

EFFECTS OF DIFFERENT DIETARY LEVELS OF DOCOSENOIC ACIDS
ON MALE RATS DURING COLD STRESS

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ABSTRACTS

The toxic effects of high concentrations of erucic acid in rapeseed oil have been the subject of much controversy since Roine *et al.* (1960) reported that rats fed a diet containing 70 cal % of rapeseed oil showed lipid accumulation and necrotic lesions in the myocardium. They also reported some deaths after 13 days of feeding in this experiment, which was carried out at room temperature. More recently, Beare-Rogers & Nera (1974) reported 80 % mortality during cold stress in a group of rats fed a high erucic acid diet for 3 weeks. In a similar experiment, Hulan *et al.* (1976) reported no mortality. The following study was made to further elucidate the effects of rapeseed oil containing high levels of erucic acid during cold stress. For comparison, two other vegetable oils, containing low levels of erucic acid, and a marine oil containing cetoleic acid, were used, and a parallel experiment was also performed at room temperature.

Male weanling Sprague-Dawley rats were used. They were placed in individual cages, measuring 27 x 21 x 14 cm, with a wire mesh bottom in a climate chamber at 4° and 90 % relative humidity, or at 23° and 65 % relative humidity, and given food and water ad libitum. The noise level in the climate chamber was 70 - 71 dB. Four groups, each of 20 rats, were used at each temperature. They were fed a synthetic diet, containing 20 % w/w of one of the following oils: Rapeseed Oil (RO) (C22:1 = 41.6 % of total fatty acids). Low Erucic Acid Rapeseed Oil (LO) (C22:1 = 6.5 %), Hydrogenated Marine Oil (HO) (C22:1 = 3.2 %, cetoleic acid) or Peanut Oil (PO) (C22:1 = 0.7 %). From each group, 5 animals were killed on days 3, 7, 14 and 24 at 4° and on days 3, 7, 14 and 42 at 23°. The heart, liver and adrenals were immediately dissected out and weighed. The apex of the heart was cut off and used for estimating the degree of fatty infiltration, while the rest of the heart was used for fatty analysis.

The most striking finding in the present experiments was the 100 % mortality found in the RO group during cold stress (Table 1). The animals in this group also showed weight loss up to day 5, by which time they had all died. In the LO group a marked growth inhibition was seen from day 8 onwards. The high mortality in the RO group coincided with an extreme lipodosis, which gave the hearts a yellow-white appearance, easily seen macroscopically. At room temperature, however, there were no deaths. The growth curves for all groups were similar and comparable to those of the HO and PO groups during cold stress. The lipodosis, as revealed by histological examination, was similar to that during cold stress, and in the RO group it persisted for the whole of the experiment.

Our results thus confirm those of Beare-Rogers & Nera (1974), while they seem to contradict those of Hulan *et al.* (1976). The reason for these differences might be variations in the sensitivity towards erucic acid in the different strains of rats used. Although the reports cited above come from the same place (Ottawa, Canada) the rats used came from different sources. A closer scrutiny of the reports reveals that the

level of erucic acid, as a percentage of the diet, was 5 % in the study by Hulan *et al.*, 6 % in the study by Beare-Rogers & Nera and 8 % in the present study. Another possible explanation for the different results might therefore be that the toxic effects of erucic acid during cold stress become fatal only at levels above 5 %. The apparent contradiction between our and Beare-Rogers & Nera's results on the one hand and those of Hulan *et al.* on the other, would then be resolved.

TABLE 1

CUMULATIVE MORTALITY RATES IN MALE RATS FED DIETS WITH DIFFERENT LEVELS OF DOCOSENOIC ACIDS DURING COLD STRESS

Group	C22:1 ^a	Days of feeding		
		0 - 7	0 - 14	0 - 24
PO	0.7	4/20 ^b	5/20	5/20
RO	41.6	20/20 ^c	-	-
LO	6.5	1/20	3/20	3/20
HO	3.2 ^d	2/20 ^e	2/20	2/20

- a. Percent of total fatty acids
- b. 3 dead animals had tail wounds
- c. All animals died within 5 days
- d. Cetoleic acid
- e. Both dead animals had tail wounds.

REFERENCES

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