Nutritional Evaluation of Medium-Chain Triglycerides in the Rat

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Abstract

Nutritional evaluation of a medium-chain triglyceride (MCT) preparation, containing about 75% octanoic acid and 25% decanoic acid, was carried out in short- and long-term experiments in rats. A casein diet containing 19.6% MCT and 2.5% safflower oil, the latter to supply essential fatty acids, was compared with similar diets containing conventional dietary fats. Data obtained in a 47-week study showed that the MCT diet supported normal growth and development. At autopsy, carcass protein and ash levels, vital organ weights and composition were similar to those in rats fed conventional fats. Histological study showed that intestinal and liver sections were normal after 47 weeks on the MCT-containing diet. In general, rats fed MCT had slightly lower growth rates and caloric efficiency values, less carcass fat and smaller epididymal fat pads than animals fed conventional dietary fats. Little C_8 and C_{10} were found in depot fat. The MCT diet also supported normal reproducton, as indicated by litter size and number. During lactation the volume of milk secreted by the rats receiving the MCT diet was smaller and contained a lower level of fat than that secreted by the rats receiving an oleo oil diet, resulting in slower gains in weight in the MCT group. After weaning, growth of the rats fed MCT compared favorably with that attained by the animals on the diet containing oleo oil.

Introduction

In recent years a number of papers have appeared which indicate that the medium-chain triglycerides (MCT) are of particular value in the nutritional management of individuals who are unable to effectively absorb dietary fat. MCT is of special importance in malabsorption syndromes which arise from a deficiency of pancreatic lipase (1), bile salts (2), or intestinal absorptive area (3). Because of ease of absorption (4–8), the calories in MCT are available to maintain positive caloric balance and body weight in individuals who are unable effectively to absorb conventional dietary fats.

Only a few papers have appeared which demonstrate the nutritional value of the medium-chain triglycerides. Kaunitz et al. (9) demonstrated that male rats which were fed diets containing MCT for a year weighed significantly less than animals fed a lard diet and had higher caloric requirements to maintain weight than animals fed a lard or a fat-free diet. Kaunitz et al. also concluded that linoleic acid requirements are less with MCT than with long-chain triglycerides (C_{12-18}) (10). In the past few years the authors' laboratory has been engaged in a series of studies designed to obtain more information on the nutritional and biochemical aspects of MCT so that this unique triglyceride might be used for special dietary needs. Although much of this work has not yet been published, two long-term studies with MCT, a 47-week growth study beginning with weanling rats and a reproduction and lactation study, are now reported.

Methods

In the long-term growth study, groups of 15 male and 15 female rats of the Wistar strain were fed diets which differed only in the source of dietary fat. Throughout the 47-week study the animals were housed in individual screen-bottom cages in an air-conditioned animal room. The diets contained sufficient fat to supply 40% of the calories from MCT, oleo oil, butter fat, coconut oil, corn oil, and safflower oil. Safflower oil (2.5%) was added to the diets containing MCT, oleo oil, butter fat, and coconut oil to insure adequacy of the essential fatty acids in all diets. The diets also supplied 38% of the calories from carbohydrate, 22% of the calories from protein, and adequate amounts of vitamins and minerals (Table I).

Records of food intake were kept for the calculation of caloric efficiency and net absorption of fat, protein, and calcium. At intervals during the study, feces were collected daily, pooled in weekly samples, and analyzed for fat (11), total nitrogen (Kjeldahl method), and for calcium (12). At specified intervals, blood was obtained from the tail vein and analyzed for cholesterol by method of Abell et al. (13).

At the termination of these studies the rats were killed, and the weights of the livers, kidneys, spleen, heart, adrenals, femurs, testes, and epididymal fat pads were determined. Liver and intestine were examined histologically; liver and carcass were analyzed for fat by method of Folch et al. (14) and protein by Kjeldahl. Phospholipid levels in the liver were also determined (15). The fat content of the fat pads was determined (11), and fatty acids were measured by gas chromatography (16) after methylation (17).

