# VI. RESEARCHES ON FAT METABOLISM. II.

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(1) IT was shown in the first paper of this series [Verkade *et al.*, 1933] that with two healthy subjects (V. and v. d. L.) considerable quantities of undecanedioic acid were excreted in the urine after administration of triundecylin. In the human organism the terminal methyl group of the undecoic acid, the component acid of triundecylin, is thus oxidised—and as we shall see later, very readily—to a carboxyl group. The term *ω-oxidation* was introduced by us for this type of oxidation

$$CH_3 . (CH_2)_9 . COOH \rightarrow HOOC . (CH_2)_9 . COOH.$$
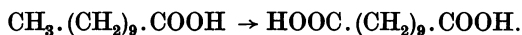
The present communication deals with the question whether the administration of chemically pure simple triglycerides of other, higher and lower, odd and even saturated fatty acids leads similarly to the excretion of the corresponding dicarboxylic acids and if so, to what extent.

Influence of simultaneous administration of carbohydrate.

(2) During our original experiments with triundecylin this formed part of a diet which was very poor in carbohydrate; the subject V., *e.g.*, then received 23 g. carbohydrate, 136 g. protein, 192 g. ordinary food fat and 100 g. triundecylin. In a continued study of the *diaciduria* (thus we term the phenomenon of excretion of dicarboxylic or dioic acids in the urine) produced by triundecylin we have discovered that addition of a liberal amount of carbohydrate to the diet leads with most people, among them also the subjects V. and v. d. L., to a pronounced rise of the dioic acid excretion. We have repeatedly taken advantage of this noteworthy and definitely important fact, which very probably points to a function of the liver in the processes here in question and which will be discussed fully in a later communication, in the investigations which will be dealt with in this paper.

Because of their general plan the simple experiments described in this paper can only serve for a preliminary orientation; we shall return to this later. For this reason also we have considered it superfluous to indicate in detail the composition of the diet administered and the distribution of it over the day for all the experiments. We have frequently regarded it as sufficient to mention only a few brief data on the point.

EXPERIMENTAL.

Tricaprylin.

(3) The tricaprylin used was prepared in the way described elsewhere [Verkade *et al.*, 1932] and refined in the way commonly employed technically. Caprylic (octoic) acid with a setting-point of 16·1°, which was isolated from coconut fat *via* the ethyl ester, served as our starting-material. The setting-point of an earlier caprylic acid specimen purified by us with the greatest

possible care, which had at that time to serve for precision measurements, lay only a little higher, namely at 16·35°; Garner and Randall [1924] give the same setting-point for a similar product. The saponification number of the fat obtained was 357·3 (calculated 357·8) and the setting-point 9·45°; we find the values 8–8·3° [Scheij, 1899], 9° [Jaeger, 1917] and 8·3° [Loskit, 1928] for the melting-point of tricaprylin in the literature.

A diet which contained 100 g. tricaprylin as well as amongst other things a liberal amount of carbohydrate, was administered to the healthy subject V. The fat was taken mixed with coffee in portions of 20 g. at practically equal intervals in the course of 9 hours; the carbohydrate was also distributed over this period in several portions. The urine of the subject was carefully collected from the time of partaking of the first portion of fat and indeed up to and including that passed immediately after rising on the next day; on the basis of researches to be published later we knew that collection of the urine for a longer time was unnecessary.

The collected urine was made strongly alkaline with KOH and then evaporated as far as possible, and the residue was heated for a considerable time on the water-bath. Hydrolysis of the hippuric acid present takes place as a result. The removal of this acid, which is relatively little soluble in cold water, facilitates the isolation in a pure state of the dicarboxylic acid sought, especially if—as, for example, in the isolation of sebacic acid discussed on p. 34— extraction with benzene is not employed; hippuric acid is only very slightly soluble in boiling benzene. It is almost certain that compounds of dicarboxylic acids with glycine, glucuronic acid etc. if present would also be hydrolysed. The residue after evaporation was taken up in water, acidified with hydrochloric acid and continuously extracted with ether for a considerable time. The ethereal extract was filtered and the residue obtained after distilling off the ether was dried in vacuo. It was subsequently extracted several times with 50 ml. of boiling benzene. The mass of crystals gradually separating from the combined cold benzene solutions contains practically all the suberic acid present; this acid is indeed practically insoluble in cold benzene [Verkade and Coops, 1930, 2]. The crystals were filtered off and taken up in hot water. The hot aqueous solution was treated with a small amount of adsorption charcoal and then filtered through a small glass filter. From this solution evaporated to about 15 ml. 0·18 g. of practically pure suberic acid (octanedioic acid) separated out on standing in the ice-chest. The M.P. of this product was 139–141°; the mixed M.P. with a specimen of suberic acid prepared in the usual way from castor oil [Verkade, 1927] and melting at 140–141° was 139–141°.

