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THE FUNCTIONAL STATE OF THYROID AND PARATHYROID GLAND WITH RELATION TO CALCITONIN LEVELS OF HIGH PRODUCING COWS

[1]El-Hag, Y. I., [1]Babiker, M. A., [2]Ahmed, D. E., [3]Hammed, M. E., [4]Turki I. Y. & [4]Khogali, M. E.
[1]Department of Medicine, Faculty of Veterinary Medicine, Bahri University
[2] Department of Meat Science and Technology, Faculty of Animal Production Science and Technology
[3] Department of Milk Science and Technology, Faculty of Animal Production Science and Technology
[4] Department of Animal Production, Faculty of Animal Production Science and Technology

ABSTRACT
The study was conducted on high producing cows 3 to 8.5 years old, to determine the level of thyroid, parathyroid and calcitonin levels. Each group consisted of 50 heads based on their ages and productivity. Trace element deficiency was clearly manifested in the experimental animals mainly in cows of 8 years old. The result of this study showed that there is a direct relation between the activities of the thyroid, parathyroid hormones on the age of the cow, the season of the year. The results also showed that keeping animals on a basic ration which is deficient in iodine, cobalt and zinc leads to progressive hypo function of the thyroid gland.

KEYWORDS: Thyroid, parathyroid, element deficiency, iodine cobalt and zinc.

INTRODUCTION

Osteodystrophy is a chronic disease of adult animals accompanied with dystrophic changes in the bone tissues mainly due to disorder of calcium and phosphorous ratio and vitamin D deficiency. Sharabrin (1983) and Bandzaite *et al.*, (2005) reported lowest calcium and phosphorous blood levels in cows with parturient paresis and decreased phosphorus and magnesium in cows with osteomalacia. Osteodystrophy is reported in dairy cows in highly specialized farms in KIEV district Ukraine (Sudakov and Onipinko, 1977). Hormones play an important role in supporting the balance of minerals in ruminant animals.

Kondrahin (1980) observed that under the hypo function of the thyroid gland in cows the thyroid calcitonin decreased and the activity of the osteoblast diminished and the function of the osteoclast increased. According to Block (1993) two parathyroid dependent functions, bone resorption and renal production of 1.25 dihydroxyvitamin D, these responses are enhanced in cows fed diets with added onion which increases the resistance to milk fever and hypocalcaemia. Calcitonin reduces Ca removal from bones and increases urinary Ca excretion.

Vital traceelements, iodine, zinc and manganese play an important role in the metabolism of calcium and phosphorus hence these elements constitute part of the hormones and vitamins involved in calcium and phosphorous metabolism (Tabanov *et*

The present study was conducted to investigate the functional activity of hormonal regulation (T_4, T_3, TSH, PTH, calcitonin) , calcium and phosphorus blood level in pregnant heifers 30 – 40 days before parturition and cows before third and fifth parturition in KIEV district-Ukraine in which the biochemical composition of the soil and plants known to be deficient in some trace elements like iodine, cobalt and zinc.

MATERIALS AND METHODS

Experimental animals:
The experiment was carried in dairy farm sovki in KIEV district for two years period.

High producing black dotted dairy cows (3 to 8.5 year) (productivity 5.5–6 thousand liter of milk). The first group consisted of 50 cows received the basic ration plus daily supplementation of 6mg potassium iodide, 30mg cobalt chloride and 1200mg zinc sulphate per head. The other 50 cows were given only the basic ration as a control.

Clinical Examination:
The clinical examination carried according to Sudakov *et al.* (1977) including abnormalities in growth of hair, mucous membranes, changes in the heart tone, osteolysis of the last coccygeal vertebra and other as show in table (1).

These examinations were performed twice, in November, the beginnings of the experiment and in May.

Blood Hormones level:
For serum analysis,10 animals from each group were randomly selected and sampled. Hormones levels were measured by radioimmunoassay using commercial kits.

For parathyroid hormone Ria-MAT-PTH was used, for calcitonin Ria MAT calcitonin (kits) was used, for thyrolropic (thyroxin stimulating hormone Ria MAT TSH was used. These reagents (kits) were obtained from Mallinckrodt Diagnostic Company (Germany). For thyroxin (T_4) and Tri-iodthyronin (T_3) Ru T_4-PG reagent and Ru-Tri-iod thyronin PG reagent(kits) obtained from Biochemical Institute. Byelorussia were used respectively.