In the reproduction and lactation study, groups of young adult male and female rats of the McCollum-Wisconsin Strain were fed the MCT and oleo oil diets, as above, and a third group was given a low-fat diet containing 2.5% safflower oil (Table I, Diet 7). After three weeks on these diets the animals were mated. The females were housed in a separate room, and each

TABLE I

Composition of Diets

	Diet 1–6 40% Fat calories	Diet 7 Low fat
	%	%
Fat[a]	21.0	2.5
Casein (ANRC 91.4% protein)	26.2	26.2
Amidex[b]	44.5	63.0
Nonnutritrive fiber	4.0	4.0
Mineral mixture[c]	4.0	4.0
Vitamin mixture[d]	0.35	0.35

[a] Diets 1–4 contained mainly MCT, oleo oil, butterfat, and coconut oil respectively, with 2.5% safflower oil added to insure adequate essential fatty acids. (The level of the fat in the MCT diet was increased slightly since MCT provides only 8.3 cal/g.) Diets 5 and 6 contained corn oil and safflower oil respectively.

[b] Partially hydrolyzed corn starch, Corn Products Company, New York.

[c] J. H. Jones and C. Foster (J. Nutr. *24*, 245, 1942) with 10 ppm F added as NaF.

[d] H. P. Sarett and L. P. Snipper (J. Nutr. *52*, 525, 1954). Ascorbic acid omitted. In addition, 0.015 g Oleum Percomorphum and 0.005 g *dl-a*-tocopherol acetate were added per 100-g diet.

TABLE II

Weight Gains and Caloric Efficiency Values for Male and Female Rats Fed Different Dietary Fats for 47 Weeks

Dietary fat	Males				Females			
	4-Week caloric efficiency	Weight gain after			4-Week caloric efficiency	Weight gain after		
		4 wks	8 wks	47 wks		4 wks	8 wks	47 wks
	g gain/1,000 cal.	g			g gain/1,000 cal.	g		
MCT[a]	115 ± 10	181 ± 21	332 ± 44	637 ± 94	101 ± 5	139 ± 12	209 ± 21	375 ± 83
Oleo oil[a]	119 ± 6	200 ± 22[b]	354 ± 39	668 ± 115	99 ± 5	137 ± 10	208 ± 20	403 ± 76
Butter fat[a]	118 ± 6	201 ± 15[b]	356 ± 32	669 ± 97	101 ± 8	146 ± 16	223 ± 29	417 ± 81
Coconut oil[a]	121 ± 5	197 ± 14[b]	353 ± 25	715 ± 102[b]	98 ± 16	142 ± 13	215 ± 18	432 ± 76
Corn oil	122 ± 9	196 ± 19[b]	353 ± 38	630 ± 62	100 ± 5	140 ± 11	220 ± 19	414 ± 39
Safflower oil	119 ± 7	188 ± 17	345 ± 37	674 ± 71	103 ± 6	139 ± 15	212 ± 21	400 ± 64

[a] Plus 2.5% safflower oil.
[b] $P < 0.05$ compared with MCT group.
All values are shown with standard deviations.

TABLE III

Weights of Epididymal Fat Pads and Carcass Composition of Rats Fed Different Dietary Fats for 47 Weeks

Dietary fat	Epididymal fat pads		Carcass Composition[b]			
			Weight	Fat	Protein	Ash
	g	% body wt.	g	%	%	%
MCT[a]	14.6	2.2	580 ± 80	22.1 ± 5.9	19.4 ± 1.6	3.0 ± 0.3
Oleo oil[a]	18.7	2.6	607 ± 91	22.4 ± 4.9	20.1 ± 2.0	3.1 ± 0.5
Butter fat[a]	19.1	2.7	612 ± 83	24.7 ± 5.5	19.4 ± 1.9	3.0 ± 0.6
Cocount oil[a]	23.2[c]	3.1[c]	644 ± 89[c]	26.7 ± 6.1[c]	18.2 ± 1.7	2.8 ± 0.5
Corn oil	16.7	2.5	572 ± 51	23.7 ± 3.3	19.0 ± 0.8	3.1 ± 0.4
Safflower oil	17.9	2.5	610 ± 61	22.6 ± 4.0	19.8 ± 1.1	3.0 ± 0.3

[a] Plus 2.5% safflower oil.
[b] Does not include liver, heart, epididymal fat pads, or gastrointestinal tract.
[c] $P < 0.05$ compared with MCT group.
All values are shown with standard deviations.

