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Original title: Sulla presenza di acido erucico nei globuli rossi


Translated by the Translation Bureau Multilingual Services Division Department of the Secretary of State of Canada

Department of the Environment Fisheries and Marine Service Halifax Laboratory Halifax, N.S.

1975

4 pages typescript
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Bollettino della società italiana per biologia sperimentale

Bulletin of the Italian Society for Experimental Biology
ON THE PRESENCE OF ERUCIC ACID IN THE RED BLOOD CELLS

by

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Bologna Section - Session of December 4, 1973

The oil obtained from seeds of colza (brassica napus) and rape
(brassica napus oleifera) contain appreciable quantities of erucic acid.
This fatty acid, according to biological and medical literature, causes
biochemical, functional and anatomical lesions in many animal species,
histiocytic infiltration of the myocardium, kidney alterations, liver
cirrhosis, etc. The absorption of oils containing erucic acid is,
according to some authors, quite low (1), however, this fatty acid
reaches practically all organs and tissues (2). Experiments with marked
specimens (3, 4) show that in certain animal species the β-oxidation
is almost halted or is extremely slow and that often the fatty acid
encounters a saturation process and tends to remain in the tissues in
these forms.
Isolated mitochondria from the heart of rats fed with rape oil for three days showed a clear reduction in oxygen consumption and a lower production of ATP. All this indicates that erucic acid interferes with the oxidative metabolism of the heart muscle (5). In one of our preceding notes, we saw that the physical resistance of the animals with erucic acid in their tissues was lower than that of the controls (6).

Some time ago we were thinking of verifying whether the erucic acid reaches the cellular and subcellular membranes, but for the appearance in the literature (7) of the work by Walker, which indeed demonstrated the presence of erucic acid in the erythrocytes of the rat. At this point, it seemed worthwhile to verify the time necessary for the erucic acid which had entered into the biochemical composition of the membranes to leave them.

We used two groups of male rats of the Wistar strain, weighing on an average 200 g, fed with a balanced diet containing 10% lipids, which in the first case consisted of olive oil and in the other of colza oil, containing 55% erucic acid. The first group was subdivided into lots of 4 rats each (a, b, c, d) and they were fed for 15, 30, 45 and 105 days on the diet containing olive oil; at the end of the treatment each lot was killed. The second group, subdivided in the same manner into 4 lots of 6 animals each (A, B, C, D), was fed for 15 days with the diet containing colza oil. At the end of this period lot A was killed; lots B, C, D continued the treatment for another 15, 30, and 90 days respectively but with olive oil, thus returning to the experimental conditions of the first group.

At the end of the experiment, the total lipids of the erythrocytes were extracted and the spectrum of the pertinent fatty acids was determined. The values found are shown in Table 1, from which it may be noted that erucic acid, which is absent from the red blood cells of the
rats treated with olive oil, is found in a percentage of 3.2% in the animals receiving colza oil for only 15 days (lot A). This percentage of erucic acid decreases very slowly and the same thing occurs with the behenic acid (C 22:0), while the gadoleic acid disappears.

This research once again confirms the tendency of erucic acid to enter into the composition of tissues and demonstrates the slowness with which it leaves them.

It seems logical to examine this behaviour in the light of observations by Christophersen and Bremer, who studied the mechanism of utilization of erucic acid, using a derivative activated by this fatty acid: erucyl-carnitine. According to these authors, erucyl-carnitine is metabolized at a rate 5 times lower than palmityl-carnitine and clearly causes a slower consumption of O₂. The presence of erucyl-carnitine increases the inhibition of the mitochondrial oxidation of the palmityl-carnitine: erucyl-carnitine is a less favourable substrate than palmityl-carnitine for the carnitine-CoA-acyltransferase. The glycerophosphate is acylated more slowly by the erucyl-carnitine than by the palmityl-carnitine (8).

TABLE 1 - Behaviour of the fatty acids of the lipids of red blood cells of rats under different experimental conditions (see test).

<table>
<thead>
<tr>
<th>Fatty Acid</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a b c d</td>
<td>A B C D</td>
</tr>
<tr>
<td>oleic</td>
<td>20,4 21,6 19,8 20,5</td>
<td>14,2 18,8 19,1 18,8</td>
</tr>
<tr>
<td>linoleic</td>
<td>5,8 6,3 5,7 7,4</td>
<td>7,3 8,2 7,8 8,1</td>
</tr>
<tr>
<td>gadoleic</td>
<td>- - - -</td>
<td>1,4 tr. tr. -</td>
</tr>
<tr>
<td>arachidonic</td>
<td>23,7 24,5 25,1 23,9</td>
<td>19,3 18,7 19,8 21,5</td>
</tr>
<tr>
<td>behenic</td>
<td>- - - -</td>
<td>0,6 0,7 0,9 0,5</td>
</tr>
<tr>
<td>erucic</td>
<td>- - - -</td>
<td>3,2 3,0 2,6 1,3</td>
</tr>
</tbody>
</table>
One of us and Lorusso think that the "impediments" of erucic acid may be related to its particular configuration (9).

**BIBLIOGRAPHY**


Work carried out with the contribution of the Ministry of Health, 1972/73 No. 702/28.64/761.