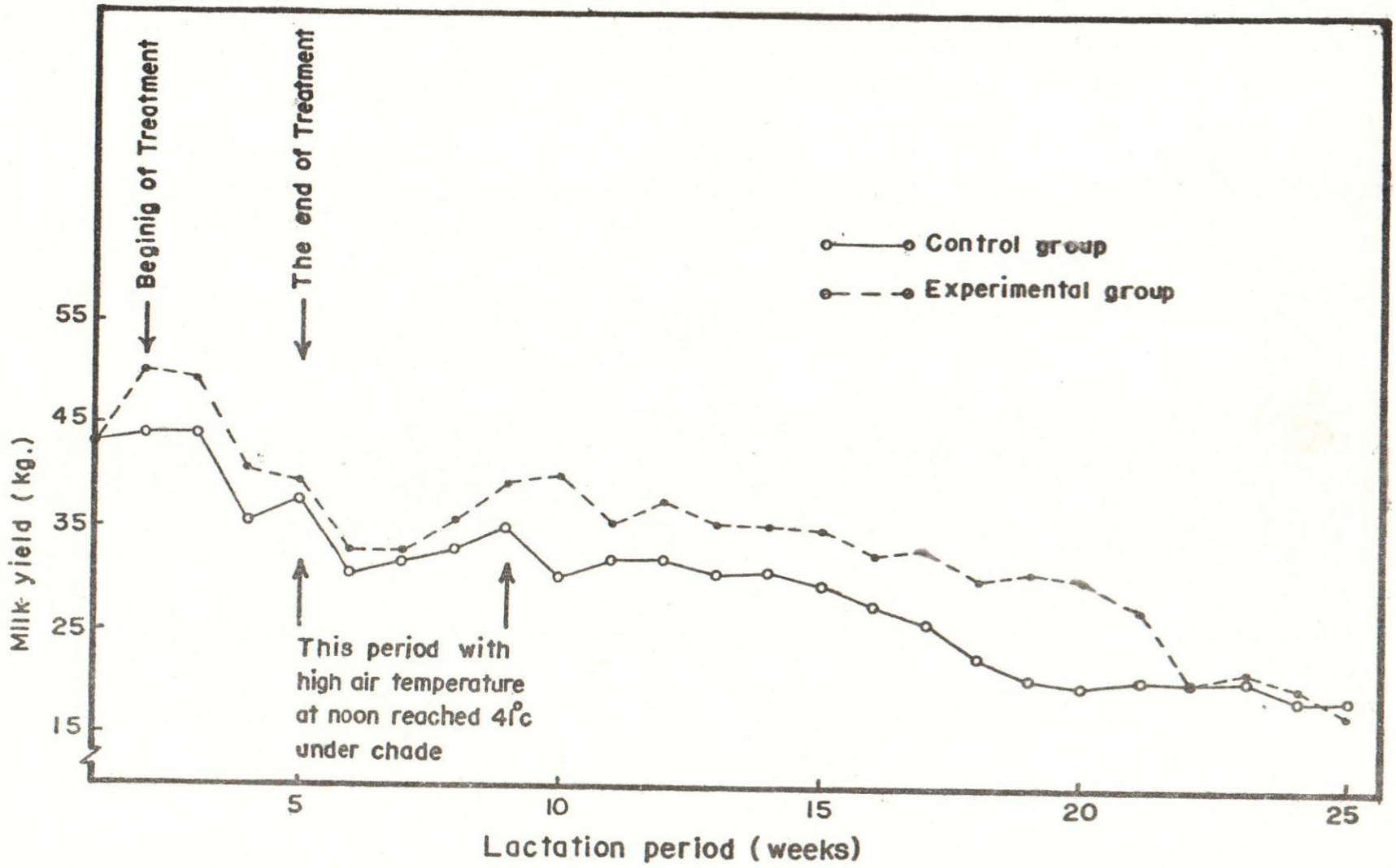

Fig.(1) Average weekly milk yield of buffaloes treated with Imposil_200