Stoffe sind hitzestabil und nicht dialysierbar. Sie dürften für die Entzündungsreaktionen, welche durch grampositive Bakterien ausgelöst werden, von Bedeutung sein. Es ist weiterhin möglich, dass die Entstehung von organspezifischen Autoantikörpern mit ihrer Bildung in Zusammenhang steht. Abklärung ihrer chemischen Konstitution und ihrer pharmakologischen Wirkung im einzelnen dürfte weitere Aufschlüsse geben.

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Summary

Streptococcus pyogenes haemolyticus grown in glucose broth is capable of producing or liberating a heat-stable factor of high molecular weight which stimulates the emigration of leucocytes *in vitro*, only if certain animal organs are present.

The Exudative Diathesis Produced by Torula Yeast*

The development of exudative diathesis in chicks was first produced by vitamin E deficient diets to which was added an easily oxidizable fat such as cod liver oil[1]. When the vitamin E deficient diet was fat-free, the symptom did not appear[2].

SCOTT, HILL, NORRIS, DOBSON, and NELSON[3] have described the development of exudative diathesis by means of diets containing about 60% (dry) torula yeast as the only source of protein, and without added fat. Similar results have been reported by BIERI, POLLARD, and BRIGGS[4] using alcohol-extracted torula yeast. These authors were of the opinion that the diets used in their experiments did not contain fat in such a quantity that it could be responsible for the development of the symptom, and therefore held that easily oxidizable fat is not necessary for the occurrence of exudative diathesis.

We have had the opportunity to carry out similar feeding experiments with chicks receiving diets with torula yeasts of the same kinds ('1N' and '3N' from Lake States Yeast Corporation, Rhinelander, Wisconsin) as those used by SCOTT *et al.* We thereby confirmed the observation that exudative diathesis occurs in chicks fed such diets without added fat.

However, we found a considerable content of fat and easily oxidizable fatty acids in the torula yeast. Torula yeast '1N' was found to contain 4·5% total fatty acids, 41·8% of which were dienoic and 5·7% trienoic. The corresponding figures for torula yeast '3N' were 5·3% total fatty acids with 44·7% dienoic and 2·6% trienoic.

The total amount of fatty acids in the yeast was found after alkaline hydrolysis. Extraction after acid hydrolysis alone gave a somewhat lower figure.

Dr. BIERI of the National Institutes of Health, Bethesda, Md., has generously sent us two samples of his torula yeast, one untreated and the other alcohol extracted. We found that the untreated yeast contained 4·8% total fatty acids, whereas the alcohol extracted yeast contained 2·7%. The contents of dienoic fatty acids in the total fatty acids of the two samples were 44·8 and 45·3%, respectively; the contents of trienoic were 4·0% and 3·6%.

In our experiments we have found that diets with as little as 10% of torula yeast may produce exudates, although to a much lesser extent than diets with 60% of this yeast. In certain earlier experiments[5] very pronounced exudates were produced with diets containing 5% lard, whereas the corresponding fat-free diet gave no such symptoms. Although the lard used at that time was not analyzed for individual fatty acids, it is apparent from later analyses of lard, that 5% of lard must have contributed about as much dienoic and trienoic acids as 10% of torula yeast has. 60% of torula yeast will contribute roughly the same amount of dienoic and trienoic acids as will 30% of lard.

We, therefore, do not consider the experiments described by the aforementioned American authors as proof for the assumption that easily oxidizable fat is not necessary for the occurrence of exudative diathesis, although we agree with them with respect to the usefulness of torula yeast in the study of exudative diathesis in chicks.

It may be added that a type of yeast (Fleischmann 50 B) which in our experiments did not produce exudative diathesis contained 3·8% of total fatty acids, but only 0·3% of this amount was dienoic. The presence of tri-, tetra-, penta-, and hexaenoic acids could not be demonstrated with certainty.