Data Analysis: The significance of difference was calculated by T-test at $P<0.05$ level of significance using SPSS program Microsoft Excel software.

RESULT AND DISCUSSION

Clinical examination of high producing cows with osteodystrophy showed signs of cobalt, zinc and iodine deficiency as presented in table (2).

The symptoms of iodine, zinc and cobalt deficiency were clearly manifested in cows at late stage of pregnancy about 30 to 40 days before parturition because these animals are in need of traceelement which not available in the main ration.

TABLE 1: Composition of basic ration given to both groups

Component	Wt Kg	Wt DM Kg	DCP gm	TDN gm	Cellulose Kg	Ca gm	P gm	Caroten e gm
Concentrate	3	2.5	432	117	0.03	6.7	11.6	00
Grass Hay	10	4.5	330	160	1.4	55	6	350
Straw	2	1.42	16	13	0.51	4.8	1.8	6
Silage	25	5.35	300	332.5	1.85	41.75	13.25	300
Hay	3	2.19	93	42	0.74	18	6.4	6
Beat Roots	8	0.93	72	432	0.03	3.5	4.16	00
Molasses	1	0.12	45	473	0.00	3.2	0.15	00
Bear Residue	4	0.18	2.08	00	0.11	3.92	7.36	8
NaCl	1	00	00	00	00	00	00	00
Total	56.1	17.19	14.96	1569.5	4.67	136.87	50.87	670

DCP = digestible crude protein, TDN = total digestible nutrient, DM = dry matter , Wt = weight

TABLE 2: Clinical Examination of high producing cows with osteodystrophy

Clinical Findings	Groups of cows and data of inspection					
	Dairy Heifers 30-40 days before parturition		Cows before the third parturition		Cows before the fifth parturition	
	November	May	November	May	November	May
1\ Abnormal growth of hear	54	58	12	18	10	12
2\ Dry skin	14	16	12	10	12	14
3\ Pale mucous membrane	42	48	24	22	20	22
4\ Change in the heart lone	20	26	58	38	56	60
5\ Osteolysis of coccidial vertebra	16	28	56	62	86	92
6\ Abromalities of the teeth	28	24	16	18	56	60
7\ Osteolysia of the last rib	-	-	20	22	32	28
8\ Deformity of the horn	-	-	18	20	16	48
9\ Effect on the limbs	-	-	10	12	28	26

The symptoms of osteodystrophy is clearly manifested in cows of 8 years old and it is good seen in cows at the end of the second lactation and not seen in dairy heifers at late stage of pregnancy. Similar results were reported by Sharabrin *et al.* The results of this study showed that there is direct relation between the activity of the thyroid and parathyroid hormones, the age of the animal and season of the year. Its observed that keeping cows or traditional ration deficient in iodine and other trace elements leads to progressive hypo function of the thyroid gland. The concentration of T_3, T_4 in the plasma of high producing and heifers were very low than the standard values (1.7-2.1) and (33-45.5 n mol/l) respectively table (3) (Bunder, 1988). The concentration of TSH to different group of cows is slightly changed, that means there is hypo function of the thyroid gland, as a result of iodine deficiency (table 4 and 5). These results were reported by Bunder (1988) who noted hypothyroidism and metabolic disorder in high producing cow in KIEV district. The hypothyroidism leads to decrease not only T_4 but also calcitonin which is clearly manifested in cows with clinical signs of osteodystrophy. The level of calcitonin was lower in high producing cows with severe symptoms of osteodystrophy (20.2±4.2) while it was (43.64±0.62 ng /ml) in cows with primary osteodystrophy (Lukasz *et al.*, 2005). The concentration of PTH in the plasma blood of the experimental cows is elevated according to progressive dystrophic changes in the bone tissues. In heifers at late stage of pregnancy the level of PTH was 1.51±0.16 ng/ml while in cows of eight years old it was 2.51±0.32 ng/ml. In May after four month of trace element supplementation the level of Blood calcitonin hormone in cows received trace element supplements reached 148±0.64 ng/ml which is significantly ($P<0.05$) higher than 103±2.38 ng/ml reported in the control. The level of calcitonin was sharply increase in both treatment due to green fodder given to the animals instead of dry stored and silage, in addition to that the animals were released to the direct sunlight exposure after they had been indoors. In the same month (May) the level of the blood parathyroid hormone (PTH) decrease from 1.48±0.13 ng/ml than recorded in January 0.39±0.01 in cows given trace element supplements and was significantly ($P<0.05$) table (2).The role of trace element supplementation on elevation of calcitonin blood and reducing parathyroid level reputed in the cows supplemented with trace element. This study agreed with findings of Blum *et al.* (1974), Garlet and Barlet (1975) and Lukasz and Adam (2005) who reported decrease of calcitonin level during hyperparathyroidism indicating suppression of osteoblast process activity and osteolysis agumentation. These authors also reported that increase of parathyroid hormones activity over long periods could cause fibrous osteodystrophy which lead to decalcification of bones making them soft and fragile.