TABLE IV

Fatty Acid Content of Dietary and Epididymal Fat in Rats Fed Various Dietary Fats for 47 Weeks

	Fatty acids, %											
	C_8	C_{10}	C_{12}	C_{14}	C_{16}	$C_{16:1}$	C_{18}	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$	$C_{20:4}$	Other
Dietary Fat												
MCT[a]	51.0	35.0	2.0		0.9			1.4	9.0			0.7
Oleo oil[a]				2.9	22.1	4.8	13.4	43.2	12.5			1.1
Butter fat[a]	1.9	3.3	2.9	8.1	22.8	3.8	10.5	23.3	13.3			10.1
Coconut oil[a]	8.1	7.2	36.8	17.2	10.0		2.4	7.2	11.0			0.1
Corn oil					13.4		1.4	26.2	57.8			1.2
Safflower oil					6.7		1.9	10.0	80.8	0.2		0.4
Epididymal Fat												
MCT[a]	0.4	4.9	1.5	2.2	21.9	8.3	2.3	30.8	25.1	0.7	0.4	1.5
Oleo oil[a]				1.4	16.2	4.0	5.0	59.8	10.6	1.0	0.2	1.8
Butter fat[a]			1.1	5.1	22.4	6.1	4.2	45.2	11.7	1.9	0.1	2.2
Coconut oil[a]		0.7	20.3	12.9	15.7	4.6	1.1	26.2	17.4	0.4	0.1	0.6
Corn oil				0.3	11.9	1.2	1.6	33.0	50.2	0.6	0.6	0.6
Safflower oil				0.4	9.4	1.0	1.8	17.4	68.0	0.4	0.9	0.7

[a] Plus 2.5% safflower oil.

was kept in a large plastic cage with wood shavings during pregnancy and lactation. After weaning, selected young from each litter were housed in the screen-bottom cages and raised to maturity for further reproduction and lactation studies in succeeding generations.

In order to estimate the volume of milk secreted during lactation, the mother was removed from her litter for a six-hour period every third day. Milk secretion was estimated by the increase in weight of the pups measured just prior to and immediately after a one-hour nursing period after the return of the mother. In a separate reproduction study, milk was obtained from the lactating rats receiving the MCT and oleo oil diets, by the method of Cox and Mueller (18), for proximate analysis and determination of fatty acid content.

Growth Studies

Weight gains of the rats receiving the MCT, oleo oil, butterfat, coconut oil, corn oil, and safflower oil diets after 4, 8, and 47 weeks and caloric efficiency values for the first four weeks are shown in Table II. Weight gains with MCT were only slightly less than with other fats. After four weeks the male rats fed the MCT diet gained 181 g compared to gains of 200 g with oleo oil, 201 g with butter fat, 197 g with coconut oil, 196 g with corn oil, and 188 g with safflower oil. Four-week caloric efficiency values were also similar with all dietary fats, varying between 115 and 122 g gained per 1,000 calories. At the end of 47 weeks, weight gains with MCT, in both males and females, were moderately lower than those with most of the other dietary fats. There was a significant difference only between the values with the MCT and coconut oil diets in the male rats.

Mortality was not markedly different in the groups receiving the various fats during the study. During the 47 weeks an average of 2.5 rats died per group of 15 males and 1.7 per group of 15 females; in the groups receiving MCT, 3 males and 2 females died during the study.

Organ weights of the liver, kidneys, spleen, heart, adrenals, femurs, and testes were determined at the end of the study and were similar in all groups; data are not given. Histological examination of the liver and intestine also show no marked differences among the groups receiving the different dietary fats.

Weights of the epididymal fat pads were found to be affected by the type of dietary fat, as shown in

Table III. In the group receiving the MCT diet, the fat pads were 2.2% of the body weight, as compared with values of 2.5 to 3.1% in the groups receiving the other dietary fats. These data correlate fairly well with the level of fat in the carcass. Animals consuming MCT had the lowest level of carcass fat. Levels of protein and ash in the carcass were similar with all dietary fats.

