

INFLUENCE OF SEWEED MEAL ON THE THYROID FUNCTION AND MILK PRODUCTION OF DAIRY COWS

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ABSTRACT

Study of the effect of seaweed in rations for dairy cows on thyroid function and milk production. Testings were carried out in two different regions: an iodine-providing (non-iodogenic) zone (Palas-Constantza) and an iodine-deficient (iodogenic) zone (Lereşti-Argeş). The estimation of thyroid activity was carried out by dosage of protein bound iodine (P.B.I.) in blood and milk. There was established that in the iodine deficient area, seaweed added to food determines an average increase in P.B.I.: with 88.37 p.c. in milk and 75.26 p.c. in blood. The daily milk production of cows which received seaweed meal in their rations rose with 8.63 p.c.

Thyroid hypertrophy may be the result of iodine deficiency in soil, water or fodder, but it may be determined also by an exaggerated iodine consumption under certain physiological conditions or by certain factors that interfere with right utilization of iodine by the organism. Recent researches have proved that in the goitrous zone, water contains less iodine and the iodine content of fodder is from 3.3 to 19.5 times lower than that of the unendemic zone (TEODORU, CIOFU and CHIRILA, 1969). It was also established that in iodine-deficient areas there is a thyroid hypofunction in cows and thyroid gland undergoes histological alterations, though there are no significant weight alterations (MILCU and coll. 1970, 1971).

In the endemic areas, water and food failing to provide sufficient quantities of iodine, a faulty thyroid hormone synthesis ensues which brings about disturbances in the general metabolism, hence unfavourable results on milk production, reproduction and the health of animals. Therefore in this areas addition of iodine to food (iodine salts or tablets, Lugol solution etc.) is the simplest and most efficient prophylactic and curative measure (MILCU and TEODORU, 1958, 1968) and in the same time a method to increase the (milk) production of the animals (TEODORU, 1968).

Numerous experimental data have shown, lately, that seaweed owing to their chemical complexity, represent an efficacious remedy for diseases caused by mineral insufficiency. Addition of seaweed to live stock food determines an improved health condition and increases resistance to various diseases (McINNES, 1956).

Besides important quantities of organic and mineral substances, similar to the nutrient stuff contained by usual fodder, (DEMČENKO, 1966) seaweed contains physiologically-active substances (DINU and VILCU, 1968) which make them suitable for foddering purposes.

Since biochemical studies of macrophyte seaweed have revealed the presence of important amounts of iodine in their composition (BARASKOV, 1963) our experiments proposed to study the effect of the administration of this rich-iodine-containing natural nutritive addition on the thyroid function and milk production in dairy cows.

Material and method

Addition of seaweed to the food of dairy cows was carried out in two regions : a non-goitrogenic (iodine-providing) zone, the Palas station (Constantza), and a goitrogenic (iodine-deficient) zone, the Lerești Agricultural Production Cooperative (District of Argeș).

At Palas, the experiments were conducted over the 1 Nov. - 15 Dec. 1969 period with two lots of 5 Red Dobrogea breed cows, each. Both lots (experimental and control) received following rations : 4 kg concentrates ; 3 kg alfalfa hay ; 10 kg fodder beet; 20 kg siloed maize; maize stalk and molasses-soaked chaff.

At Lerești the experiments were conducted over the 1 May - 15 June 1970 period with two lots of 6 Brown breed cows, each. The basic food ration was: 5 kg hay; 10 kg siloed maize ; 2 kg concentrates; 20 kg mowed green matter.

Beside these rations the experimental lots received an addition of seaweed. To get the animals accustomed to seaweed, it was added gradually to their rations, beginning with 0.100 kg/day seaweed meal and amounting to 0.500 kg/day seaweed meal by the end of the first week, ration which was administered daily to the end of the experiment. The seaweed meal consisted of a mixture of green, red and brown seaweed thrown ashore. The main share (95 p.c.) was supplied by Cladophora, Enteromorpha, Ulva, Ceramium, Laurencia and Cystoseira species, the rest (5 p.c.) by other macrophyte seaweed species.

In setting up the experimental lots one has chosen animals of the same age and same lactation month. During the period of experimental seaweed feeding both the production and the variation of iodine in blood and milk, were checked.

