is presented. The solution thus formed is only slightly more convulsant than procaine hydrochloride but considerably more anesthetic on topical application.

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Effect of a High Fat Diet on Carbon Dioxide Combining Power of Blood Plasma.

HELEN L. WIKOFF AND JOSEPH F. VINCENT. (Introduced by Clayton S. Smith.)

From the Department of Physiological Chemistry, College of Medicine, The Ohio State University, Columbus, Ohio.

Stewart, Gaddie and Dunlop[1] in a series of experiments on human subjects studied the carbon dioxide combining capacity of plasma with relation to blood fat content during and after exercise. They found that total lipid content varied inversely with the blood carbon dioxide combining power. These investigators believed that the carbon dioxide combining power was responsible for the changes in the blood fat content because changes in carbon dioxide combining capacity preceded the changes in fat content.

Since the subjects were not fed a high fat diet, nothing can be learned concerning the effect of an excessive amount of fat in the plasma on the CO_2 combining power. Van Slyke, Sendroy, Hastings and Neill[2] have shown that carbon dioxide is much more soluble in lipemic plasma than in normal plasma. Accordingly, even if the alkaline reserve of a lipemic blood sample were decreased, this might not be apparent from the carbon dioxide combining capacity as ordinarily determined from whole plasma.

During the past year, a group of investigators at this university conducted an experiment in which they fed students meals consisting chiefly of fried foods and pastries. Since such a diet is obviously high in fat content, we believed that information concerning the influence of fat in the diet on the carbon dioxide combining power of plasma might be obtained by studying the blood of these subjects. Permission was therefore granted us to draw the samples necessary for conducting the present investigation.

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1 Stewart, C. P., Gaddie, R., and Dunlop, D. M., *Biochem. J.*, 1931, **25**, 733.

2 Van Slyke, D. D., Sendroy, J., Jr., Hastings, A. B., and Neill, J. B., *J. Biol. Chem.*, 1928, **78**, 784.

Three groups of university students were observed consecutively for periods of 6 weeks each. Each group consisted of 10 men and 10 women. The ages of the subjects varied from 17 to 27 years. The heights varied from 65 to 73 inches for the men, and from 59 to 70 inches for the women. The men weighed from 123 to 180 pounds; the women from 79 to 188 pounds. As these data indicate, short, tall, thin, and fat individuals as well as those of so-called average stature were included in the groups.

The subjects were selected to include as nearly a representative cross-section of the university student body as possible. Consequently their daily activities varied as markedly as did their physical characteristics. The only factor common to the entire group was the type of food eaten during the 6 weeks' duration of the experiment. Each subject could eat as much as desired at the meals provided, but no other food or meals were allowed to be eaten elsewhere during the 6-week interval.

During the first week of the experiment, a normal well-balanced diet was provided for each group. During the second and third weeks of the experiment, an adequate diet having a high fat content was served. The diet during the fourth week was essentially the same as that of the first week, while the menus of the second and third week were duplicated during the fifth and sixth week.

The fresh foods and the vegetables served varied with the season of the year. Meals were served to the first group during October and part of November. Group II ate the special meals during the first 3 weeks in December and after a 3-weeks interval resumed the meals in January for another period of 3 weeks. Group III was fed during February and part of March. The season when these experiments were conducted is the time of the year when most individuals increase their fat intake.

Since our experiment was not really a part of the original investigation designed to duplicate home conditions as far as possible, it was not feasible for us to weigh the amounts of food eaten by the subjects nor to analyze it. However, at all times we had access to the menus showing the foods eaten by the subjects. Expert dietitians had previously checked the menus to make sure that adequate amounts of all essential foodstuffs were always provided in addition to the excessive amount of fat. During the test periods, about 2 pounds of fat per week per person were used in the preparation of the foods but some of this, a portion of the fat used in deep frying was discarded from time to time.