Fatty acid composition of depot fat was influenced by dietary fat and varied widely among the groups. In each group, epididymal fat composition was quite similar to that of carcass fat; data on fatty acids in epididymal fat are shown in Table IV along with composition of dietary fats. The high levels of C_{12} in coconut oil, and $C_{18:2}$ in corn oil and safflower oil were reflected in the high levels of these fatty acids in the epididymal fat. However low levels of C_8 and C_{10}, 0.4 and 4.9% respectively were found in the fat pads of the rats fed MCT although these fatty acids comprised about 85% of the dietary fat. High levels of palmitic acid (21.9%) and of oleic acid (30.8%) were in the fat pads of the rats fed MCT although only traces of these fatty acids were in the diet. Examination of the data suggest that fatty acids such as C_{12}, C_{14}, and $C_{18:2}$ are apparently utilized to a great extent for direct incorporation into tissue fat; C_8 and C_{10} are rapidly metabolized to smaller units, and little of these is directly incorporated into tissue fat; C_{16} and $C_{18:1}$ are the main fatty acids synthesized.

It is interesting that the level of $C_{18:2}$ in the epididymal fat of the MCT and coconut oil-fed groups were 2.8 and 1.6 times the levels in the diets respectively whereas, with the other diets, the epididymal fat contained 0.8 to 0.9 as much $C_{18:2}$ as the dietary fats. This may be related to the presence of the shorter-chain fatty acids in MCT and coconut oil; these are mostly metabolized, thereby indirectly increasing the relative amount of $C_{18:2}$ in the fat made available to the animal.

Total plasma cholesterol levels measured at intervals during the study (Table V) were lower in male rats receiving the MCT diet than in those receiving the other dietary fats. This relationship was not apparent in female rats. In both sexes the highest levels were found in the groups receiving the coconut oil diet. At the end of the study, blood samples for more complete cholesterol analyses were obtained by cardiac puncture after the animals were fasted for 18 hours. Under these conditions the lowest values were found in the animals on the corn oil and safflower oil diets; with MCT the values were higher. The differences in findings between the earlier values and the terminal values may have been attributable in part to differences in conditions under which the blood samples were obtained or may reflect changes in age of the animals or in length of time on the diets.

Total liver lipids and cholesterol levels were lower in both male and female on the MCT diet than in those receiving the other dietary fats (Table VI). Phospholipid levels were similar on all diets and were apparently not affected by the type of dietary fat in both males and females. The difference between total lipids and the sum of phospholipids and cholesterol presumably represents the triglyceride fraction. This

TABLE V

Plasma Cholesterol Levels in Rats Fed Various Dietary Fats for 47 Weeks

	Weeks							
	7	14	21	35	47			
	Plasma cholesterol							
	Total				Total	Free	Esterified	Esterified
	mg/100 ml				mg/100 ml			%
Males								
MCT[a]	84 ± 9	85 ± 13	92 ± 15	99 ± 15	100 ± 28	27 ± 7	73 ± 23	73 ± 5
Oleo oil[a]	105 ± 18[b]	110 ± 20[b]	116 ± 26[b]	117 ± 23[b]	86 ± 26	22 ± 8	64 ± 20	74 ± 5
Butter fat[a]	110 ± 16[b]	108 ± 15[b]	123 ± 19[b]	126 ± 29[b]	92 ± 28	22 ± 7	72 ± 21	76 ± 3
Coconut oil[a]	112 ± 9[b]	115 ± 13[b]	128 ± 13[b]	135 ± 12[b]	113 ± 28	25 ± 7	89 ± 27	78 ± 3[b]
Corn oil	110 ± 21[b]	104 ± 24[b]	118 ± 25[b]	115 ± 19[b]	81 ± 17	15 ± 4[b]	66 ± 13	82 ± 1[b]
Safflower oil	100 ± 17	97 ± 17[b]	109 ± 23	105 ± 18	82 ± 23	15 ± 7[b]	67 ± 18	82 ± 3[b]
Females								
MCT[a]	109 ± 13	107 ± 11	119 ± 19	126 ± 21	124 ± 26	33 ± 9	92 ± 19	74 ± 4
Oleo oil[a]	106 ± 15	104 ± 13	107 ± 13	116 ± 25	102 ± 36	26 ± 9	73 ± 27	74 ± 2
Butter fat[a]	110 ± 13	108 ± 9	125 ± 19	122 ± 23	126 ± 15	33 ± 6	92 ± 13	74 ± 4
Coconut oil[a]	124 ± 20[b]	125 ± 19[b]	142 ± 25[b]	148 ± 28[b]	125 ± 31	28 ± 8	97 ± 24	79 ± 3[b]
Corn oil	96 ± 14[b]	96 ± 11[b]	103 ± 19[b]	112 ± 17	93 ± 37[b]	17 ± 9[b]	76 ± 29	82 ± 3[b]
Safflower oil	88 ± 13[b]	83 ± 11[b]	101 ± 12[b]	107 ± 13[b]	90 ± 16[b]	17 ± 5[b]	74 ± 13[b]	82 ± 4[b]