The exudative diathesis produced by torula yeast diets without added fat is very pronounced. Exudates occur in fat tissue and in muscles and skin, as is the case when cod liver oil-casein diets are used. The exudates originating from muscles may be even more pronounced with torula yeast diets. Torula yeast diets also produced peroxidation of body fat as previously found with casein diets containing cod liver oil[6] and lard[7]. White striation of breast muscles[8], and a few cases of encephalomalacia also occurred when exudate-producing torula yeast diets were fed.

During the course of the experiments described here we received a personal communication from Dr. E. L. R. STOKSTAD of The American Cyanamid Company, Research Division, and shortly thereafter one from Dr. K. SCHWARZ, National Institutes of Health, Bethseda, Md., informing us that selenium as selenite prevents the exudative diathesis in chicks, when this element is fed in amounts below the toxic level.

Using 60% torula yeast diets we have confirmed this very important finding, and may add that at the level of 5 ppm Se as pure SeO_2 (7 ppm) did not prevent encephalomalacia, even though the exudative diathesis and

* We are grateful to Lake States Yeast Corporation, Rhinelander, Wisconsin, for supply of the torula yeast used in these experiments.

[1] H. DAM and J. GLAVIND, Nature *142*, 1077 (1938).

[2] H. DAM, Proc. Soc. exper. Biol. Med. N. Y. *52*, 285 (1943).

[3] M. L. SCOTT, F. W. HILL, L. C. NORRIS, D. C. DOBSON, and T. S. NELSON, J. Nutrition *56*, 387 (1956).

[4] J. G. BIERI, C. J. POLLARD, and G. N. BRIGGS, Fed. Proc. *16*, 381 (1957).

[5] H. DAM, J. Nutrition *27*, 193 (1944).

[6] H. DAM and H. GRANADOS, Acta physiol. scand. *10*, 162 (1945).

[7] H. DAM, INGE PRANGE, and E. SØNDERGAARD, Acta pharmacol. toxicol. *8*, 1 (1952).

[8] H. DAM, INGE PRANGE, and E. SØNDERGAARD, Acta pathol. microbiol. scand. *31*, 172 (1952).

the peroxidation of depot fat were suppressed. On a diet with 30% casein and 30% lard, which produced encephalomalacia as the main symptom, the incidence of encephalomalacia was uninfluenced by the presence of 7 ppm of SeO_2.

On a 30% casein, 10% cod liver oil diet which produced about an equal incidence of encephalomalacia and exudative diathesis, only the last mentioned symptom was prevented by 7 ppm of SeO_2.

The finding of the protective effect of selenium on exudative diathesis may throw light upon certain older observations from our our laboratory[9], according to which a certain cystine preparation gave protection against exudative diathesis (not against encephalomalacia) when fed at a level of 0·5%. This observation could not be confirmed with later supplies of cystine from other sources. As emphasized by SCHWARZ, cystine may sometimes be contaminated by the corresponding selenium compound.

The details of the experiments reported here will be published elsewhere.

H. DAM, G. KOFOED NIELSEN,
INGE PRANGE, and E. SØNDERGAARD

Department of Biochemistry and Nutrition, Polytechnic Institute, Copenhagen, July 12, 1957.

Zusammenfassung

Die exsudative Diathese, welche bei Küken durch Verfütterung einer Vitamin-E-freien Nahrung mit Torulahefe als Proteinquelle hervorgerufen wird, wird mit dem nicht unbeträchtlichen Gehalt dieser Hefe an leicht oxydierbaren Fettsäuren in Verbindung gesetzt.

Die Vitamin-E-freie Torula-Hefe-Nahrung führt zu Peroxydation des Körperfettes, wie es früher in entsprechenden Versuchen mit Kasein-Lebertran-Nahrungen gefunden wurde.

Die von amerikanischen Forschern gefundene Schutzwirkung von Selen gegen exsudative Diathese wird bestätigt.

Das Auftreten von Encephalomalacie wurde durch Selen nicht verhindert.

[9] H. DAM, I. KRUSE, INGE PRANGE, and E. SØNDERGAARD, Biochim. biophys. Acta *2*, 501 (1948).

