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THE INFLUENCE OF WINTER AND SUMMER RATIONS ON BODY WEIGHT DEVELOPMENT AND SOME BLOOD CONSTITUENTS OF BUFFALO HEIFERS AT TWO DIFFERENT AGES

(With 5 Tables)

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تأثير العلائق الشتويه والصيفيه على وزن الجسم وبعض مكونات الدم فى عجلات الجاموس عند عمرين مختلفين

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أجريت هذه التجربه على عدد ٣٨ من عجلات الجاموس عند عمر ١٢-١٨ ، ١٨-٢٤ شهراً لدراسة تأثير علائق كل من الشتاء والصيف على النمو وبعض مكونات الدم فى هذه الحيوانات بجانب القاء الضوء على مستوى بعض العناصر المعدنيه سواءاً فى مواد العلف أو العلائق نفسها خاصة ما يؤثر منها على المستقبل الانتاجى لعجلات الجاموس . قسمت العجلات الى أربعة مجاميع منها مجموعتين ذات عمرين مختلفين فى الشتاء ومثلها فى الصيف . وقد استمرت التجربه لمدة ثمانية شهور (أربعة شهور فى كل فصل).

وقد اتضح من التجربه زيادة وزن العجلات فى الشتاء عنه فى الصيف ووضحت هذه الزياده فى العجلات الأصغر سناً .

لوحظ أيضاً وجود اختلاف معنوى موسمى فى مستويات كل من الكالسيوم والفسفور والنحاس والزنك والسلينيوم بينما لم يلاحظ تغيير فى مستوى البروتين الكلى أو المنجنيز فى سيرم الدم .

وقد اتضح أيضاً نقص مستوى عنصرى المنجنيز والزنك فى العلائق ومواد العلف والتى تم شراؤها من محافظتى الاسماعيليه والشرقيه وينصح باضافة هذين العنصرين لعلائق عجلات الجاموس فى هاتين المحافظتين .

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SUMMARY

38 buffalo heifers at 12-18 and 18-24 months old were used to investigte the effect of winter and summer rations on body weight development, some blood constiuents and also to shed light upon some minerals content, either in the used feedstuffs or rations, especially the minerals which may affect the future breeding efficiency of buffalo heifers. Therefore two groups of two ages in winter and another similar two groups in summer were used. The experimental period was extended for eight months (four months for each season). There was a slight increase in body weight of heifers on winter than summer season. This increase was higher in younger than older heifers. Seasonal variations in serum levels of Ca, P, Cu, Zn, Se, T_3 and T_4 were observed, while Mn and total serum protein were not changed. The minerals content of rations for buffalo heifers and the analysis of the used feedstuffs, which were purchase form Ismailia and Sharkia provinces, revealed that these rations must be supplemented with Mn and Zn.

Keywords: Rations, body weight, blood, buffaloes.

INTRODUCTION

Beyond a doubt the ration composition, either in winter or summer, plays an important role in health and productivity performance of the animals. However, the majority of the macro and microelements during the green or dry season, especially those which may affect the future breeding efficiency are of especial importance for buffalo heifers. Moreover, information pertaining to the status of majority of these elements during green and dry season in early puberty of buffalo heifers appear to be less understood. Therefore, an experiment was designed to investigate the weight gain as well as some mineral elements, total protein, T_3 (Triiodothyronine) and T_4 (Tetraiodothyronine or thyroxine) in the blood of buffalo heifers at two ages (12-18 and 18-24 months) in winter and summer, also to study the level of these important minerals either in feedstuffs or rations for these animals. Thyroid hormones were studied in this investigation as they required for growth, maturation and related to the various phases of reproduction *(COLES, 1986)*, also thyroid hormones increase glycolysis, glyconeogenesis and glucose absorption from the intestine to stimulate new protein

syntheses (*FRASER* et al., *1986*), meanwhile the thyroid activity is greater in winter and spring than summer (*ASPLUND* et al., *1959*).

The recommended mineral contents of rations for growing heifers in percentages are 0.40 & 0.26 for Ca & P, while the microelements in ppm are 10; 40; 40 and 0.10 Cu, Mn, Zn and Se respectively (NRC, 1978).

