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Observations on Human Subject Subsisting Six Months on a Diet Extremely Low in Fat.*

W. R. Brown, Arild E. Hansen, Irvine McQuarrie and G. O. Burr.

From the Departments of Botany and Pediatrics, University of Minnesota.

Although it has been established that the animal organism is unable to subsist on a strictly low fat regimen,[1, 2] relatively little is known concerning this type of diet as regards the human subject. The characteristic features found in rats reared on an extremely low fat diet as described by Burr and Burr[1] are scaliness of the feet and tail, early cessation of growth, hematuria and premature death. These animals also exhibit abnormal respiratory quotients. Burr and Burr[3] and Brown and Burr[4] have demonstrated the essential rôle of linolic acid as regards this deficiency syndrome. Von Gröer[5] following the work of Aran,[6] who had found that rats fed on fat-poor regimens failed to grow normally, maintained 2 infants on a diet practically free from fat for a period of several months. In the work of these investigators the vitamin factors were not controlled; however, it is interesting to note that one of these infants developed an eczematous eruption. Holt[7] recently found that one of 3 infants reared on a low fat diet developed eczema. No studies have been made on the adult human subject maintained on an extremely low fat diet for a prolonged period.

A normal adult was maintained on a diet consisting of carefully skimmed milk, sucrose, potato starch, baking powder, sodium chloride, orange juice, plus vitamin and mineral supplements, liquid petrolatum with anise oil and citric acid occasionally added for flavoring for a period of over 6 months. The total fat consumed per day was about 2 gm. and consisted chiefly of butter fat. Rats fed

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3 Burr, Geo. O., and Burr, M. M., *J. Biol. Chem.*, 1930, **86**, 587.

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5 Von Gröer, F., *Biochem. Z.*, 1919, **97**, 311.

6 Aran, H., *Biochem. Z.*, 1918, **92**, 211.

7 Holt, L. E., Jr., Tidwell, H. C., Kirk, C. M., Cross, D. M., and Neale, S., *J. Pediat.*, 1935, **6**, 427.

on this diet developed the characteristic features of the fat deficiency syndrome of Burr and Burr[1] in the usual length of time. The following features were studied: Serum lipids using Bloor's[8] methods and the pyridine sulphate dibromide method[9] for iodine absorption capacity of the serum; arachidonic and linolic acid, using the same technique as described in the previous paper[10]; blood and urine analyses using the routine clinical laboratory procedures; blood pressure, mercury manometer; basal metabolic rate, indirect method; respiratory quotients, closed-chamber method; periodic physical examination by the same examining physician and careful notes on subjective symptoms by the experimental subject.

The following observations were made: *Serum lipids:* No change was found in the level of the cholesterol or total fatty acids, but the iodine number of the serum fatty acids fell from an average of 122 on normal diet to an average of 93 while on the fat-poor diet. This drop in the degree of unsaturation of the serum lipids confirms for the human subject the observation of several investigators[11, 12, 13] on various types of animals. *Arachidonic and linolic acids:* Values of 3.2% for arachidonic and 5.7% for linolic of the total fatty acids of the serum on normal diet compares with those found in pooled samples of blood from other normal subjects. There was a definite decrease in the content of both these acids on the low fat regimen, the values of 1.87% and 3.2% of the total fatty acids for arachidonic and linolic acids respectively being found. This decrease in the content of these highly unsaturated fatty acids tends to confirm the previous finding of a drop in the iodine number of serum fatty acids on the low fat regimen. *Blood and urine examinations:* The hemoglobin and red cell count remained essentially the same throughout the study. There was a definite tendency to a leucopenia, the leucocyte count at one time being only 2,000. The differential count remained unchanged. The fasting blood sugar level and glucose tolerance curve remained normal. The urine remained normal throughout the study, microscopic hematuria being especially watched for because of the finding of the bloody urine in rats

8 Bloor, W. R., *J. Biol. Chem.*, 1928, **77**, 53.

9 Yasuda, M., *J. Biol. Chem.*, 1931, **94**, 401.

10 Brown, Wm. R., and Hansen, Arild E., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 113.

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12 Williams, H. H., and Maynard, L. A., *J. Dairy Sc.*, 1934, **17**, 223.

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on this diet. *Blood pressure:* The average blood pressure reading was about 10 mm. of mercury less after having been on the special diet for about 4 months than either before or after the return to normal diet. *Weight changes:* There was a gradual decrease in weight for the first 3 months on the diet. *Metabolism studies:* Basal rates by the indirect method were run by the hospital technician. Also, metabolic rates and respiratory quotients were found with a closed-chamber apparatus. With the former, rates of −11%, −11%, −2% were found, the highest value coming just before the low fat diet was abandoned. With the latter apparatus metabolic rates and R.Q.'s were found after starvation and during food utilization. Work with rats has shown that high metabolic rates, high dynamic action of food, and high respiratory quotients are to be expected when there is fat deficiency. The present studies showed no definite trend in metabolic rates (either before or after taking food), but higher respiratory quotients were encountered after the patient had been on the restricted regimen 6 months. These quotients were again lower 6 months after return to normal diet. The highest non-protein respiratory quotient (1.14) came in the sixth month on the diet. Eight months later the quotient under like conditions reached 1.01. *Objective clinical findings:* There was no significant change in the physical condition of the subject throughout the course of the study. Physical examinations made following resumption of normal diet were essentially negative. *Subjective findings:* The most noticeable feature was the marked absence of fatigue. Migraine attacks, which had been occurring at 7- to 10-day intervals, ceased after the subject had been on the diet for about 6 weeks.

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Experimentally Altering Galactin Content of the Rat Pituitary.

R. P. REECE AND C. W. TURNER.*

From the Department of Dairy Husbandry, Missouri Agricultural Experiment Station.

In earlier communications we reported that the injection of the estrogens increased the galactin content of the male rat pituitary

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