Prophylactic Effect of Selenium Dioxide against Degeneration (White Striation) of Muscles in Chicks

It is known (DAM, PRANGE, and SØNDERGAARD[1]) that chicks reared on vitamin E-deficient, low-casein diets, with or without added fat, develop degeneration of muscles within 5 weeks. Macroscopically this form of degeneration appears as a white striation along the muscle fibers. The condition is prevented by vitamin E, and counteracted, to a large extent, by adding cystine (DAM, PRANGE, and SØNDERGAARD[1]) or methionine (MACHLIN and SHALKOP[2]) to the diet.

[1] H. DAM, INGE PRANGE, and E. SØNDERGAARD, Acta pathol. microbiol. scand. *31*, 172 (1952).

[2] L. J. MACHLIN and W. T. SHALKOP, J. Nutr. *60*, 87 (1956).

After having been notified by personal communications from Dr. E. L. R. STOKSTAD of The American Cyanamid Company, Research Division, and Dr. K. SCHWARZ, National Institutes of Health, Bethesda, Md., of the protective effect of selenium against exudative diathesis in chicks, a finding which we have confirmed (DAM, KOFOED NIELSEN, PRANGE, and SØNDERGAARD[3]), we have tested the effect of selenium dioxide against the type of muscular degeneration mentioned above.

Two groups of ten day-old chicks were used for the experiment. After twelve days on a commercial diet (DAM, HARTMANN, JACOBSEN, and SØNDERGAARD[4]), one group was shifted to the basal diet indicated in the Table, and the other to the same basal diet plus 7 parts per million of SeO_2 (5 p.p.m. of Se). One chick in the selenium group died accidentally after a few days.

The other chicks in both groups were sacrificed by decapitation after having received the experimental diets for five weeks, and autopsied.

Basal Diet	%
Crude casein	15
Gelatin	3
Salt mixture (DAM and SØNDERGAARD[4])	5·17
Vitamin mixture (DAM and SØNDERGAARD[4])	0·1
Choline chloride	0·2
Sucrose	76·53
	100·00

+ 0·001 g dicalciumsalt of 2-methyl-1,4-naphthohydroquinone diphosphoric acid ester (Synkavit 'Roche') per 100 g diet. Vitamins A and D_3 were given in aqueous solution (DAM, HARTMANN, JACOBSEN, and SØNDERGAARD[4]) 0·1 ml twice a week.

The average weights of the chicks in the two groups were 80 and 81 g at the beginning and 275 and 252 g (the selenium group) at the end of the experiment.

Seven out of the ten chicks in the unsupplemented group had white striation of breast muscles, whereas in the group receiving the SeO_2 supplement only one out of the nine surviving showed this symptom.

The result obtained by adding 7 p.p.m. of SeO_2 to the diet was approximately the same as previously found by adding 0·5% of cystine (DAM, PRANGE, and SØNDERGAARD[1]).

H. DAM and E. SØNDERGAARD

Department of Biochemistry and Nutrition, Polytechnic Institute, Copenhagen, August 3, 1957.

Zusammenfassung

Zwei Gruppen von je 10 Küken wurden während fünf Wochen mit einer künstlichen, Vitamin-E-freien Nahrung von niedrigem Kaseingehalt gefüttert. Die eine Gruppe erhielt eine Zulage von 7 mg Selendioxyd per kg Nahrung. Sieben Küken in der unsupplementierten Gruppe zeigten makroskopische Muskelveränderungen, während bei den Küken, welche die Selendioxydzulage erhielten, nur eines dieses Symptom aufwies.

[3] H. DAM, G. KOFOED NIELSEN, INGE PRANGE, and E. SØNDERGAARD, Exper. *13*, 493 (1957).

[4] H. DAM, S. HARTMANN, J. E. JACOBSEN, and E. SØNDERGAARD, Acta physiol. scand. (1957) (in press).

[5] H. DAM and E. SØNDERGAARD, Acta pharm. tox. Kbh. *9*, 131 (1953).