[a] Plus 2.5% safflower oil.
[b] $P < 0.05$ compared with MCT group.
All values are shown with standard deviations.

TABLE VI

Liver Lipid Composition in Rats Fed Various Dietary Fats for 47 Weeks

Dietary fat	Liver weight	Total lipid		Phospholipids	Cholesterol
	g	mg	%	mg/g	mg/g
Males					
MCT[a]	14.3 ± 1.9	889 ± 236	6.2 ± 1.2	26 ± 2	2.5 ± 0.4
Oleo oil[a]	14.5 ± 2.9	991 ± 380	6.7 ± 1.0	24 ± 3[b]	3.1 ± 0.4[b]
Butter fat[a]	13.9 ± 1.6	1040 ± 375	7.4 ± 2.2	24 ± 2[b]	3.0 ± 0.5[b]
Coconut oil[a]	16.1 ± 3.6	1317 ± 435[b]	7.8 ± 1.0[b]	24 ± 3[b]	2.8 ± 0.3[b]
Corn oil	13.8 ± 1.9	1073 ± 243	7.7 ± 0.9[b]	22 ± 3[b]	4.0 ± 0.6[b]
Safflower oil	15.7 ± 3.9	1529 ± 1052[b]	9.1 ± 3.6[b]	23 ± 3[b]	4.7 ± 1.3[b]
Females					
MCT[a]	9.8 ± 1.7	705 ± 282	7.1 ± 1.8	24 ± 3	2.2 ± 0.3
Oleo oil[a]	10.4 ± 1.8	937 ± 277[b]	8.9 ± 1.7[b]	24 ± 3	2.5 ± 0.3
Butter fat[a]	10.9 ± 1.8	857 ± 238	7.8 ± 1.2	24 ± 2	2.4 ± 0.2
Coconut oil[a]	11.1 ± 2.3	988 ± 266[b]	8.9 ± 1.5[b]	25 ± 2	2.4 ± 0.3
Corn oil	11.5 ± 2.0	894 ± 182[b]	7.9 ± 1.7	24 ± 3	2.8 ± 0.4[b]
Safflower oil	10.1 ± 1.8	907 ± 282	8.9 ± 1.7[b]	24 ± 2	3.1 ± 0.3[b]

[a] Plus 2.5% safflower oil.
[b] $P < 0.05$ compared with MCT group.
All values are shown with standard deviations.

TABLE VII
Net Absorption of Dietary Fat, Protein, and Calcium from Diets with Different Dietary Fats

	Percentage of Dietary Intake				
	Fat absorption 35 wks	Protein absorption 35 wks	Calcium absorption 3 wks	Calcium absorption 10 wks	Calcium absorption 21, 35, and 47 wks (Average)
	%	%	%	%	%
Males					
MCT[a]	97	94	70	41	20
Oleo oil[a]	78	93	68	41	16
Butter fat[a]	89	94	71	45	17
Coconut oil[a]	96	94	73	44	20
Corn oil	95	93	67	39	20
Safflower oil	95	91	74	43	21
Females					
MCT[a]	98	91	74	35	26
Oleo oil[a]	85	93	73	25	22
Butter fat[a]	94	91	74	36	17
Coconut oil[a]	96	92	78	42	21
Corn oil	97	91	72	40	15
Safflower oil	97	94	70	38	22

[a] Plus 2.5% safflower oil.
100 g of diet supplied about 21 g fat, 23.6 g protein from casein, and 454 mg of calcium (447 mg from $CaCO_3$, and 6.8 mg from casein).

fraction was also lower in the MCT groups than in those on the other diets.

