Bio-chemistry. — "*Changes in Milk due to Sterile Inflammation of the Udder.*" By Prof. B. SJOLLEMA and J. E. VAN DER ZANDE. (Communicated by Prof. C. EYKMAN.)

(Communicated at the meeting of May 27, 1922).

The examination of a number of samples of abnormal milk from cows suffering from clinically observable affections of the udder, as well as from cows in which clinically no anomalies of the udder were noticeable, impressed us in 1921 with the idea that too great an importance is ascribed to streptococci as causative agents of the secretion of abnormal milk. We found for instance that in very abnormal milk streptococci are often absent.[1]) We, therefore, decided to go further into this subject and produced sterile inflammation of one of the quarters (R. F.) of the udder of a milch-cow in full lactation, with the aid of a suitable injection. On the suggestion of Prof. PAIMANS a solution was administered of of silver-nitrate of 0,2 %.[2])

In the same cow a sterile abscess had previously been developed through injection of oil of turpentine in the region of the neck with a view to ascertain whether such a sterile inflammation exerted any influence on the secretion of milk. We were induced to do so, because in a previous investigation in our laboratory anomalies had been found in the milk yielded by animals which were affected by inflammation of quite other parts of the body than the udder.

The results obtained after the injection of oil of turpentine need not take us long. Although a considerable abscess had developed, the composition of the milk did not undergo a notable change, neither during the development, nor after the abscess had become mature.

Once the sediment of the milk from one of the quarters had increased a little, of which the abscess may not have been the

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[1]) Our report pertinent to the matter in question appeared in Tijdschrift voor Vergelijkende Geneeskunde enz. Band 7 1922.

[2]) We were in a position to prosecute this inquiry thanks to the aid of Prof. W. J. PAIMANS and the Conservator for Obstetrics, Mr. J. A. J. M. KIRCH, whose assistance we acknowledge with gratitude.

cause. It would seem, therefore, that a sterile inflammation does not affect the secretion of milk in the same way as a bacterial inflammation has in our earlier researches repeatedly proved to do; this result could be expected.

The effect of the sterile inflammation of the udder with silver-nitrate solution was quite different. The very next day (9 March) the composition of the milk had changed very much, as was also the case on the following days, when the milk presented also a very abnormal aspect.

Gradually composition and aspect improved; however, this quarter became choked before the milk was quite normal; at all events not a trace of milk could be drawn on March 19 and following days. The examination of the milk-samples gave the results tabulated on the following page. For the sake of comparison we have also tabulated the figures of some abnormal milk-samples *with* (N°. 164 and 142) and *without* (N°. 181 and 267) streptococci, which samples were examined in 1921. For the same reason we included the figures obtained from the same quarter (R. F.) of the injected cow before this treatment (N°. 343 and 337) and from other quarters (N°. 385 and 381) after the injection.

The table shows that the milk from the quarter injected with silver-nitrate possessed, — with the exception of the presence of streptococci, — all the properties of milk from animals, suffering in a high degree from udder-affections e.g. streptococci mastitis). Acidity, p_H, sediment after centrifugation in Trommsdorff-tubes, leucocytes, chlorin-, and lactose-content, were all changed in the same measure,[1]) as were also the total protein-content and the calcium-content.

Furthermore the content of total, combined-, and free carbonic acid appeared to have increased, just as in milk from cows with diseased udder. This anomaly and its connection with the hydrogen-ions concentration of milk has been pointed out in 1919 by L. L. VAN SLIJKE and J. C. BAKER[2]).

Lastly, the tryptophane-content appeared to be considerably increased. In 1921 we found this content in abnormal milk (derived from diseased udders), and in colostrum to be very high. This is no doubt due to the occurrence in these kinds of milk of much protein, which is identic with, or related to the globulins of bloodserum, just as the other anomalies of the milk from cows with diseased

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[1]) Milk containing streptococcci has sometimes a high degree of acidity.

[2]) Journ. Biol. Chem. 40. 335 (1919).

N⁰. (quarter).	Ordinary Acidity	Oxalate Acidity	p.H.	Sediment Tromms-dorff (resp. number of leucocytes)	Chlorin mgrs. per 100 c.c.	Lactose %	Katalase figure	CaO mgrs. per 100 c.c.	Tryptophane (after precipitating with alum) mgrs. per 100 c.c.	
381 (R.F.)	2 5	—	—	0.35 ‰ [1]	—	—	–	120.2	110 [6]	
382 »	3.3	—	–	2.2 „ [2]	298.4	—	—		—	*after* treatment of the
385 »	5.3	1.3	6.98—7.06	(mucus) [2]	280	— [5]	—		300	udder with silver nitrate
387 »	4.8	0	6.75—6.82	0.5 ‰ [3]	153.6	—	—	196	90	
164	4.8	1.2	6.8 – 6.9	±1.5 c.c.	290	1.3	6.9	101	—	streptococci occur
142	5.6	0.8	6.75– 6.82	0.5 ‰	149	—	3.5	188	—	„ „
181	4.4	0.4	6.9 - 6.98	0.7 „	220	3.2	—	179	—	„ absent
267	4.6	0.1	6.75—6.82	450 000	169	—	7	—	—	„ „
343 (R.F.)	7	2.3	—	0.35 ‰	89.5	4.8	—	242.5	—	of „silvernitrate" cow *before*
337 »	7.4	—	—	0.2 „	107.7	—	—	—	norm.	treatment.
385 (L.F. and L.B.)	8.6	4.2	6.5 —6.6	—	—	—	—	—	—	from other quarters of the „silvernitrate" cow; drawn simultaneously with abn. milk from quarter R.F.
381 (L.F.)	7	—	—	0.1 ‰ [4]	84.3	—	—	—	—	

Examination 1921.

[1]) rather many leucocytes.
[2]) full of leucocytes.
[3]) few leucocytes, many cells with rounded nucleus.
[4]) number of leucocytes normal.
[5]) Milk drawn one day later contained 2.7 % lactose.
[6]) Milk drawn one day later contained 348 mgrs. of tryptophan.

udders are connected with the transit of bloodplasma-components in abnormal milk. While 100 c.c. normal milk — after removal of casein and fat with the aid of potassium-alum contain according to our investigations about 14—20 mgrs. of tryptophane, as much as 348 mgrs. occurred in the milk-samples after the injection of silvernitrate, that is about twenty times more.

The determination of the tryptophane-content, easily executed by the colorimetrical method of VON FÜRTH and NOBEL[1]), is no doubt one of the most accurate methods for examining the normality of milk.

The foregoing experiments tend to show that the anomalies characteristic of streptococci-containing milk, arise also from sterile inflammation of the udder-tissue, so that streptococci need not always be essential to the occurrence of similar anomalies. The question whether, in the case of streptococci-mastitis, these bacteria are very often only of secondary importance can of course not be answered on the basis of this investigation.

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[1]) Biochem. Zts. 109. 103. (1920).