0·1009 g. required 11·79 ml. 0·0974 N NaOH; equiv. wt. 87·9; calc. 87·06.

Tricaprylin was the last triglyceride we examined. As appears from the table on p. 37 we had good reason to expect that only very small quantities of suberic acid would be excreted after administration of this substance [cf. Verkade and van der Lee, 1933]. We therefore gave the subject v. d. L.—the latter generally shows the greatest tendency to diaciduria of all subjects who have been at our disposal—100 g. of tricaprylin in a single portion together with 160 g. of bread, 25 g. of sugar and 10 g. of butter shortly after rising. Our intention in doing this was naturally to flood the body with resorbed caprylic acid—we shall not consider the question of the form in which this circulates in the blood—and thus to provoke accumulation of suberic acid in the blood and excretion thereof in the urine. The experiment with the subject V. described above has taught us later that this forced administration of tricaprylin was unnecessary. Diarrhoea occurred in the evening as was indeed not surprising;

investigation of the faeces showed, however, that by far the greater part of the fat administered had been resorbed. The urine was again collected up to the next morning while the subject was still fasting.

In this experiment 0·12 g. of practically white suberic acid, M.P. 139–140°, was isolated from the urine; the mixed M.P. was also 139–140°.

(Found: equiv. wt. 86·8, C 55·4, 55·5; H 7·7, 7·7%: calc. for $C_8H_{14}O_4$: equiv. wt. 87·06; C 55·14; H 8·11 %.)

Trinonylin.

(4) The preparation and purification of the trinonylin employed has already been described elsewhere [Verkade et al., 1932]. The setting-point of this fat was 8·7°, the saponification number 328·7 (calc. 328·5).

To the subject v. d. L. a diet was administered which contained besides 100 g. of trinonylin a liberal amount of carbohydrate in the form of bread and sugar. The fat was taken as such in portions of 20 g. at nearly equal intervals in the course of 10½ hours; the carbohydrate was also taken in portions a short time before the fat. The urine was again collected up to the following morning.

The ethereal extract of the urine obtained in the way described on p. 32 and dried in vacuo was extracted several times with 50 ml. of boiling benzene. The odd acids of the oxalic acid series, with the exception of the two lowest members, are readily soluble in boiling benzene and are thus rapidly extracted in this way even when present in somewhat larger quantities; on the other hand they are very sparingly soluble in cold benzene; azelaic acid, e.g. only to the extent of 9 mg. in 100 g. of benzene at 25° [Verkade and Coops, 1930, 2]. The mass of crystals separated from the combined ice-cold benzene solutions was filtered off at the pump and taken up in hot water. The hot aqueous solution was treated with some adsorption charcoal and concentrated to about 75 ml. On cooling 0·60 g. pure azelaic acid (nonanedioic acid) separated out. The M.P. of this product was 104–105°; the mixed M.P. with a specimen of azelaic acid prepared in the usual way from castor oil [Verkade, 1927] and melting at 106·5–107·5° was 105–106°. A further 0·05 g. of the same acid was obtained from the benzene and aqueous mother-liquors. Thus a total of 0·65 g. of azelaic acid could be isolated from the urine.

(0·2020 g. required 20·53 ml. 0·1041 N NaOH: equiv. wt. 94·5; calc. 94·06.)

A similar experiment was made with the subject V. The latter excreted 0·35 g. of azelaic acid in the urine after taking 85 g. of trinonylin.

(Found: C, 57·4, 57·6; H, 8·3, 8·4 %; calc. for $C_9H_{16}O_4$: C, 57·41; H, 8·56 %.)

Tricaprin.