Net absorption of fat, protein, and calcium during various periods of the study are shown in Table VII. The values were calculated from dietary intakes and fecal excretion with no correction for endogenous losses. Values were obtained on group-pooled samples and do not permit statistical comparisons. The net absorption of MCT was higher than that of the other dietary fats; there was little difference in protein absorption. Calcium absorption was apparently not markedly affected by the type of fat in the diet. However retention of calcium decreased with age; about 70% during the third week, 30 to 40% in the 10th week, and about 20% later in the study.

Reproduction and Lactation Study

The F_0 generation (young adult male and female rats of the McCollum-Wisconsin Strain) were maintained on the MCT diet, the oleo oil diet, and the low-fat diet for three weeks prior to mating. The average number of pups per litter and birth weights of the F_1 generation are shown in the upper half of Table VIII. Findings were similar on all three diets. Weight gains during weaning were lower on the low-fat diet than on the MCT or oleo oil diet; at 21 days male rats on the MCT diet averaged 45 g and those on the oleo oil diet 47 g whereas those on the low fat diet weighed only 39 g. Mortality during the lactation period was 6, 7, and 2% on the three diets respectively.

After weaning the F_1 rats were raised on the same diets fed to their mothers. Weights at 49 and 105 days of age were again lowest in the group receiving the low-fat diet. This difference in weight gain is related in part to food intake since caloric efficiencies were similar on all three diets.

At 12 weeks of age each group of F_1 rats was divided into three subgroups; one subgroup was continued on the same diet whereas the two other subgroups were switched to the diets containing one of the other two fats, thus providing nine experimental groups, as shown in the lower portion of Table VIII. After three weeks the F_1 females were mated; data on their pups, the F_2 generation, are summarized in Table VIII. The number of pups per litter and birth weights were also similar for all the subgroups. However weight gains of the pups during lactation were related to the fat in the diet of the mothers during this period. In general, the highest weights at weaning (21 days) were found in the groups on the oleo oil diet except for the slightly low value in that group which had previously received the low-fat diet. Intermediate weaning weights were found in the groups receiving the MCT diet, and the lowest weaning weights were found in the groups receiving the low-fat diet.

Mortality was relatively high in two of the groups receiving MCT, the one previously on MCT (22%) and that previously on the low-fat diet (20%), but not in the group previously on the oleo oil diet (6%). Mortality was 7% or less in the other six subgroups. Subsequent growth of these animals showed no marked differences, as shown by weights of males at 63 days. Determination of the amount of milk secreted by the mothers of each subgroup suggested that this factor may have affected weight gain and mortality.

The increase in weight of the litters during a timed lactation period was used as an index of milk secretion; these values are summarized in Table IX. During these seven periods the F_0 mothers secreted on the average about 40, 41, and 43 g of milk on the MCT, oleo oil, and low-fat diets respectively, showing no difference because of diet. There was much greater variation in milk secretion by the F_1 mothers. However milk secretion was quite low in those animals which had received the MCT diet for two generations.