Two or 3 weeks before the feeding experiments began, a preliminary sample of blood was obtained from each member of Groups II and III. The blood drawn from the median vein of the forearm was immediately oxalated, and then centrifuged. The plasma, so obtained, was poured into paraffined tubes and stored in a refrigerator. When the subjects were on the experimental diets, blood samples were drawn on the days preceding each change in diet.

The CO_2 combining capacity of each sample was determined by the usual Van Slyke manometric procedure.[3] Analyses were all made within 8 hours after the drawing of the samples in the case of Groups II and III. Some plasma samples obtained from members of Group I stood for 3 days before the analyses were made.

Table I shows the carbon dioxide combining capacities (expressed as volumes percent) for the members of Groups I, II and III respectively. We were unable to draw blood from one of the women subjects in Group I, consequently only 19 sets of values are listed for Group I. Two of the men in Group II dropped out at the end of the first 3 weeks and were replaced by other men. Incomplete analyses for 12 men subjects are therefore included in the table. Occasionally a subject forgot to report at the proper time for drawing blood samples as is evidenced by blank spaces in the table.

Discussion. Inspection of Table I fails to reveal any common reaction to a high fat diet. Some individuals show a marked deviation from the CO_2 content of plasma drawn under normal conditions of diet while others apparently are not affected at all. Even the deviations from normal values show no constant trend. Independent individual variations are caused by such factors as exercise, state of health, metabolic rate, inherent ability to metabolize fats, and amount of fat in the blood stream.

When the averages of the individual findings for the men and the women of each group are studied, it may be seen that (with the exception of the second control diet of Group II) the carbon dioxide combining capacities of the men are all higher than the corresponding values for the women. This is also true for the general averages for all men and all women.

If these average results are still further investigated, it will be seen that the average values for the carbon dioxide combining capacities of the men in Groups I and II on the first high fat diet are higher than values obtained while the same subjects were on the control diet. However, during the latter half of the experiment, the average values for the same subjects are lower on the high fat diet than when on the control diet. The behavior of the average carbon

[3] Van Slyke, D. D., *J. Biol. Chem.*, 1917, **30**, 347.

TABLE I.
The CO_2 Combining Capacities Expressed in Volumes Percent.