Total serum proteins in buffalo heifers during winter and summer season were 7.89 and 7.74 gm% (*SHARAWY, 1980*), 8.2 and 9.6 gm% (*ABDEL REHEIM, 1982*). *HAFEZ and ANWAR (1954)* found that Ca level ranged form 90 to 11 mg% in serum of buffaloes, while *FOAD* et al. *(1975) and OSMAN* et al. *(1985)* rerecorded 7.7 to 11.6 and 6.87 to 14.06 mg% in healthy buffaloes respectively. Serum P. level ranged from 2.46 to 8.24 mg% in normal buffaloes (*BARAKAT and HASSANEIN, 1968*), while *FAHMY* et al. *(1979) and ABOUD (1989)* recorded 7.5 mg% in 15 months old buffalo calves and 6.79 mg% in buffalo calves over 2 years old respectively. Serum Cu level obtained from Egyptian water buffalo ranged from 84 to 125 Ug% (*GAZIA, 1983*) while in buffalo calves, *ATTIA* et al. *(1987,II)* recorded 143.14 to 190.85 Ug%. Serum Mn level in buffalo heifers ranged from 11.3 to 17.26 Ug% with average level of 14.28 ug% (*EASSA, 1987*), while *BLOOD* et al. *(1983)* stated that the Mn level in blood of normal cattle is 12-19 Ug%. They mentioned also that the normal serum Zn level is 80-120 ug/dL. *EL SAYED (1990)* reported that the maximum and minimum level of se in the serum of healthy buffalo calves 1-2 years old were 58.2 and 108.2 Ug/dL. Regarding the activity of thyroid gland *ISMAIL (1991)* noted that the thyroid hormones concentration (T_3 and T_4) increase during winter (29.11 and 4.2 Ug/dL) than summer (78.42 and 2.38 Ug/dL) in the serum of sheep.

This study aimed to investigate the effect of winter and summer rations on the performance of buffalo heifers, some blood constituents and also to shed light upon some minerals content either in the used feedstuffs or rations, especially the minerals which may affect the future breeding efficiency of these animals.

MATERIAL and METHODS

Thirty eight buffalo heifers, 12-18 and 19-24 months-old with an average weight 211 and 275 Kg respectively, were used to carry out this investigation. The animals were apparently healthy and free from parasites. They were divided into four groups, two groups were in both winter (green season) and summer (dry season) with the numbers and ages shown in table 1. Each group was kept in a separate pen at the farm of the

Faculty of Vet. Med., Suez Canal University. The experimental periods were 4 months in winter (from December to March) and 4 months in Summer (form June to September). the rations composed of feedstuffs which have been purchased from Ismailia and Sharkia Governorates as green berseem, commercial concentrate mixture (CCM) and wheat straw in winter while in summer the ration was composed of CCM, berseem hay and wheat straw (The rations were calculated to satisfy the need of these animals as recommended by *RANJHAN (1980).* The CCM was composed physically in percentages of 25 corn, 35 wheat bran, 20 CSC, 7.85 molasses, 7 rice polish, 3 ground limestone, 1.2 common salt, 0.8 urea, and 0.15 sulphur. The wheat straw was fed *ad libitum* and the offered amounts were weighed to find out the consumed part as reported in table 1. Mineral blocks were fixed in front of the animals beside the mangers as a free mineral supplement (Phos-Rick Rochies®, Produced by Tithebran, Ltd., U.K.).

The used feedstuffs were chemically analysed after collecting several samples during the experimental periods for determination of moisture, ash, Cp. fat. fiber and NFE followed the general conventional methods after *NEHRING (1960).* Moreover, the mineral elements Ca, P, Cu, Mn, Zn and Se in feedstuffs were determined by flame atonic absorption after the preparation of the sample in aqueous form as described by *AOAC (1975).*

Heifers were weighed at the start and the end of the experimental periods to find out the weigh gain. Blood samples were collected at the end of each experimental period. Blood serum levels of Ca, Cu, Zn, Mn and Se were determined by using atomic spectrophotometry system as described by *WILLIS (1960),* while P and total serum protein were determined according to *RAAB and ARCH (1952) and WEICHSELBAUM (1946)* respectively. In addition T_3 and T_4 were determined according to *KAPLANM (1985).*

The obtained data were statistically analysed according to the method described by *SNEDECOR and COCHRAN (1967).*

RESULTS

Results are presented in tables (1-5).

DISCUSSION

Table 2 shows the chemical composition of the feedstuffs used in the formulation of rations for heifers during the experimental periods. From the data in this table, besides the amounts of rations stated in table 1, the mineral levels were calculated in these rations in both winter & summer (Table 3).

