HISTOMETRY OF MYOCARDIAL CHANGES IN RABBITS FED VARIOUS OILS

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INTRODUCTION

Prolonged feeding of high amounts of cruciferous oils has been associated in rabbits with hypercholesterolemia and myocardial changes. The intensity of these abnormalities was related to the level of erucic acid in the dietary fat (1,2). Since the hearts of control rabbits are seldom devoid of lesions, it appeared useful to reconsider and to quantify more accurately the alleged cardiopathogenicity of low-erucic-acid rapeseed oil in comparison with other edible oils. To this end, the hearts of rabbits, fed for two years high amounts of primor oil - a new French rapeseed oil -, palm oil or sunflower-seed oil, were submitted to a detailed morphometric investigation.

ANIMALS AND METHODS

Six-month old male Dutch belted rabbits were fed for two years semi-synthetic regimens in which 22, 38 and 40% of total dietary energy was supplied by protein (casein), carbohydrate (maize starch) and oil, respectively. Adequate amounts of vitamins and minerals completed the diets. The experimental oils were primor oil, palm oil and sunflowerseed oil of edible quality. Two different batches of primor oil were used. One batch, which was given during the first eight experimental months, contained 0.3% erucic acid. For the remaining part of the trial a primor oil with a content of 4% erucic acid was used.

At the end of this long-term test, the animals were killed and the hearts removed and fixed in 10% buffered formalin. The ventricles were sliced in six transversal parts which were embedded in paraplast and routinely processed. Sections of 6 μ were sampled at preselected sites, stained with Masson's trichrome and coded in order to be examined microscopically without prior knowledge of the dietary treatment.

Hence six transversal sections per heart were screened systematically by means of semi-automatic image-processing equipment as shown in Fig. 1. This equipment comprises a photomicroscope with a projection attachment (M), a scanning stage (S), an Intel microprocessor (I), a control panel (C), a Teletype (T) and a joy-stick (J) which allows manual driving of the scanning stage. The microprocessor is programmed to control the movements of the scanning stage along two perpendicular axes. Moreover, it is used for input and storage of data via the control panel. The output of the results and their printing are made possible by means of the Teletype.

Besides data concerning the type and number of lesions, the image-processing system collects information about the localisation and the size of the lesions. The localisation permits rapid retrieval of all abnormalities. The size is defined by the length of the Feret diameter which is the projection of the affected area on the abscissa. This measurement is performed using the projection attachment and a metric scale giving an actual magnification of x 125.

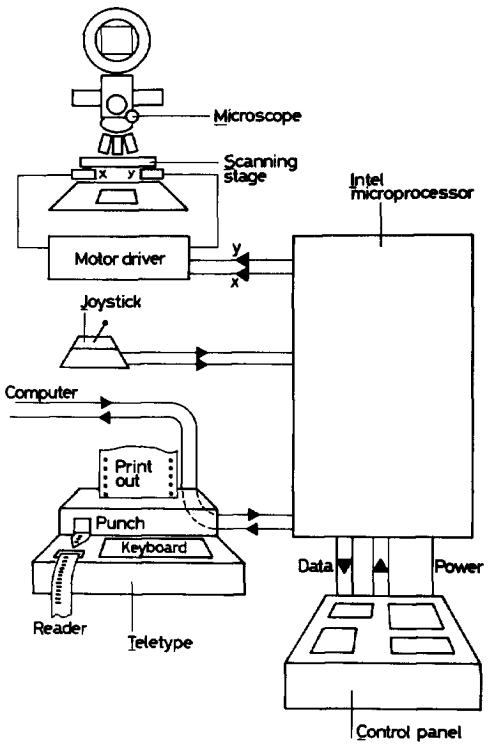

Fig. 1 Semi-automatic image processing equipment

The results were statistically analysed. A χ^2 test was applied to the incidence of affected animals. Analysis of variance on ranked data according to Kruskal and Wallis was carried out on the individual frequency of lesions and on the individual extent of the lesions expressed as the sum of the Feret diameters. These statistical tests were applied both to all lesions and after exclusion of those with a lymphohistiocytic character.

RESULTS

Two main types of lesions were recognized in the histological sections, namely lymphohistiocytic infiltrations and fibrotic scars. Data refering to the number of affected animals, the number of myocardial lesions, their extent and ranking are presented in Table 1. Statistical analysis did not reveal any significant difference between the groups.

It should be noted that in comparison with one-year old, specific-pathogen-free rats (3), these rabbits show rather a high frequency of lesions, independently of the dietary oils. These background lesions may be related to the respiratory disease complex which occurs quite commonly in conventional laboratory rabbits. Moreover a specific effect of the semi-synthetic diets cannot be ruled out. It has been suggested (4) that a high incidence of background lesions might mask a possible cardiotoxic effect of the oil under investigation. On the other hand, it has previously been shown (1) that erucic acid considerably increases the incidence of heart lesions. The present elaborated study of cardiac tissue in rabbits fed rapeseed oil with a low erucic acid content for two years did not reveal higher frequency nor increased severity of heart abnormalities.

Table 1. Myocardial changes in rabbits fed 40 energy % of primor-, palm- or sunflowerseed oil for two years

	Primor	Palm	Sunflowerseed
Number of examined animals	13	9	13
Number of affected animals			
+ [1]	13	9	11
-	4	2	5
Number of lesions/animal			
+	47	75	61
-	2	0.4	1
Average sum of Feret (in mm, 125x)			
+	519	542	568
-	127	13	94
Mean rank			
number of lesions			
+	16.2	21.3	17.5
-	18.5	16.2	18.7
sum of Feret			
+	18.5	15.9	19.0
-	17.8	17.1	18.8

[1] Including (+) or excluding (-) the lymphohistiocytic infiltrations

CONCLUSION

The detailed morphometric study of heart tissue from rabbits fed various oils for two years did not disclose any relation between the extent of the myocardial changes and the type of dietary oil administered.

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