(5) The tricaprin used was prepared in the manner described elsewhere and purified by recrystallisation from a mixture of alcohol and ether. Capric (decoic) acid setting at 31·35°, which was obtained from pure n-octylmalonic acid, served as starting material. The fat obtained set at 30·95°, thus below body-temperature, and was consequently applicable as such to the experiments in hand (see on the other hand sections (7) and (8)); the values 31·1° [Scheij, 1899; Jaeger, 1917] and 31·0° [Loskit, 1928] are given for the M.P. of tricaprin in the literature. The saponification number of the fat was 302·7 (calc. 303·4).

The experiments were here carried out with the standard technique which we apply to other work and which will be discussed rather more fully in a later paper.

Shortly after rising 25 g. of tricaprin melted up in coffee together with a liberal amount of carbohydrate were administered to the sober, healthy subject V. The urine was collected át intervals of 1–2 hours and the presence of sebacic acid was tested for in each portion by treating the urine with a concentrated mineral acid, *e.g.* phosphoric acid; even with very small concentrations of sebacic acid the latter then separates out as micro-crystals in a characteristic way. The collection of the urine was continued with the subject still fasting until two successive portions gave a negative reaction.

The ethereal extract obtained in the manner described on p. 32 was extracted with boiling water, and the filtered aqueous solution was evaporated to about 50 ml.; on cooling practically pure sebacic acid (decanedioic acid) crystallised out. This acid weighed 0·55 g. and melted at 129·5–130·5°; the mixed M.P. with a specimen of sebacic acid prepared in the usual way from castor oil and melting at 132·5–133·5° was 132–133°.

(0·1202 g. required 11·26 ml. 0·1046 N NaOH: equiv. wt. 102·0; calc. 101·08.)

In another similar experiment this subject excreted 0·11 g. of sebacic acid in the urine.

Two similar experiments were made with the subject v. d. L. With the latter 1·10 g. and 0·29 g. of sebacic acid were respectively excreted in the urine after partaking of 25 g. of tricaprin together with a liberal amount of carbohydrate. Below are given some analytical data for the acid isolated in the last experiment, recrystallised once more from water after treatment with some adsorption charcoal and then melting at 131·5–133°.

(Found: equiv. wt. 101·7; C, 59·6, 55·6; H, 8·8, 8·8 %: calc. for $C_{10}H_{18}O_4$: equiv. wt. 101·08; C, 59·36; H, 8·98 %.)

Triundecylin.

(6) It is here sufficient to state that, employing the above mentioned standard technique, with the administration of 25 g. of triundecylin together with a liberal amount of carbohydrate, amounts of undecanedioic acid, varying from 0·29 g. to 0·66 g. and from 0·60 g. to 1·59 g. were excreted by the subjects V. and v. d. L. respectively. These experiments will be discussed in detail in the communication in which we deal with the rôle of the carbohydrate.

Trilaurin.

(7) The trilaurin required was obtained in a yield of more than 85 % by crystallising tangkallak fat (from *Litsaea sebifera* Bl.) several times from a mixture of 2 vols. 96 % alcohol and 1 vol. ether [van Eldik Thieme, 1911]. Its saponification number was 263·0 (calc. 263·5). The M.P. of trilaurin is 46·2°.

By melting together 1 part of trilaurin with 1 part of coconut fat a mixture was obtained which was completely liquid at body-temperature. The use of such a mixture appeared to us to be necessary to obtain a good adsorption of the fat. On administering trilaurin as such, completely melted up in coffee or thin broth, it was excreted to an appreciable extent in the faeces in the form of large and small solid pieces. For two reasons we have used coconut fat for the purpose mentioned and not a fatty oil setting only at low temperatures. Firstly it is well known in the food fat industry that the addition of coconut fat is particularly suitable for lowering the M.P. of a fat; secondly coconut fat contains amongst its component fatty acids an appreciable amount (about 50 %) of lauric acid, although in the form of mixed glycerides. Against this addition of coconut fat one can *a priori* raise the objection that this fat contains as com-

ponent fatty acids various other higher and lower acids of the same series in varying though always much smaller amounts. One may ask whether administration of the fat mixture in question might lead to the excretion of a mixture of several dicarboxylic acids in the urine, so that the isolation in the pure state of dodecanedioic acid possibly present and the proof of the origin thereof as an ω-oxidation product of lauric acid might be made much more difficult. From what follows it will be seen that this objection is of a purely theoretical nature and, taking into account the quantitative composition of coconut fat [see *e.g.* Taylor and Clarke, 1927], we get an indication why this is so. Reference may be made here to the third paper of this series.

