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THYROID FUNCTION IN PRIMARY KETOSIS

By

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It is only in recent years that a possible relation between thyroid function and ketosis has been noted. *Robertson et al.* (1957) reported a lower content of protein-bound iodine (PBI) in ketotic than in normal cows, which indicates a lower thyroid activity in the former. *Hatziolos & Shaw* (1963) studied the histological appearance of the thyroid in ketotic cows and considered there to be signs likewise of hypoactivity. Other published data, on the other hand, can be oppositely interpreted. *Emery & Williams* (1964), for instance, found that either the incidence or the severity of ketosis increased after administration of triiodothyronine, and *Hibbitt* (1964) induced ketosis by combining a high-protein diet with thyroxine injections.

It may thus be said that any relation which may exist between thyroid function and ketosis is still very incompletely known. This is probably due to several factors, among which are the too few studies that have been made, the uncertainty in assessment of different methods (*Thorell* 1965), and the relation that is known but the nature of which has not been made clear between the thyroid, adrenal and liver function (e.g. *Robertson et al.*; *Skanse* 1962; *Hatziolos & Shaw*).

MATERIAL AND METHODS

To discover whether any relationship existed between total protein in blood plasma and erythrocyte uptake (EU), a comparison was made of earlier analyses of 118 clinically healthy

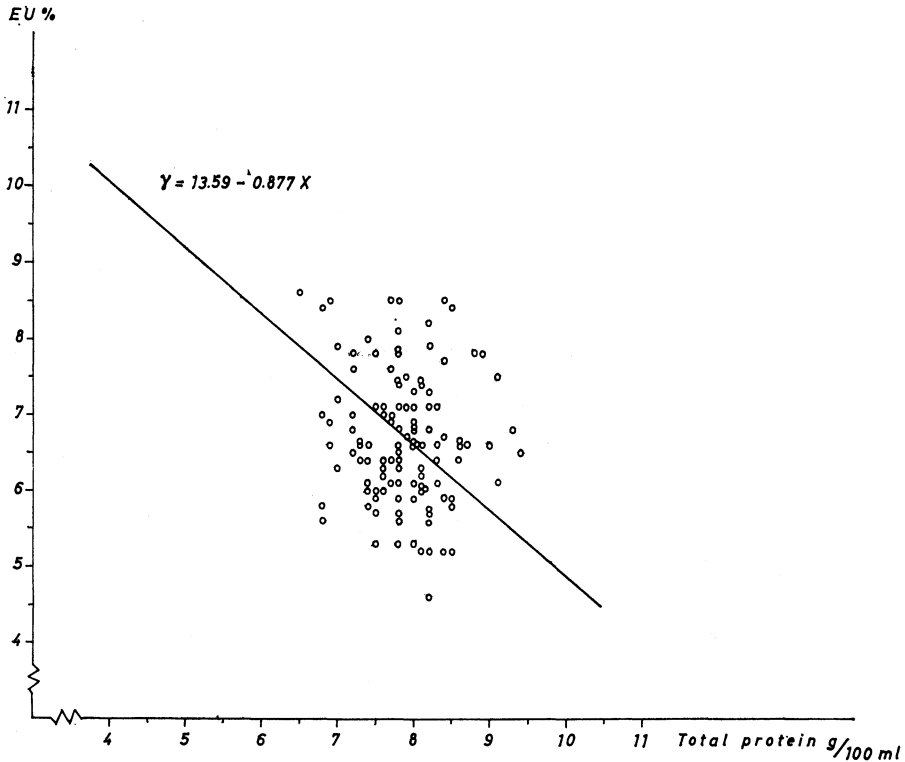


Figure 1. Correlation between total protein content in blood plasma and EU in 118 lactating Swedish Red and White Breed cows. The regression coefficient is -0.88 , the correlation coefficient -0.20 .

lactating cows. The remainder of the material consisted of cows with the diagnosis of primary ketosis (*ketotic cows*) and of clinically healthy cows in the same stage of lactation and, with few exceptions, from the same herds (*normal cows*). No cow was treated in any way before collection of the samples. The diagnosis of primary ketosis was in all cases verified by determinations of blood sugar and blood acetone. All cows were of Swedish Red and White Breed.

The thyroid function was assessed by the method based on *in vitro* erythrocyte uptake of I^{131} -labelled L-3, 5, 3-triiodothyronine (EU method). This method has been described in detail and tested with satisfactory results on cattle by *Thorell* (1965).

The total protein content in blood plasma was determined *ad modum Weichselbaum* (1946), and the haematocrit after cen-

trifugation of heparinized whole blood for 5 minutes at 12.000 r.p.m. in a Kemila type 543 centrifuge.

Statistical analyses were done by conventional methods (*Bonnier & Tedin* 1957).

RESULTS

Fig. 1 shows a negative correlation between total protein in blood plasma and EU in lactating Swedish Red and White Breed cows. The correlation was statistically significant ($t = 2.24^*$ for $r = -0.20$).