The range of Ca, P, Cu and Se levels in the different rations were 0.62-0.81%, 0.50-0.59%, 10.14-10.90 ppm and 0.166-0.180 ppm respectively. It was very clear that these levels covered the recommended level required by heifers according to *NRC (1978)*. On the other hand the level of Mn and Zn (28.62-32.92 and 17.01-23.80 ppm respectively) were under the recommended levels. These findings were confirmed by the data stated in table 2, Whereas the Mn and Zn contents of berseem (23.61 and 30.49 ppm) and CCM (33.11 and 35.12 ppm) were lower than that recorded by *ATTIA et al. (1987, I and II)* who reported that the Mn contents were 99.25 ppm in berseem and ranged from 46.96 to 47.5 ppm in CCM, while Zn contents were 38.49-44.23 ppm in berseem and 53.94 to 103.25 ppm in CCM. On the other hand Mn content was very low in wheat straw, 28.13 ppm (Table 2) than that stated by *NRC (1978)* which was 40 ppm Concerning the other parameters showed in table 2 for berseem and CCM, they were within the normal range as mentioned by *ATTIA et al. (1987, I and II)*, while those for berseem hay and wheat straw were within the normal range stated in the Egyptian Feed Composition Tables by *MINISTRY of AGRICULTURE (1968) and NRC (1978)*. Therefore, one may expect the deficiency symptoms of Mn and Zn in animals fed on rations formed of feedstuffs cultivated in Ismailia or Sharkia provinces if such rations were not supplemented with these minerals. Such deficiency symptoms were not appeared on the buffalo heifers in our study due to the presence of the salt blocks in front of these animals along the experimental period.

Some blood serum parameters of heifers either at the age of 12-18 or 18-24 months in winter and summer are shown in table 4. There was no significant ($P<0.05$) change regarding serum total proteins where level ranged from 8.544 to 9.638 gm% which agree with those recorded by *ABDEL REHIM (1982)*. Similarly, Mn levels were not significantly ($P>0.05$) changed in winter and summer in all groups, it was ranged from 12.983 to 14.224 Ug%. These results were coincided with that reported by *EASSA (1987)*. Ca levels were within normal in all heifers at both seasons, and ranged form 9.698 to 11.518 mg%. These data were in accordance with those reported by *HAFEZ and ANWAR (1954), FOAD et al. and OSMAN et al. (1985)*. There was also a significant ($P<0.05$) increase in serum Ca levels in winter than Summer at both ages which in agreement with *SHARAWY (1980)* who reported 9.13-11.02 and 8.69-1.71 mg% in winter and summer respectively. The serum Zn levels had also the same manner as serum Ca and its level ranged from 82.667 to 108.857 Ug/L which is in accordance with *BLOOD et al. (1983)*. Regarding serum P, Cu and Se levels, they were increased significantly in summer than winter, although they were within the normal level, P

(5.933-7.759 mg%), Cu (93.133-121.033 Ug%) and Se (71.786-79.40 UG/L) which coincide with *BARAKAT and HASSANIEN (1968), GAZIA (1983) and El-SAYED (1990)* respectively. Regarding T_3 and T_4 their levels were significantly increased in winter than in summer in all groups which was proved by *ASPLUND* et al. *(1959).*

It is of interest to notice that Zn and Mn were of normal levels in blood of all animals although the low level contents of the used rations. This may be due to the presence of the salt blocks.

The data concerning the body weight development and average daily body weight gain of heifers in the different groups are stated in table 5. From the tabulated data, one can observe that the highest body gain was recorded in heifers at 12-18 months old either in winter or summer (47.7 and 44.0kg respectively) with the average daily gain 0.398 and 0.367kg in winter and summer respectively. This difference in body gain between heifers at 12-18 and 18-24 months old may be due to the age factor. It was also noticed that body weight gain was higher in winter than summer for both ages. This weight increment in winter may be due to the hormonal effect of the thyroid hormones *(FRASER* et al., *1986)* as the levels of T_3 and T_4 were significantly ($P<0.01$) increased in winter than summer.

It could be concluded that rations for buffalo heifers must be supplemented with some trace elements especially Mn and Zn. There were also seasonal variations in some serum parameters such as Ca, P, Cu, Zn, Se, T_3 and T_4 with an increase in body weight gain in winter than in summer season.

REFERENCES

Abdel-Rehim, A.A. (1982): Studies on serum constituents in fertile and infertile cows and buffaloes. Assiut Vet. Med. J. 10, 19: 101-108.

Aboud, M.M. (1989): Some studies on downer cow syndrome M.V.Sc., Fac. Vet. Med., Zag.

