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NUTRITIONAL EFFECTS OF RAPESEED OILS IN PIGS
3. HISTOMETRY OF MYOCARDIAL CHANGES

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INTRODUCTION

Myocardial cell damage has been reported to occur in pigs fed rapeseed oil (1-3). However, other studies did not reveal clear-cut differences in incidence of cardiac changes between swine fed rapeseed oil and animals on control diets (4-7). Differences in experimental conditions and methodology might explain some discrepancies. Moreover, it should be noted that small areas of muscle cell necrosis with infiltration of mononuclear cells are not uncommon in pigs heart (8-12). Therefore, accurate quantification of the myocardial changes is required to evaluate any possible increase of lesions.

The following histopathological study was undertaken to determine the effects of various dietary treatments on the frequency and severity of abnormalities in the heart of growing pigs. The presented morphometric data constitute part 3 of a larger collaborative trial, parts 1 and 2 dealing with the effects of rapeseed oils on the performance and carcass characteristics and on the composition and changes of tissue lipids (13,14).

ANIMALS AND METHODS

Experimental design, formulation of the diets, zootechnical and analytical procedures are to be found elsewhere in these Proceedings (13,14). The dietary oils under investigation were soybean oil, three different mixtures of Primor oil with high erucic acid rapeseed oil and Lesira oil. Erucic acid- and fat content of the regimens are given in Table 1. After being fed the different diets for about 120 days, sixty-eight barrows were slaughtered following a randomization plan. The animals were killed by exsanguination while under anesthesia by electric shock.

Immediately following slaughter, the heart was removed and was cut into eight slices with the help of a mould. Samples of tissue were taken according to a strictly standardised procedure. Figure 1 shows the numbering and the selection of the sampling sites. The apical slice (slice I) yielded one tissue sample, four samples were taken from the even numbered slices and five samples from the odd numbered ones. Hence each heart yielded 28 tissue samples of about 1x0.5x0.5 cm^3. The samples were fixed in 10% buffered formalin, embedded in paraplast, sectioned at 6 µ and stained with Masson's trichrome. All slides were coded in order to be examined histologically without prior knowledge of the experimental treatments. All sections were screened and those showing abnormalities were submitted to a detailed morphometric investigation using semi-automatic equipment as described by Timmer and Vles (15).

By means of this image-processing system, data were collected on the number, type, localisation and size of the changes. The size of the lesions was determined by measurement of the Feret diameter being the projection of the affected surface on the horizontal axis. All animals were ranked on the basis of either the individual number of lesions or the individual sum of Feret diameters. The differences between the groups were submitted to an analysis of variance on ranked observations according to Kruskal and Wallis.

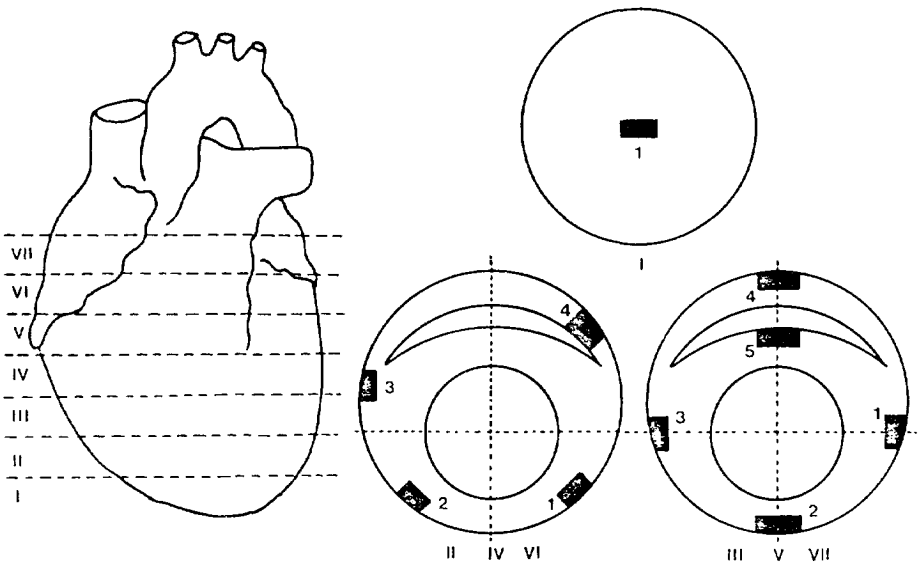

Fig. 1 Heart tissue sampling procedure for histometric determination of myocardial changes

RESULTS

Most cardiac changes observed in the pigs consisted of foci of mononuclear cell infiltrations. Some of these lesions showed a more diffuse pattern. These diffuse lesions could not be measured and were noted to have an arbitrary Feret diameter of half a millimetre. In some cases the focal infiltrations were associated with myocardial cell necrosis and the presence of eosinophils. Scar formation was seldom observed. The number of affected animals, the number of lesions per animal and the average sum of Feret diameters for each group as well as the mean ranks are presented in Table 1.

Several comparisons were statistically evaluated. No significant differences were found between all ten groups. Moreover, neither the erucic acid- or fat level, nor the type of oil influenced the number and severity of the mild cardiac changes. Pigs fed diets containing up to 2.2% erucic acid showed no significant aggravation of background lesions. Number and size of the lesions were identical in pigs fed 8% Lesira oil containing 1.9% erucic acid and in animals on the low-fat barley-soybean meal regimen.

CONCLUSION

An elaborate histometric study of myocardial changes in pigs fed various rapeseed oil mixtures, soybean oil or Lesira oil for 17 weeks showed that neither the level nor the nature of the oil in diets containing erucic acid levels of about 0.2% to 2.2% influenced the number and the severity of the mild cardiac changes observed in growing pigs.

Table 1. Myocardial changes in pigs fed a low-fat diet, soybean oil, rapeseed oil mixtures or Lesira oil

Diet	Low-fat	Soybean oil		Rapeseed oil mixtures						Lesira oil
Content (%) of erucic acid	0	0		7.5		15		22.5		1.7
fat	2	6	10	6	10	6	10	6	10	10
Number of examined animals	7	6	7	7	7	7	7	7	7	6
Criteria										
Number of affected animals	7	3	7	7	7	7	7	7	6	5
Number of lesions per animal[1)]	4.4	3.3	15.0	11.7	10.0	5.3	20.3	5.4	11.0	4.3
Average sum of Feret diameters (in mm, 125x)	66	35	176	134	120	69	271	93	151	44
Mean rank number of lesions	25	21	46	39	39	32	45	30	39	26
sum of Feret	28	18	45	36	41	34	45	33	38	24

[1)] In transversal sections sampled at 28 preselected myocardial sites (7 levels)

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