We have administered this fat mixture to various subjects, finally, since no positive results were obtained, in very large quantities. We shall only discuss two of these experiments here, one of them somewhat more fully.

225 g. of the fat mixture in question were administered in the course of 8 hours as part of a diet very poor in carbohydrate to the healthy subject B., to whom on the preceding day no food whatever had been given. We succeeded in isolating from the urine collected up to the following morning a few mg. of a substance which melted at 118–122° and the mixed M.P. of which with a specimen of dodecanedioic acid, prepared by the method of Walker and Lumsden [1901] and melting at 125–127°, was 119–124°. After recrystallising once more from boiling benzene this substance melted at 122·5–125·5°. Taking the solubility relations of this substance also into account—it was very slightly soluble in cold water and cold benzene [see Verkade and Coops, 1930, 2], more readily in cold ether and boiling water and readily in boiling benzene—the conclusion is justified that we were very probably dealing with dodecanedioic acid. The amount of material was quite inadequate for a more definite confirmation by titration or elementary micro-analysis.

In the second experiment 190 g. of the same fat mixture were administered to the same subject in the course of $8\frac{1}{4}$ hours, together with a liberal amount of carbohydrate in the form of bread and sugar. The composition of the diet and the distribution of it over the day are indicated in the following table:

Time	Bread g.	Sugar g.	Fat mixture g.
9.15	40	8	—
9.40	—	—	30
11.00	—	—	30
11.10	40	—	—
12.15	—	—	30
13.15	80	8	—
13.30	—	—	25
14.45	—	—	25
16.45	30	—	25
18.00	—	—	25
18.55	70	—	—
	260	16	190

Each portion was taken after being completely melted up in thin broth; taking the large amount of fat was greatly facilitated by adding some lemon juice and eating a few grapes. On working up the urine, again collected until the following morning, indications of the presence of only a very small amount of dodecanedioic acid were obtained.

Notwithstanding the administration of tea and of *pulvis opii*—in the second experiment, for example, the subject received 50 mg. of the latter each time at 12 hours 30, 17 hours and 23 hours—diarrhoea occurred in both experiments,

which can indeed cause no surprise. It occurred, however, only late at night and it is therefore quite certain that a very considerable part of the fat mixture administered had been adsorbed. That no appreciable excretion of dodecanedioic acid in the urine took place, in spite of the large amount of fat adsorbed in these experiments, is very striking; for example, for comparison with the result of the second experiment it should be mentioned that the subject B. excreted a large amount (namely 1·05 g. and 0·45 g. respectively) of undecanedioic acid on the administration of only 25 g. of triundecylin together with a liberal amount of carbohydrate employing the standard technique in the tests. The same remarkable difference in behaviour between trilaurin and the lower triglycerides was observed with other subjects, among them the subject V.

Since natural products (tangkallak fat and coconut fat) served as the starting materials in the experiments discussed in this section, for the sake of completeness we shall deal with the question whether these products possibly contained preformed dodecanedioic acid in some form or other so that the traces of this acid, which were present in the urine of the subject, might be derived from this. This question is really of no importance to us. Indeed in the case of a confirmatory answer the contrast between trilaurin and the lower triglycerides, to which we have just drawn attention, becomes, if possible, still more pronounced. However, a negative answer is already clearly implied in the fact that—as will be shown in later communications partly from data in the literature [see, among others, Baer and Blum, 1908; Mori, 1918; Flaschenträger, 1927], partly from our own investigations—animal and human organisms are able to burn considerable amounts of the higher normal saturated dicarboxylic acids in a day, combined with the consideration that the trilaurin obtained by repeated crystallisation of tangkallak fat from alcohol-ether and the coconut fat (both products which were repeatedly and carefully investigated) in no case contained appreciable amounts of these acids.

Tritridecylin.

(8) The preparation and purification of the tritridecylin employed has already been described elsewhere. The saponification number of this fat was 246·1 (calc. 247·3) and the setting-point 42·65°.

To each of the subjects V. and v. d. L. 25 g. of this fat completely melted up in thin broth or coffee together with a liberal amount of carbohydrate were administered, employing the standard technique. No tridecanedioic acid could be detected in the urine collected up to the next morning. In this case too, however, a considerable part of the fat supplied was excreted in the faeces in the form of large and small solid pieces.

