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On the Nutritive Value of Certain Oils.

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Following the work of Burr and Burr,[1, 2] a study of several oils has been made and it has been noticed that cod liver oil affects the animals in a way different from the common edible oils. This has been pointed out recently by Sinclair[3] and by Graham and Griffiths.[4] These workers find that the feeding of cod liver oil does not prevent scaliness of the feet and tail and our findings are in agreement with this view. Although in our earlier work, we thought the animals receiving cod liver oil were always normal in appearance, in later work we have found a considerable number of animals which were receiving 2 to 5 drops of cod liver oil daily with scaly feet and tails.

However, cod liver oil does cause renewed growth. Table 1 shows the increases in weight of sick animals after the feeding of cod liver oil.

TABLE I.

Date	Number in Group	Cod Liver Oil	Average wt. increase in 5 weeks	Condition of skin after feeding dose
1928	3 males	2 drops	68 gm.	Scaly
1928	6 females	2 "	37 "	"
1930	3 "	5 "	22 "	"

The 3 females in the 1930 group all mated and produced litters. This is another indication of much improvement over the fat-free animals.

Of the more unsaturated oils, cod liver oil is distinctive, in that it leaves the skin of many of the animals scaly. Lard, olive oil, corn oil, linseed oil, methyl linolate and methyl linolenate all produce skin free from scales and dandruff.

It should be pointed out, however, that cod liver oil is highly unsaturated without linolic and linolenic acids being present in ap-

[1] Burr, G. O., and Burr, M. M., *J. Biol. Chem.*, 1929, **82**, 345.

[2] Burr, G. O., and Burr, M. M., *J. Biol. Chem.*, 1930, **86**, 587.

[3] Sinclair, R. G., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 1059.

[4] Graham, C. E., and Griffith, W. H., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 756.

preciable quantities.[5] Although Suzuki and Masuda[6] list both linolic and linolenic as being present this is disputed by Denisov[7] and others. Our feeding tests indicate that they certainly are not present in appreciable quantities. In this respect it is different from all other oils studied in this work. As shown by Sinclair[3] cod liver oil in the diet markedly increases the degree of unsaturation of the phospholipids of the animals consuming it. This is further evidence that the structure of the acids is more important than the degree of unsaturation. The possibility of a toxic effect of the cod liver oil, suggested by Graham and Griffith[4] must of course be considered.

Sinclair[3] has observed that his animals do not become scaly but do remain subnormal in weight if they have access to their feces. We have been unable to completely confirm this. As a preliminary experiment 2 females (31004 and 31005) were kept in individual cages on shavings. After 16 weeks on a "fat-free" diet their feet were only slightly scaly, but there was a trace of dandruff and the tails were moderately scaly with swollen, red tips. They were not in as bad condition as their sisters on wire bottoms, but they were not normal. There was undoubtedly some beneficial effect of the feces or the shavings. Their weights were 158 g and 168 g, respectively.

At the same time that the above animals were started 4 cures were attempted, 2 with the fat extracted from the feces of animals on the "fat-free" diet 550-B and 2 with 20% of powdered feces added to the diet. The results of these experiments are given in Table 2.

TABLE II.

Rat Number	Dose Fed Daily	Weight Increase in 5 weeks	Condition of Skin after 5 weeks
		gm.	
30161	5 drops fecal fat	—8	Much scale
30137	5 " " "	+7	" "
30132	20% dry feces	+3	" "
30151	20% " "	—8	" "

From our experience it seems that the effects of feces are small, leaving the animals at a subnormal weight and probably exerting a slight prophylactic effect over a long period of time, but not giving effective cures in a period as short as 5 weeks.

[5] Bills, C. E., *Chem. Rev.*, 1926, **3**, 425.

[6] Suzuki, B., and Masuda, Y., *Proc. Imp. Acad.* (Japan), 1928, **4**, 165.

[7] Denisov, I., *Chem. Abst.*, 1930, **24**, 6047.

Conclusion. From the data at hand it would seem that the highly unsaturated fatty acids of cod liver oil can be used by fat deficient rats for growth, but that their scaly skin is cured only by linolic and linolenic acids, which, apparently are lacking in cod liver oil.

It may prove possible to isolate a fat which will cure the skin without producing growth, as indicated by Sinclair's experience.

The fat deficiency may therefore resolve itself into 2 factors. It so happens that linolic and linolenic acids seem to relieve both growth and skin abnormalities. The relative values of several fatty acids in the prevention of the above symptoms as well as kidney degeneration is being included in our present studies.

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Individual Variation in Serum Calcium in Normal Men and Women.*

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Since the work of Bell[1] many investigators have studied the blood calcium level in relation to menstruation. The results of these investigations have been contradictory. Watchorn[2], Close and Osman[3], Allen and Goldthorpe[4], Spiegler[5], and others have concluded that there is very little or no change in the blood calcium in relation to the menstrual cycle. Sharlit et al[6] and Matters[7] report a premenstrual rise in blood calcium and a menstrual fall in the calcium level. Okey et al[8] state that "while the changes in the concentration of serum calcium at any phase of the monthly cycle are not outstanding, there is some tendency to frequency of low values for

* This study was carried out with the aid of a grant from the Research Fund of the University of Minnesota.

1 Bell, Blair W., *Proc. Royal Soc. Med.*, 1908, **1**, 291.

2 Watchorn, Elsie, *Brit. J. Exp. Path.*, 1926, **7**, 120.

3 Close, H. G., and Osman, A. A., *Biochem. J.*, 1928, **22**, 1544.

4 Allen, E., and Goldthorpe, H. C., *Am. J. Obs. and Gyn.*, 1929, **17**, 789.

5 Spiegler, R., *Arch. Gyn.*, 1930, **143**, 201.

6 Sharlit, H., Corscaden, J. A., and Lyle, W. G., *Arch. Int. Med.*, 1927, **39**, 780.

7 Matters, R. F., *Australian J. Exp. Biol. and Med. Sc.*, Part 2, 1929, **6**, 119.

8 Okey, R., Stewart, J. M., and Greenwood, M. L., *J. Biol. Chem.*, 1930, **87**, 91.