

Comparative Curative Values of Unsaturated Fatty Acids in Fat Deficiency.*

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Some time ago¹ we called attention to the fact that cod liver oil fed at 2-5 drop levels daily caused renewed growth of fat-deficient rats but did not clear the scaly skin. In recent years we have had occasion to test numerous oils and pure fatty acids for these effects. Some of the results are reported in this paper.

Fat deficiency in white rats was produced with the diet 550-B used by Burr and Burr² consisting of casein, sucrose and salts supplemented with whole dried yeast (Northwestern) and the unsaponifiable fractions of cod liver oil and wheat germ oil. When a growth plateau is reached and the skin has become scaly the animals are used for a study of the curative effects of the oils and fatty acids. The results are recorded as gains in weight in a given time and in apparent change in skin condition. An arbitrary rating of scale on the feet, scale on the tail and dandruff in the hair, ranging from 0 to 3 (most severe) is summed to give a maximum scaly condition of 9. Three to 6 rats are used in each group and the results have been repeated several times.

During a search of corn oil, linseed oil and codliver oil for isomeric fatty acids the oils were fed at low levels and the responses noted at the end of 4 weeks. The results are recorded in Fig. 1. Ten mg daily of corn or linseed oil is not sufficient to produce marked improvement. At the 20 and 40 mg levels, however, all 3 oils give good growth responses. On the other hand, corn oil is the only one which produces a complete skin cure in this period of time. These differences can be explained if we assume that linoleic acid is responsible for the clearing of the skin, while linolenic and cod liver oil acids have little or no such effect. Corn oil (Mazola) has over 60% linoleic acid. Linseed oil probably has 30% linoleic and 40% linolenic acids.

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¹ Burr, G. O., Burr, M. M., and Brown, W. R., *PROC. SOC. EXP. BIOL. AND MED.*, 1931, **28**, 905.

² Burr, G. O., and Burr, M. M., *J. Biol. Chem.*, 1929, **82**, 345.

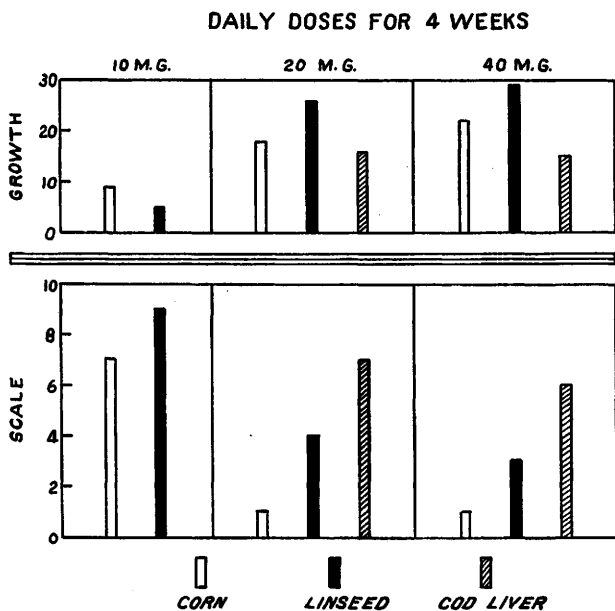


FIG. 1.

Growth and skin cure during 4 weeks of feeding oils at 3 levels. Poor skin cure is indicated by high column for scale.

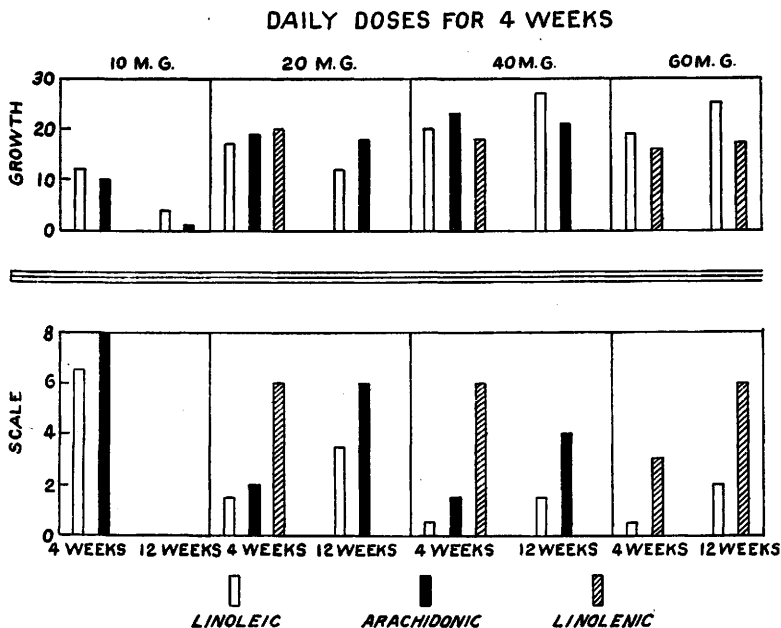


FIG. 2.

Growth and skin cures with 3 pure fatty acids. The doses were fed daily for 4 weeks and stopped, while growth and skin records were continued 8 more weeks to show storage effects.

In Fig. 2 are summarized the results of feeding linoleic, linolenic and arachidonic acid. In these experiments the doses were fed for only 4 weeks and the observations continued for 8 more weeks to measure the storage effects. It is clear that linolenic acid gives good growth responses but has little effect on the skin. Arachidonic and linoleic acids are similar in their effects. When fed at these low levels we do not find the superior action of arachidonic acid cited by Turpeinen.³ When fed at a 40 mg level there is a storage effect of linoleic acid which makes those animals superior in both weight and skin quality after 8 weeks on the fat-deficient ration.

These findings are of particular interest at this time in the study of the relation of unsaturated acids to vitamin B₆ deficiency. It has been observed by numerous workers that certain oils cure the severe acrodynia accompanying B₆ deficiency. Schneider, Ascham, Platz and Steenbock⁴ recently summarized their findings on the anti-acrodynic potency of foods. Examination of their Table I shows that cod liver oil is very poor and the linolenic acid of linseed oil is ineffective. Those oils highest in linoleic acid are most effective (corn oil and wheat germ oil). Salmon⁵ recently reported that methyl linolate was much more effective than methyl linolenate in curing the skin of B₆ deficient rats.

Conclusions. Unsaturated fatty acids (linoleic, linolenic, arachidonic and cod liver oil acids) show differences in growth and skin effects. They should no longer be treated as an interchangeable group but should be used individually in nutrition studies.

³ Turpeinen, O., *J. Nutr.*, 1938, **15**, 351.

⁴ Schneider, H. A., Ascham, J. K., Platz, B. R., and Steenbock, H., *J. Nutr.*, 1939, **18**, 99.

⁵ Salmon, W. D., *Proc. Soc. Biol. Chem.*, 1940, **34**, 83.