

ON THE EXTRACTION OF FAT FROM FECES AND THE OCCURRENCE OF LECITHIN.

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In the last few years I have had occasion to carry out a number of experiments on the rapid extraction of fat from feces, and especially with reference to securing enough crude fat for a determination of phosphoric acid as a measure of the lecithin content, or the content of similar phosphorus-holding body. The extraction has been made in the usual manner and also with the use of the paper coil as introduced for the well-known milk test.

When the tests were first made in my laboratory in 1898, I was surprised to find that the results for the crude fat obtained were generally appreciably higher than those obtained by the usual process of drying, grinding with sand and extracting from a paper shell in the Soxhlet apparatus, through the same period. In subsequent work this experience has been repeated, and recently in carefully conducted experiments.

In the paper coil method, as in the other, the moist mass for examination is slightly acidified with very dilute hydrochloric acid to decompose soaps possibly present. Then 10 to 15 grams of the uniformly mixed sample are spread with a spatula over the strip of paper which is finally rolled up, with a piece of extracted cotton twine enclosed, and tied. The coil prepared in this manner dries out quickly to practically constant weight, as may be found by repeated weighings, and in a much shorter time than is required for drying in mass. The dried coil is placed in the Soxhlet apparatus and extracted with anhydrous ether during two days in the usual way; the crude or total fat, including cholesterol, lecithin and some other bodies, is found on evaporation of the ether and may be employed for special examinations. The completion of this extraction requires less time than is necessary for the sand method.

As 10 grams of moist feces yield 2 to 2.5 grams of dry product, usually, the fat secured may weigh from 0.4 to 0.8 gram. In some cases as high as 16 grams of moist feces has been taken, giving an amount of crude fat correspondingly larger. This amount is sufficient for most separations which may be desired. For 1 gram of fat I have frequently found 1.5 mg. P_2O_5 after ignition

of the fat with nitrate and carbonate of sodium, and this in cases where no definite pathological condition could be assumed. The following short table shows something much more remarkable. It exhibits first, the amounts of fat extracted from the same mixed feces by the two methods, and also the phosphorus content of the fat in terms of P_2O_5 , which is unusually high for what may be considered as normal feces.

No.	Dry. Per cent.	Coil extraction.			Shell extraction with sand.		
		Fat in dry. Per cent.	P_2O_5 in fat. Per cent.	P_2O_5 in dry. Per cent.	Fat in dry. Per cent.	P_2O_5 in fat. Per cent.	P_2O_5 in dry. Per cent.
1a	24.3	28.9	4.15	1.20	27.9	4.73	1.32
1b		28.5	27.5	4.98	1.37
2a	19.4	19.5	4.56	0.89	16.2	5.24	0.85
2b		18.4	4.77	0.88	16.5	5.02	0.83
3a	26.5	30.1	4.38	1.32	29.5	4.20	1.24
3b		29.7	4.37	1.29	28.9	4.46	1.29

It appears from the above that the coil extraction yields a larger amount of fat in the three sets of tests. In one case the difference is very marked. It is possible that a much longer treatment here might have increased the yield from the sand extraction. No reason is apparent why such differences should obtain, where sufficient time is given. It must be added that the paper used was found to be perfectly fat-free. The method commends itself on account of ease in manipulation and complete extraction. A perfectly clear ether extract is obtained, which, after evaporation, again dissolves readily in ether.

PHOSPHORUS CONTENT.

Under the conditions of the experiment the ordinary inorganic phosphates can not be extracted with the fat and the phosphoric acid found must evidently be of organic origin, coming possibly from lecithin. But according to all authorities lecithin is found at most in traces only in normal feces. If we calculate the phosphoric acid found above to lecithin it is evident that about half of the crude fat would consist of this body. Assuming the total excretion to be 150 grams, the daily excretion of lecithin on this basis would amount to from 3 to 5.5 grams, about, in the three samples. I could obtain no evidence of the existence of a pathological condition in the man furnishing the material examined. It will be noticed that the phosphoric acid is found in the fat secured

by both methods of extraction, and as pure anhydrous ether was used it can not be traced to substances of inorganic origin.

To further test the matter two other examinations were made some weeks later of the feces of the same individual, apparently still in normal condition. In these tests the paper coil method was followed, in one case with acidification and in the other case without.

The following figures were obtained.

	Dry. Per cent.	Fat in dry. Per cent.	P ₂ O ₅ in fat. Per cent.	P ₂ O ₅ in dry. Per cent.
1 Acidified		17.8	1.65	0.294
2 No acid	23.4	17.6	1.69	0.298

While these results are lower than before in phosphoric acid content, they are still large from the ordinary standpoint. If calculated as lecithin they correspond to an excretion of about 1 gram daily, on the assumption made above as to total excretion.

The amount of lecithin which may be excreted under pathological conditions, or better the amount of organic phosphorus bodies soluble in ether, is relatively large. The results of Deucher¹ in this regard are remarkable; in the case of a man with closed pancreatic duct as high as 8 grams of lecithin daily was found in the feces, this amount being calculated from the phosphoric acid of the ether extract. With our present knowledge of the distribution of lecithin in animal and vegetable foods it is somewhat difficult to account for such values, or even for the first ones which I reported above. In view of the lack of agreement on this point it appears likely that further attention should be given to the question of the nature of the organic phosphorus compounds which may be extracted from feces by ether. The assumption that these are all of the character of lecithins may not be justified.

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NOTES ON TYPEWRITER RIBBONS.

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It is only within comparatively recent years that typewriter

¹ "Jahresbericht über die Fortschritte der Thierchemie," 1898, p. 606; also Schmidt und Strasburger: "Die Faeces des Menschen," p. 160.