TABLE 3: Plasma levels of T4, T3, TSH, PTH and calcitonin in dairy heifers post calving during the experimental period

		Cows given trace elements supplement			Cows not given trace elements supplement		
Hormones	Unit	January	May	October	January	May	October
T_4	nmol/l	40.2±3.32	82.2±3.3	62.8±6.8	37.7±0.8	51.0±3.92	41.6±1.74
T_3	nmol/l	0.98±0.05	2.05±0.08	3.56±0.04	1.14±0.06	1.97±0.09	3.40±0.09
TSH	me/ml	1.50±0.08	1.45±0.32	1.70±0.02	2.31±0.02	2.29±0.12	2.15±0.03
PTH	ng/ml	1.48±0.13	0.39±0.01	1.08±0.09	1.54±0.31	0.63±0.02	2.18±0.06
Calcitonin	ng/ml	18.6±2.30	148±0.64	16.3±0.64	17.4±0.76	10.3±2.38	13.69±2.00

T_4= Thyroxin, T_3= Tri-iodo-thyroxin, TSH= Thyroid stimulating hormone, PTH= Parathyroid hormone.

TABLE 4: The level of thyroid, parathyroid hormones and thyrotrophic hormones in the plasma of high producing cows before third parturition

M+m n=10

		Group of animals an data of examination					
		Cows with slight symptoms of osteodystrophy			Cows with severe symptoms of osteodystrophy		
Hormones	Unit	November	May	October	November	May	October
T_4	nmol/l	46.17±4.55	50.38±3.40	55.77±1.48	33.51±2.06	36.79±5.88	48.12±2.40
T_3	nmol/l	1.55±0.04	2.23±0.14	2.75±0.05	1.47±0.08	1.41±0.08	1.81±0.06
TSH	me/ml	2.58±0.01	1.39±0.02	2.22±0.05	2.63±0.12	2.47±0.90	1.85±0.17
PTH	ng/ml	1.31±0.26	0.43±0.02	2.01±0.40	2.67±0.12	1.30±0.45	2.53±0.32
Calcitonin	ng/ml	16.07±0.43	133.73±1.16	43.5±1.06	6.64±1.06	45.40±0.62	20.2±4.20

TABLE 5: The level of thyroid, parathyroid and thyrotrophic hormones in plasma of high producing cows before fifth parturition

M+m n=10

		Data of examination		
Hormones	Unit	November	May	October
1	2	3	4	5
T_4	n mol/l	41.68±1.41	38.38±1.19	39.07±2.19
T_3	n mol/l	1.74±0.07	1.48±0.07	1.42±0.09
Thyrotrophic	me/l	2.16±0.12	2.65±0.02	2.75±0.04
PTH	ng/ml	2.90±0.59	1.35±0.05	2.27±0.06
Cat	ng/ml	3.93±0.15	36.28±2.29	16.61±1.19

CONCLUSION

1. The results of this study showed that in zones of microelement deficiency, the deficiency of traceelement causes hypothyroidism in high producing cows of different ages, this was accompanied by a decrease in the iodine containing hormones T_3, T_4 and calcitonin.
2. The activity of the parathyroid hormones on the account of decrease of calcitonin level appears to be an important factor in the development of dystrophic processes in the bone tissues.

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