Results and discussions

The amount of iodine found in the seaweed meal used for our experiments was 4.65 mg for 100 g dry substance (105°C)^{x)}. PROHOROVA

^{x)} The authors wish to express their thanks to Professor Aurelia CIOFU

V.I. and TRUSOV, N.V. (1969) found 41 mg iodine/kg in Fucus meal. Through the method we have used to detect iodine in seaweed we could establish that iodine-contents of various types of fodder ranges between 12.4 and 71.7 micrograms/100 g dry substance in iodine deficient areas and between 90.5 and 748.0 micrograms/100 g dry substance in non- endemic areas (TEODORU and co-workers, 1969).

As is known, the latest part of organic iodine is connected with serous proteins. This is why in appreciating the activity of the thyroid gland (synthesis and circulation of hormones) one has used the biochemical test of the thyroid function (Protein-Bound-Iodine-Testing).

Our tests proved that the P.B.I. value both in milk and blood of cows having consumed seaweed, has increased. The rise in organic iodine in milk and blood, during the seaweed feeding period, was rendered evident by the statistical calculations (See table 1). At Palas the P.B.I. increased with 26.5 p.c. in blood and with 31.36 p.c. in milk, the production undergoing no alteration. In the iodine-deficient area - Lerești - the P.B.I. increased with 75.26 p.c. in blood and with 88.37 p.c. in milk, the production being positively influenced by the nutritive seaweed addition.

The results of our experiments concord with the observations of PROHOROVA, V.I. and TRUSOV, N.V. (1969) who studied iodine content in the milk of dairy cows from the Norilsk sovhoz, a very iodine-deficient area north of the Polar Circle. Adding to the food of dairy cows 0.400 g seaweed/day per head, the authors were able to record an increase in iodine from 89 to 2,272 micrograms/litre in February and from nought (zero) to 1,681 micrograms/litre in October. Similarly other authors have recorded significant iodine accumulations in eggs of hens fed on seaweed. Thus SUNDE, I. (1956) has noted that a 7 g p.c. addition of Laminaria meal to the daily ration of fowl has brought about an over 150 times increase in the iodine contents of eggs (from 6 to 910 micrograms iodine/egg).

from the Institut of Agronomy-Bucharest, for her Kindness on accomplishing the iodine contents in seaweed.

Table 1

P. B. I. Variation (micrograms p. c.) in blood and milk of cows fed on seaweed

Unit	Kind of test	Period	\bar{x}	s^2	s	$S_{\bar{x}}$	v_{10}
Palas Station	blood	2. XI. 1969	6.04	0.19	0.438	0.175	7.21
		16. XII. 1969	7.62	0.43	0.657	0.294	8.6
	milk	2. XI. 1969	74.6	80.3	8.96	4.0	12.0
		16. XII. 1969	98.0	12.5	3.53	1.52	3.6
blood : $t = 4.4$ $t_{\alpha} = 0.01 = 3.355$ $\hat{t} > t_{\alpha} = \text{significant difference}$ milk : $\hat{t} = 5.4$ $t_{\alpha} = 0.001 = 5.041$ $\hat{t} > t_{\alpha} = \text{highly significant difference}$							
Ierestl Agricultural Cooperative	blood	1. V. 1970	3.8	1.20	1.095	0.447	28.8
		16. VI. 1970	6.66	0.34	0.583	0.238	8.8
	milk	1. V. 1970	44.3	148.8	12.16	4.98	27.4
		16. VI. 1970	83.5	250	15.81	6.45	18.0
blood : $\hat{t} = 5.6$ $t_{\alpha} = 0.001 = 4.587$ $\hat{t} > t_{\alpha} = \text{highly significant difference}$ milk : $\hat{t} = 4.8$ $t_{\alpha} = 0.001 = 4.587$ $\hat{t} > t_{\alpha} = \text{highly significant difference}$							

Seaweed used as iodine addition to the food of livestock in iodine-deficient areas is being studied now by several research teams in different countries. The researches carried out in this field have reached an advanced stage at the U.S.A. agricultural stations, in the states of Ohio and Wisconsin (OKAZAKI, 1970).