Group I Subject No.	CO_2 Combining Capacity (Volumes %) Pre-Control	Control Diet	High Fat Diet	Control Diet	High Fat Diet	Group II (cont'd) Subject No.	CO_2 Combining Capacity (Volumes %) Pre-Control	Control Diet	High Fat Diet	Control Diet	High Fat Diet
Men						Women					
1		72.2	63.2	57.2	67.0	32	59.0	54.0	65.5		
2		61.3	62.5	61.0	63.2	33	68.0	61.0	65.0	69.5	62.8
3		64.8	64.0	67.0	68.0	34		64.5	61.0	65.5	62.9
4		71.9	68.0	63.3	63.8	35	63.1	60.8	64.4	59.0	63.5
5		68.3	63.9	67.0	70.0	36	66.0		65.5	69.5	65.6
6		70.0	69.5	61.0	65.8	37	58.0	61.4	66.0	65.0	51.9
7		68.3	66.5	57.8	65.2	38	59.1	65.2	63.2	61.5	58.5
8		66.5	65.3		64.5	39	63.0	66.7	59.0	64.7	60.5
9		74.7	65.6	70.9	65.2	40		58.4		62.5	61.0
10		56.1	61.4	63.0	68.8	41		64.5	62.0	60.8	59.5
Avg		67.6	65.0	63.1	66.2	Avg	62.4	61.9	63.5	65.7	60.4
Women						Group II					
11		64.0	64.5	65.0		Avg =	64.0	65.1	61.7	64.0	62.5
12		53.7	58.8	51.0	59.3						
13		57.1	64.1	64.0	67.0	Group III					
14		64.0	65.8	55.2	61.8	Men					
15		55.9	65.1	58.0	62.0	42	61.7	62.0	63.0	58.5	53.0
16		64.0	52.0	66.2	49.0	43	67.0	65.5		61.0	64.2
17		65.6		56.0	60.9	44	67.5	57.0	62.8	58.0	61.9
18		60.0	61.1	60.7	51.0	45	71.5	65.7	66.7	62.8	65.0
19		60.9	66.5	56.8	61.0	46	68.0	66.4	67.0	57.2	67.5
Avg		60.6	61.0	59.4	59.0	47	66.5	61.4	66.4	60.2	68.2
Group I						48	66.0	68.0	65.0	69.1	67.0
avg =		64.4	63.2	61.4	63.0	49	70.5	61.6	64.0	65.4	65.2
						50	72.0	65.0	61.0	68.0	65.0
Group II						51	67.5	49.5	66.0		61.6
Men						Avg	67.8	62.2	64.7	62.2	63.8
20				57.8	58.0	Women					
21	62.1	68.7	67.0	66.5	66.0	52	60.5	56.5	59.2	63.5	64.0
22	64.0	66.2	62.5	64.0	65.0	53	62.5		65.0	57.8	59.4
23	64.5	72.8	77.5	62.5		54	55.8	61.3	61.9	61.0	65.0
24	69.0	70.5	75.0	69.5	67.0	55	64.2	62.7	60.0	58.5	62.2
25	64.5	64.2	70.5			56	61.7	62.5	56.7	60.2	63.8
26				60.8	66.5	57	63.0	61.2	61.9	54.3	62.3
27	71.0	66.0	70.0	59.0	61.0	58	52.9	59.5	59.4	54.7	58.5
28	67.8		56.0			59	62.9	63.2	62.1	59.2	64.3
29		66.5	67.5	59.0		60	60.5	64.0	60.5	55.2	61.8
30		72.5	68.0	57.0	67.7	61		63.1	57.0	63.0	53.4
31		66.2	52.0	69.5	65.5	Avg	60.5	61.5	60.4	58.7	61.5
Avg	66.0	68.1	66.0	62.6	64.7	Group III					
						Avg =	64.4	61.9	62.5	60.4	62.5
			Average for all men			=	66.9	66.0	65.2	62.6	64.9
			,, ,, ,, women			=	61.4	61.4	61.8	61.3	60.5
			,, ,, ,, subjects			=	64.2	63.8	63.8	61.9	62.7

dioxide capacities for the women subjects, eating with the same groups is exactly the reverse of that of the men. The values increase on the first high fat diet and decrease on the second. The values for the men in Group III behave like those for the women in

Groups I and II, while those for the women in Group III behave like those for the men in Groups I and II. It is apparent that no striking conclusions can be drawn from these data.

If the individual findings for the various groups are again studied and if variations of 2 to 3 volumes per cent are regarded as experimental error, a table (Table II) may be constructed showing the percentage of total subjects in which the carbon dioxide combining capacity increases, decreases, or does not vary while on the high fat diet. In each case, the comparison is made between the value obtained during the high fat diet and that for the control period immediately preceding.

TABLE II.
Percentage of Total Subjects Showing Changes in CO_2 Combining Capacities When Fed High Fat Diets.

	Increase %	Decrease %	No change %
High Fat Diet No. 1	28.2	26.4	45.6
” ” ” ” 2	41.6	22.6	35.8

Table II shows that there are nearly as many persons who experienced no changes in CO_2 combining capacity while on the first high fat diet as there are persons who did exhibit deviations. These variations are about equally divided between increases and decreases. However, when the second high fat diet was fed, a considerable greater percentage of subjects showed a deviation from normal and this variation is definitely towards an increased CO_2 combining capacity. However, it is our opinion that this is an apparent rather than true increase in carbon dioxide combining capacity and is caused by the increased solubility of carbon dioxide in lipemic plasma.[2]

Summary. 1. A high fat diet produced no characteristic reaction as measured by the carbon dioxide combining capacity of blood plasma. 2. The carbon dioxide combining capacities of the men were greater than those of the women when on identical diets.