A.O.A.C. (1975): Official Methods of Analysis. 12th Ed., Association of Official Analytical Chemists. Washington, D.C.

Asplund, R.O.; McLaren, G.A.; Henderson, H.O. and Perterfield, I.D. (1959): Unusual magnitude and variation of plasma protein bound iodine values of dairy cattle. J. Dariy Sci. 42: 1718-1726.

Attia, A.N.; Awadalla, S.A.; Esmail, E.Y. and Hady, M.M. (1987,1): Role of some microelecments in nutrition of water buffalo and its relation to producation. I. Effect of copper supplementation. Assiut Vet. Med. J. 18 (35) 82-90

Attia, A.N.; Awadalla, S.A.; Esmail, E.Y. and Hady, M.M. (1987,II): Role of some microelements in nutrition of water buffalo and its relation to producation. II- Effect of zinc supplementation. Assiut Vet. Med. J. 18(35) 92: 100-107.

Barakat, M.Z. and Hassanein, R.R. (1986): Biochemical Analysis of normal buffalo blood. Zent. Bl. Vet. Med. 15A: 69-76.

Blood, D.C.; Radostitis, O.M.; Henderson, J.A.; Arundel, J.H. and Gay, C.C. (1983): Veterinary Medicine. 6th Ed. Bailere, Tindall.

Cloes, E.H. (1986): Veterinary Clinical Pathology. 4th Ed. W.B. Saunders Company, Philadelphia, U.S.A.

Eassa, A. (1987): Wool and hair as an effective tool for diagnosis of some deficiency of diseases and environmental pollution. Ph.D. Fac. VEt. Med., Zag. Univ.

El-Sayed, R.F. (1990): The effect of some diseases on some minerals and trace-elements levels in blood of buffalo calves. Ph.D., Fac. Vet., Suez Canal Univ.

Fahmy, Fawzia; Amer, A. and Abdel Aziz, H. (1979): Normal status of zinc in blood of buffaloes in relation to some minerals. Assiut Vet. Med. J. 6, 11 and 12: 347-354.

Foad, M.T.; Awad, Y.L.; Eldein, M.S. and Fahamy, F. (1975): Certain biochemical abnormalities associating alopacia in buffalo calves. Egypt J. Vet. Sci. 12: 1: 23-31.

Fraser, C.; Mays, A.; Amstutz, H.; Armour, J. and Blood, D. (1986): The Merck Vet. Manual. 6th Ed. Merck and Co. Inc., U.S.A.

Gazia, Nabila A. (1983): Copper status and its blood level in sheep and cattle with special referance to Egyptian water buffaloes. Assiut Vet. Med. J. 10, 20: 33-40.

Hafez, E.S. and Anwar, A. (1954): Normal haematological value in the buffaloes. Nature 179: 611-619.

Ismail, S.A. (1991): Seasonal effect on the digestibility of sheep ration M.Sc., Fac. Agric., Zagazig Univ.

Kaplanm, M. (1985): Clinical and laboratory assessment of thyroid abnormalities. Medical Clinics of North America 69: 5-14.

Ministry of Agriculture (1968): Animal and Poultry Nutrition. Depts. Animal and Poultry Researchs. 2nd. Tahrier Lib. Cairo, (in Arabic Language).

Nehring, K. (1960): Agriculturchemische untesuchungs methoden fur Dunge und Futtermittel, Boden und milch; Verlag Parey, Hamburg, Berlin, (1960).

NRC (1978): Nutrient requirement of dairy cattle 5th Ed. National Academy of Sciences. Washington. D.C.

Osman, A.; Naggar, M.; Farrag. A. and Shehata, S. (1985): Ovarian incactiveity among Egyptian cows and buffaloes. B-Blood analysis. Assiut Vet. Med. J. 14, 27:219-230.

Raabe, S. and Arch, F. (1952): Photometric analysis with photometer "I.Ph. Serum". Medicine 142, 58: 282-288.

Ranjhan S.K. (1980): Animal Nutrition in Tropics. Vikas Publishing House, PVT, LTD, Ghaziaba V-P. India, (1980).

Sharawy, S.M. (1980): Some studies on ovarioan activity in buffaloes. Ph.D., Fac. Vet. Med., Zag. Univ.

Snedecor, G.W. and Cochran, W.G. (1967): Statistical Methods. 6th Ed. Iowa State univ. Press. Iowa, USA, (1967).