As appears from Table 1, no statistically significant difference existed for haematocrit, but there was a significantly ($**$) lower total protein content and significantly ($***$) higher EU in the ketotic cows.

Table 1. Haematocrit, total protein in plasma and EU in ketotic and normal cows.

	Haematocrit (‰)		Total protein (g/100 ml)		EU (‰)	
	Ketotic n = 34	Normal n = 41	Ketotic n = 16	Normal n = 12	Ketotic n = 34	Normal n = 41
\bar{x}	35.8	35.2	7.91	8.53	8.50	7.20
s	4.0	3.3	0.59	0.55	1.36	1.23
t	0.76		2.85**)		4.35***)	

DISCUSSION

The EU varies with haematocrit (*Thorell* 1965) and with total protein in the blood plasma (Fig. 1). As appears from Table 1, no statistically significant difference existed between the haematocrit values of ketotic and normal cows, so that the EU values reported in Table 1 cannot contain any serious errors on this account. But as the total protein content was significantly lower in ketotic than in normal cows, and as, according to Fig. 1, the EU is negatively correlated to total protein, the actual difference between the EU of ketotic and normal cows is probably less than shown in Table 1. Fig. 1 shows the regression coefficient to be -0.88 , which implies that for a reduction of total protein by 1 g/100 ml the EU increases *on an average* by 0.88. Since the difference between the mean total protein contents of ketotic and normal cows was 0.62 g/100 ml, this means that, *on an average*, the difference in EU would be $8.50 - 7.20$

— $0.88 \cdot 0.62 = 0.75$ instead of $8.50 - 7.20 = 1.30$. After this approximate adjustment, accordingly, the EU levels for the ketotic cows will still be, numerically, clearly higher than for the normal cows. Because the values of total protein and of EU in Table 1 do not derive from the same individuals, it was not possible to check whether the difference in EU still is statistically significant after taking into account the total protein content.

In the authors' opinion the results should be interpreted as *indicative* of a higher thyroid activity in cows with primary ketosis than in clinically healthy cows in the same stage of lactation. Further studies should be necessary, however, before any relation between thyroid status and ketosis can be definitely established. It must be considered of great importance, for example, to ascertain whether the thyroid activity is of primary aetiological significance for ketosis and whether the disease can be induced by administration of thyroid stimulants. It would likewise be of great interest to discover whether the increased thyroid activity indicated can also be brought on by a provoked starvation. For it has been found that most other deviations from normal in cases of clinical ketosis can be reproduced through such a state of starvation (*Pehrson* 1966).

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SUMMARY

The authors compared the thyroid function of cows with primary ketosis and clinically healthy cows in the same stage of lactation by a method based on the *in vitro* erythrocyte uptake of L-3, 5, 3'-triiodothyronine labelled with I¹³¹. This method (EU) proved to be affected by, among other factors, the content of total protein in the blood plasma, which was lower in ketotic than in normal cows. This caused difficulties in interpretation of the measured EU, but the authors consider that the experiments indicated an elevated thyroid activity in ketosis. The importance of continued research into the probable relation between thyroid function and ketosis is stressed.

ZUSAMMENFASSUNG

Die Thyreoideafunktion bei primärer Acetonämie.

Die Verfasser verglichen die Thyreoideafunktion bei Kühen mit primärer Acetonämie und die bei klinisch gesunden Kühen in demselben Stadium der Laktation mit Hilfe einer Methode, die sich darauf gründet, dass die Erythrocyten *in vitro* L-3, 5, 3'-Trijodotyronine mit J¹³¹ markiert, aufnehmen vermögen. Diese Methode (EU) wurde u. a. durch den Gehalt des Gesamtsproteins in Blutplasma beeinflusst, der Gehalt der bei Kühen mit Acetonämie niedriger als bei normalen Kühen war. Diese Verhältnisse verursachten Schwierigkeiten, wenn die Resultate der EU gedeutet werden sollten. Die Verfasser aber sind der Meinung, dass eine erhöhte Thyreoideaaktivität bei Acetonämie vorliegt. Die Bedeutung von erweiterter Forschung um den wahrscheinlichen Zusammenhang zwischen Thyreoideafunktion und Acetonämie zu untersuchen wird erwähnt.

SAMMANFATTNING

Thyreoideafunktionen vid primär acetone mi.

Författarna jämförde thyreoideafunktionen hos kor med primär acetone mi och hos kliniskt friska kor i samma laktationsstadium med en metod som grundar sig på erythrocyternas förmåga att *in vitro* taga upp L-3, 5, 3'-trijodotyronin som märkts med J¹³¹. Denna metod (EU) visade sig påverkas bl. a. av blodplasmans halt av totalprotein, vilken var lägre hos acetone mikor än hos normalkor. Detta orsakade svårigheter när det gällde att tolka de uppmätta resultaten på EU, men författarna anser att försöken antydde att det föreligger förhöjd thyreoideaaktivitet vid acetone mi. Betydelsen av utökad forskning för att närmare utreda det troliga sambandet mellan thyreoideafunktion och acetone mi påtalas.

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