As said above, seaweed addition providing iodine to dairy cows food helps to remedy abnormal thyroid function in animals, being implicitly a method of increasing milk production in iodine-deficient areas. In addition milk with high iodine-content can be successfully used in the prophylaxy of the hypothyroid syndrom in man and in stock rearing. Thus TEODOREU, V. (1968) conducting an experiment with calves fed on milk from cows which received iodine salts, recorded an average weight increase 21.1 p.c. higher than in the control lot.

The data provided by our experiments show that milk production was not influenced by seaweed added to the food of cows from the littoral area Palas-Constantza. The milk production in the last week of our experiment period (5-11 Dec. 1969) was only 87.10-99.25 p.c. of the first week's milk production. The lactation curve kept on decreasing normally without being influenced by the addition of seaweed iodine. The not very high P.B.I. values in a maritime area rich in iodine could be accounted for by the higher hardness of water (19-20 degrees at Constantza) and also by an enzymatic blockage in the elaboration of iodothyronines, (hypothyroidism) due to excess of iodine in the environment (BALAN, STANCU, CONSTANTINESCU, VOICULET and MUSETEANU, 1969). Seaweed addition brings about an increase in P.B.I. values, probably caused by an intervention in the process of thyroid hormones production.

At the Lerești Agricultural Production Cooperative, located in an iodine-deficient area, milk production increased (see table 2). Addition of seaweed to the food of dairy cows, during the descending period of the lactation curve, has brought about a production rise of 10.23 p.c. against the 1.60 p.c. of the control lot. The increase in the production due to the influence of seaweed feeding was 8.63 p.c.

These data are in concordance with those found by the

Norwegian researches NEBB, H. and JENSEN, A. (1965), who adding Ascophyllum meal to the food of dairy cows (200 g/cow/day), have achieved an increase of 150 liters milk over the whole lactation period, representing a 4.5 p.c. increase as against a control lot which received a standard mineral mixture food addition. The authors consider that increased production is due to some compounds contained by seaweed, in the first place, zinc and iodine compounds.

Table 2

Average production per animal head (Lerestl)

Statistics	Symbol	Experimental period				Observations
		Milk production May 1-7 1970		Milk production June 9-15 1970		
		Exper. animals	control animals	exper. animals	control animals	
Number of animals	n	6	6	6	6	
Average production/head	\bar{X}	6.35	6.25	7.00	6.35	
Correction term	C_x	241.935	234.375	294.00	241.935	
Square of deviation	$\sum x^2$	0.955	1.495	0.26	0.615	
Variance	s^2	0.191	0.299	0.052	0.123	
Standard deviation	s	0.43704	0.54681	0.22405	0.35071	
Standard error	s_x	0.17607	0.22338	0.0927	0.14318	
Variation coefficient	v%	7.4	8.74	3.20	5.52	
Difference between averages	d					0.65
Standard deviation of differences	Sd					0.17321
Coefficient of Student	\hat{t}					3.75
	t = 0.01					3.169
$\hat{t} > t_{\alpha} = 0.01 \quad P < 0.01 \quad \text{Significant difference}$						

Other researchers have also observed that animals which received seaweed addition, show a higher rate than that of the control lot. TIMARIU, S. and co-workers (1969), adding Phyllophora meal to the ration of sheep and pigs, have achieved an average higher growth rate increase of 70 g/day in wethers and 29 g/day in pigs as compared with the control lot which got no seaweed addition.

Conclusions

The authors have studied the influence of seaweed meal - as a source of iodine in ration for dairy cows - on the thyroid gland function and milk production.

It has been established that addition of seaweed to fodder has brought about increased activity of the thyroid gland resulting in increased amount of organic iodine in blood and milk. In the iodine-deficient area (Lerești-Argeș) besides a significant P.B.I. increase, there was recorded also a 8.63 p.c. rise in milk output.

In the Palas littoral area, addition of seaweed to food of dairy cows has resulted in increased amount of iodine in blood and milk, milk production remaining the same. The increase in P.B.I. could be due to the release of hormone-elaborating enzymes, probably inhibited by an excess of iodine in the environment.

One considers that seaweed is an efficient, economical source of iodine for dairy cows in the areas where this microelement is deficient. One may use as fodder, seaweed thrown ashore by storms or seaweed collected on purpose. Some organic iodine concentrates, derived from seaweed, can compensate iodine deficiency improving thyroid gland physiology and livestock health and increasing milk production in areas where fodder and water show a low iodine content.

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