Weichselbaum, T.E. (1946): An accurate and rapid method for determination of protiens in small amounts of blood serum and plasma, Am. J. Clin. Path. 16: 40-46.

Willis, J.B. (1960): The determination of metals in blood serum by atomic absorption spectrophotometry. Spector Acta. 16: 259-272.

Table (1): Age numbers of heifers and rations used during the green and dry season.

Age of the heifers (month)	Number of the animals	Av. feed consumption per head daily	Season
12-18	14	2kg CCM 10 Kg berseem 2 Kg wheat straw	Winter
18-24	12	2.5 kg CCM 11 Kg berseem 2.25 Kg wheat straw	Winter
12-18	6	2.25 kg CCM 1.75 Kg berseem hay 1.75Kg wheat straw	Summer
18-24	6	2 kg CCM 2.5 Kg berseem hay 2 Kg wheat straw	Summer

Table (2): Chemical Compostion of the feedstuffs used in rations for heifers during the experimental periods.

Paremeter	CCM	Berseem	Berseem hay	Wheat straw
DM %	90.00	14.30	90.02	92.60
CP %	17.00	2.40	14.00	1.35
EE %	5.76	0.66	3.15	0.56
Fiber %	15.85	4.62	32.16	37.86
Ash %	6.88	1.68	9.34	9.10
NFE %	44.51	4.94	31.37	43.73
Ca mg %	0.49	1.96	1.21	0.22
P mg %	1.26	0.29	0.27	0.05
Cu ppm	14.44	12.26	13.11	4.31
Mn ppm	33.11	23.61	36.71	28.13
Zn ppm	35.12	30.49	11.17	6.50
Se ppm	0.15	0.18	0.14	0.21

- Minerals were calculated on a dry matter basis.

Table (3): Recommended and actual mineral contents of rations for buffalo heifers during the experimental periods in witner and summer.

	Ca,%	P,%	Cu, ppm	Mn, ppm	Zn, ppm	Se, ppm
Recommended mineral content*	0.40	0.26	10	40	40	0.100
Minerals content in ration for heifers (12-18 months) in winter	0.81	0.55	10.14	28.62	23.39	0.180
Minerals content in ration for heifers (18-24 months) in winter	0.79	0.57	10.29	28.83	23.80	0.179
Minerals content in ration for heifers (12-18 months) in summer	0.62	0.59	10.90	32.65	19.03	0.166
Minerals content in ration for heifers (18-24 months) in summer	0.68	0.50	10.76	32.92	17.01	0.165

* Accoding to NRC (1978).

Table (4): Some serum contents of heifers (12-18) and (18-24) months old in Winter and Summer.

Items	Heifers (12-18 months)		Heifers (18-24 months)	
	Winter	Summer	Winter	Summer
Total protein gm%	9.638±0.068	9.426±0.069	8.717±0.062	8.544±0.108
Calcium gm%	11.518±0.149	10.688±0.213*	10.598±0.131	9.698±0.208*
Phosphorus gm%	6.592±0.143	7.75±0.204**	5.833±0.236	6.722±0.077*
Copper Ug%	99.4±3.772	121.033±5.011*	93.133±2.231	105.00±3.87*
Manganese Ug%	14.114±4.605	14.224±5.442	12.983±4.165	13.448±2.082
Zinc Ug/L	108.857±2.535	97.333±1.641*	91.50±1.345	82.667±2.221*
Selenium Ug/L	71.786±5.507	76.30±3.896*	73.32±3.186	79.40±9.245*
T_3 ug/L	1.486±0.079	1.033±0.125*	1.15±0.061	0.933±0.061*
T_4 ug/L	66.857±0.941	54.667±1.254**	60.167±0.916	50.833±1.18**

* Significant ($P<0.05$)

** Higly significant ($P<0.01$)

Table (5): Body weight development and body weight gain in different groups of heifers in Winter and Summer.

Items	Heifers (12-18 months)		Heifers (18-24 monts)	
	Winter	Summer	Winter	Summer
Av. initial body weight (kg)	206.571±3.571	215.667±3.17	271.333±1.800	278.667±3.183
Av. initial body weight (%)	100	100	100	100
Av. final body weight (kg)	254.286±2.462	259.667±3.596	314.410±1.417	319.833±2.806
Av. final body weight (%)	123.1	120.4	117.0	114.8
Av. total body gain (kg)	47.714±1.399	44.000±0.632	43.083±0.636	41.167±0.868
Av. daily gain (kg)	0.398±0.011	0.367±0.005	0.359±0.005	0.343±0.007