In order to lower the melting-point below body temperature we next melted tritridecylin together with the same weight of coconut fat. From the experiments discussed in section (7) we knew that, after taking coconut fat, no substances are excreted in the urine which might interfere with the isolation in the pure state of any possibly excreted tridecanedioic acid. The subject V. partook in the usual way of 50 g. of this mixture, again together with a liberal amount of carbohydrate. No tridecanedioic acid was excreted in the urine.

Finally a mixture was made of 25 g. of tritridecylin with 10 g. of paraffin oil; such a mixture shows very little tendency to crystallise at body temperature. In the preceding experiment tritridecylin formed only 50 % of the weight of a fat mixture which could be completely adsorbed in the intestines; in the mixture just mentioned on the other hand tritridecylin is the only absorbable compound,

present in it to an amount of 70 %. It therefore appeared to us conceivable, and even not improbable, that on administering such a mixture tritridecylin would be absorbed at a greater rate than on administration of the mixture of tritridecylin and coconut fat, and consequently that there would be a greater chance of the accumulation of tridecanedioic acid in the blood and of the excretion of this substance in the urine. On the contrary, it is true that a reduction of the absorbability of tritridecylin as a result of the simultaneous presence of the paraffin oil may also be conceived. We believe on good grounds that any appreciable influence of the small amount of paraffin oil in this sense may be excluded; for example, it will be shown in a communication to be published later that the velocity of saponification of the simple triglycerides under the influence of pancreas lipase is not altered by the addition of paraffin oil. The subject V. partook of the mixture in question, completely melted up in thin broth together with a liberal amount of carbohydrate; no hindrance whatever due to the presence of the paraffin oil was experienced. Again no tridecanedioic acid appeared to be present in the urine collected up to the next morning.

DISCUSSION.

(9) As appears from the preceding sections, administration under, as far as possible, corresponding conditions of different simple saturated triglycerides to one and the same subject leads to excretion of dioic (dicarboxylic) acid in the urine in very different amounts.

We only found a very considerable excretion of dioic acid after tricaprin and triundecylin had been taken. The amount of dioic acid excreted on the administration of always the same amount of the same triglyceride to one and the same subject under externally similar conditions can vary fairly considerably, while different subjects can also behave very differently with respect to the same triglyceride. We shall go into these facts, concerning which a few data are already to be found above, in later communications. It is consequently impossible to indicate yet on the basis of the results of the few experiments discussed above whether triundecylin or tricaprin has the greater tendency to cause dioic acid-acidosis and diaciduria; in other words—as we shall term it—which of the two is the more *diacidogenic*. Even after further experience obtained by us in the continuation of the work here described, we do not yet wish to state an opinion on this point. Trinonylin is certainly considerably less diacidogenic than the triglycerides just discussed, and in tricaprylin the diacidogenic properties are almost certainly still less developed. With the two higher triglycerides investigated by us, tritridecylin and trilaurin, dioic acid was either not found in the urine or at most only in traces, in spite of the selection of subjects with a considerable tendency to diaciduria.

A comparative review of the diacidogenic properties of the triglycerides investigated, based on the experiments described in this paper and therefore obviously being only of a preliminary nature, is given here.

	Term-number*	
Tritridecylin	12	Not diacidogenic
Trilaurin	11	Practically not diacidogenic
Triundecylin	10	Strongly diacidogenic
Tricaprin	9	Strongly diacidogenic
Trinonylin	8	Rather weakly diacidogenic
Tricaprylin	7	Weakly diacidogenic

* See Verkade and Coops [1930, 1].

The results of our experiments with tricaprylin justify the question whether the diacidogenic properties of the lower triglycerides only decrease slowly on descending the series and whether it will therefore, for example, be possible to prove the excretion of pimelic acid (heptanedioic acid) in the urine after the administration of triheptylin to suitable subjects. It did not at the time appear to us necessary to study this point.

On the other hand we can indeed say with certainty that with the triglycerides of higher term-number [Verkade and Coops, 1930, 1] than those we investigated (> 12)—we leave out of consideration the difficulties which these substances would lead to on account of their high M.P.—there will be no question of dioic acid-acidosis or dioic acid excretion in the urine.

However puzzling this remarkable course of the diacidogenic properties may still be in the main, one thing appears very clearly, namely, that there is definitely no question of a contrast in this respect between the triglycerides derived from acids with odd and even numbers of C atoms; the behaviour of the triglycerides with the term-numbers 9 and 10, 11 and 12 may be compared.