The composition of the milk obtained from F_0 mothers receiving the MCT and oleo oil diets was determined in a previous study. Data in Table X suggest that the level of fat in the milk of the animals receiving MCT is slightly lower than that in the milk of the rats receiving oleo oil. Although 85% of the

TABLE VIII
Birth Weight and Body Weights of Rats Born and Nursed by Mothers Receiving MCT, Oleo Oil, and Low-Fat Diets

Dietary fat[a]		Pups per litter	Day Birth	Day 6	Day 12	Day 18	Day 21	Day 49	Day 63	Day 105
			Male and Female				Male			
			Weight, g per rat				Weight, g per rat			
F1 Generation										
MCT		9.0	6.4	13	21	34	45	181		309
Oleo oil		9.1	6.1	14	24	34	47	186		326
Low fat		9.6	6.4	13	22	29	39	165		286
F2 Generation										
MCT	MCT	9.2	6.5	12	23	35	45		261	
Oleo oil	MCT	7.0	6.7	12	23	36	45		242	
Low fat	MCT	9.4	6.6	12	23	36	43		243	
MCT	Oleo oil	9.4	6.8	13	25	39	49		249	
Oleo oil	Oleo oil	9.2	6.3	12	24	39	47		244	
Low fat	Oleo oil	10.5	6.0	11	23	35	43		248	
MCT	Low fat	10.8	6.2	11	21	31	36		244	
Oleo oil	Low fat	8.8	6.4	12	25	36	39		245	
Low fat	Low fat	9.3	6.5	12	23	32	38		243	

[a] All diets contained 2.5% safflower oil.

TABLE IX

Milk Secreted by F_o and F_1 Generation Lactating Rats Receiving MCT, Oleo Oil, and Low-Fat Diets[a]

Dietary fat[b]		Day 3	6	9	12	15	18	21	Total
		g milk							
F_o Generation									
MCT		3.3	4.7	5.0	5.5	7.1	7.3	7.3	40.2
Oleo oil		4.3	6.5	4.5	5.3	6.5	6.0	6.0	41.2
Low fat		4.5	5.6	6.3	6.2	5.4	6.7	8.4	43.1
F_1 Generation									
MCT	MCT	1.7	0.8	4.0	2.3	4.0	5.2	6.3	24.3
Oleo oil	MCT	1.3	2.0	2.8	4.3	6.2	9.0	8.8	34.4
Low fat	MCT	2.4	3.9	5.0	5.0	6.7	8.7	5.5	37.2
MCT	Oleo oil	2.2	3.6	6.2	7.0	6.6	10.2	9.2	45.0
Oleo oil	Oleo oil	1.5	2.2	4.8	5.8	6.3	10.8	9.8	41.2
Low fat	Oleo oil	2.2	4.8	7.5	8.7	8.3	8.3	10.0	49.8
MCT	Low fat	1.8	6.5	5.3	4.0	7.5	11.2	10.0	46.3
Oleo oil	Low fat	2.0	4.2	5.2	4.4	7.6	9.6	8.0	41.0
Low fat	Low fat	1.6	3.9	4.4	5.3	6.6	7.7	9.1	38.6

[a] Milk secretion was estimated as the increase in weight of each litter during a one-hour lactation period; the mother was removed from the litter for six hours beforehand.
[b] All diets contained 2.5% safflower oil.

TABLE X

Fatty Acid Composition of Milk Obtained from Lactating Rats Receiving MCT- or Oleo Oil-Containing Diets

Dietary fat[b]	Milk fat	Fatty acid composition of milk fat[a] — Fatty acid No. 8	10	12	14	16	18	16:1	18:1	18:2	18:3	20:4	Other
	%												
MCT	8.2	6.5	16.8	10.3	11.5	29.9	4.7	0.9	11.7	6.5	0.3	0.3	0.4
Oleo oil	9.8	2.2	5.8	4.4	6.6	20.8	9.4	2.4	36.7	8.0	0.9	0.4	2.8

[a] Milk was obtained on 10th day of lactation.
[b] Diets also contained 2.5% safflower oil.

dietary fatty acids were C_8 and C_{10} in the MCT group, these constituted only 24% of the milk fat fatty acids. In contrast, the fatty acids in the milk secreted by the oleo oil group were similar to those contained in the dietary fat. Fatty acid composition of these milks show appreciably higher levels of saturated fatty acids C_8 to C_{16} in the milk of the MCT group and markedly more $C_{16:1}$, C_{18}, and $C_{18:1}$ in the milk of the rats fed oleo oil. It is apparent that the rats fed MCT were required to synthesize a large portion of the fatty acids secreted in the milk fat.

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