In succeeding communications we shall show that the normal saturated fatty acids—we shall at present deal only with these—are catabolised in a hitherto absolutely unknown way besides the classical way of the β-oxidation discovered by Knoop, which from now onwards we shall call *one-sided β-oxidation*. By ω-oxidation of the fatty acid the corresponding dioic(dicarboxylic) acid is formed which is then further catabolised *via* lower dioic acids formed by *two-sided β-oxidation*. It may be remarked in passing that we in no way wish to exclude the possibility of the occurrence of still further mechanisms for the degradation of these fatty acids.

It is a fact that practically no one—and in our opinion certainly rightly—doubts the degradation of saturated fatty acids by one-sided β-oxidation. The arguments in favour of this way of degradation—one can hardly speak of proofs—are, however, really of little significance. The only indication in this direction with the fatty acids with even numbers of carbon atoms, the acid components of our normal food fats, really consists in the formation from them of ketonic bodies under various conditions, which need not be enumerated here, and with the fatty acids with odd numbers of carbon atoms in the non-occurrence of ketonic bodies under these same conditions. Finally the greatest support for the correctness of the view in question is derived from experience obtained with derivatives of the fatty acids, *e.g.* with the ω-phenyl-substituted fatty acids by Knoop, with the fatty acids containing a methyl(benzenesulphonyl)amino-group by Flaschenträger, *etc*. Closer investigation of this way of degradation of the fatty acids proper is quite definitely desirable; in fact such work is included in our programme.

On the other hand in the case of the way of degradation of the fatty acids now discovered by us we have been able to follow the degradation as it were from phase to phase both with the fatty acids with even and those with odd numbers of carbon atoms with the help of simple *in vivo* experiments. As far as the first phase is concerned, the ω-oxidation, the evidence for this statement is to be found in the experimental part of this paper.

(10) We shall naturally have to deal fully in later papers with the question of the factors to which is due the fact that administration of the various simple saturated triglycerides under as far as possible similar conditions to the same healthy subjects leads to accumulation of dioic acid in the blood and excretion of it in the urine in such typically divergent amounts. At present very little can be said with certainty on this subject. The catabolism of fat administered *per os*

takes place through a highly complicated series of processes, which we cannot as yet properly grasp at all even as regards its main features, and each phase of which will occur generally with a characteristic speed for each triglyceride, or each fatty acid, *etc.* Now it is certainly obvious to suppose that it will depend on the velocity relationships of all these processes whether, and if so to what extent, accumulation of dioic acid in the blood will occur after administration of a certain triglyceride and consequently—perhaps on exceeding a certain threshold concentration—excretion of this acid will take place in the urine. Experiments such as those described in this paper can—we already pointed this out expressly in section (2)—only serve for a first orientation with regard to the newly discovered way of degradation of the fatty acids and of the phenomena connected therewith. A deeper insight can only be obtained by comparative investigations of the behaviour of the triglycerides in question in different phases of the total process of fat metabolism. The first results of work carried out in this direction in our laboratory will soon be published.

(11) It may be stated here that by accepting the idea very briefly indicated above with regard to the cause of the characteristic serial change of the diacidogenic properties in successive triglycerides one may, or rather one must, logically conclude that there also exists some analogous change in the ketogenic properties of successive triglycerides, derived from fatty acids with even numbers of carbon atoms. Systematic work in this region has not yet been carried out. There is certainly also here a possibility of interesting and doubtless important investigations with the aid of perfectly defined synthetic fatty acid derivatives; we are meanwhile convinced that it will definitely be very difficult to reach really unambiguous results in this domain.

Summary.

1. Administration under as far as possible corresponding conditions of a series of simple saturated triglycerides to one and the same subject leads to excretion of dicarboxylic acid in the urine in very different amounts.

2. With respect to this ω-oxidation of the component fatty acid there is no contrast between triglycerides derived from acids with odd and even numbers of C atoms.

3. The excretion of dicarboxylic acid is largest with triundecylin and tricaprin; it diminishes on descending the series. No dicarboxylic acid is excreted after administration of the higher triglycerides.

4. The supposed cause of this peculiar serial change of the so-called diacidogenic properties of these successive triglycerides is indicated.

5. It is pointed out that consequently some serial change may or rather must exist in the ketogenic properties of successive triglycerides, derived from fatty acids with even numbers of carbon atoms.

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