

TABLE I.  
Ketone Bodies Excreted in the Urine per Rat per Day.

Protein intake prior to fasting g/rat/day	Day of Fasting				
	1	2	3	4	5
0	2	38	63	54	22
0.53	3	14	48	48	20
1.50	1	16	16	24	14
2.80	0	3	5	8	2

measure of ketosis is supported by the blood ketone levels which for the sake of brevity have not been included here.

In fasting rats the ketosis really develops after the glycogen stores are depleted at the beginning of fasting. The ketosis then might be dependent upon the antiketogenic action of the amount of "stored" protein now available for catabolism. However, nitrogen excretion figures do not support such a supposition.

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**Basal Metabolism of 38 American-born Male Japanese University Students.**

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The effect of racial influence on the basal metabolism of Orientals, particularly the Japanese, has been debated for a long time. MacLeod, Crofts and Benedict<sup>1</sup> believe that there is an appreciable racial difference between the Americans and the Orientals, while Okada, Sakurai and Kameda<sup>2</sup> and other Japanese investigators deny its existence in the Japanese when they are compared with the classical American prediction standards. It is not the purpose of the present study to confirm or refute either one of these views, but the final results seem to indicate that there is a retention of racial characteristics in respect to the basal metabolism of Japanese. Whether or not this factor of race is influenced by differences in diet\* and climate

<sup>1</sup> MacLeod, G., Crofts, E. E., and Benedict, F. G., *Am. J. Physiol.*, 1925, **73**, 449.

<sup>2</sup> Okada, S., Sakurai, E., and Kameda, T., *Arch. Int. Med.*, 1926, **38**, 590.

\* While no attempt was made to control the dietary of the subjects, it is safe to say that the majority consumed two typically American meals (breakfast, lunch) consisting of cereals, milk, bread, and other essentials. The evening dinner meal was typically Japanese, the essential difference being the substitution of rice for bread in the American dietary.

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TABLE I.  
Average\* B.M.R. of a Group of Normal American-Born Male Japanese University Students.

Subject	Surf. area, m <sup>2</sup>	Oral temp., °F	Rate per min.			†Cals./kg/24 hr	Deviations from Prediction Stds.		
			Pulse	Resp.	O <sub>2</sub> cc		Sanborn	Aub-DuBois	Harris-Benedict
1 S.H.	1.66	97.3	64	8	267	32.4	+13.6	+17.9	+17.8
2 G.H.	1.59	97.5	64	12	249	31.8	+ 8.7	+10.5	+15.5
3 Y.O.	1.62	98.1	55	9	248	30.3	+ 7.6	+12.4	+12.9
4 A.M.	1.63	97.6	63	11	248	28.5	+ 6.6	+11.1	+10.3
5 A.Y.	1.66	97.8	71	14	249	27.4	+ 4.7	+10.0	+ 7.5
6 C.O.	1.93	97.5	64	10	269	22.9	+ 0.4	+ 2.3	+ 0.1
7 L.I.	1.76	97.4	64	9	245	27.9	+ 2.1	+ 2.1	+ 2.2
8 T.S.	1.72	97.3	65	7	238	26.8	+ 1.4	+ 1.5	+ 2.2
9 E.T.	1.66	97.6	70	12	232	29.6	+ 1.7	+ 1.2	+ 4.7
10 H.N.	1.65	97.5	60	11	236	26.3	+ 2.5	+ 0.9	+ 2.1
11 H.T.	1.67	97.0	52	9	237	23.5	+ 3.2	+ 0.0	+ 1.9
12 S.O.	1.77	97.2	81	8	239	25.2	+ 4.1	+ 0.1	+ 1.3
13 S.N.	1.65	97.5	73	13	222	26.1	+ 6.2	+ 1.4	+ 2.5
14 K.T.	1.66	97.5	66	13	215	26.1	+ 6.3	+ 5.1	+ 3.3
15 F.O.	1.67	97.2	58	9	231	27.3	+ 6.5	+ 2.2	+ 3.4
16 J.O.	1.64	96.5	57	13	216	23.8	+ 6.5	+ 3.5	+ 5.0
17 M.N.	1.72	97.6	59	11	224	26.1	+ 6.7	+ 4.5	+ 5.0
18 E.S.	1.75	97.8	61	11	225	23.9	+ 8.1	+ 5.6	+ 6.2
19 H.K.	1.69	97.2	61	9	226	25.6	+ 8.5	+ 5.4	+ 5.4
20 A.S.	1.66	98.2	64	20	205	24.3	+ 8.6	+ 9.4	+ 6.6
21 J.Y.	1.65	97.7	56	12	212	25.7	+ 9.6	+ 6.1	+ 5.1
22 T.N.	1.70	96.8	55	10	216	24.5	+10.0	+ 6.1	+ 6.5
23 T.K.	1.89	98.1	64	6	237	22.7	+10.6	+ 8.1	+ 8.6
24 F.M.	1.79	97.8	61	7	219	22.4	+11.3	+11.1	+ 9.8
25 N.K.	1.74	97.0	75	10	223	24.9	+11.4	+ 9.5	+ 7.0
26 M.H.	1.56	97.6	65	12	196	25.6	+11.7	+ 7.4	+ 8.1
27 S.A.	1.54	97.0	67	14	191	24.8	+12.0	+ 9.1	+ 8.2
28 N.N.	1.78	97.4	53	15	227	23.9	+12.3	+10.2	+ 8.0
29 G.N.	1.76	97.7	58	7	225	25.5	+12.6	+ 6.8	+ 7.6
30 R.T.	1.70	97.8	54	13	216	24.1	+12.7	+10.0	+ 7.8
31 T.I.	1.86	97.3	60	9	255	24.7	+13.1	+ 7.7	+ 3.9
32 G.T.	1.66	97.4	68	10	208	24.9	+13.3	+10.0	+ 7.5
33 J.S.	1.67	96.7	61	10	213	24.5	+13.9	+10.2	+ 7.8
34 R.M.	1.56	97.4	58	6	192	23.7	+13.9	+ 9.6	+16.0
35 T.Y.	1.74	96.5	54	9	212	24.8	+15.2	+10.6	+10.3
36 Y.F.	1.69	97.4	64	15	202	22.7	+16.2	+12.1	+11.4
37 M.I.	1.53	97.7	61	12	174	23.1	+16.7	+16.7	+14.3
38 R.H.	1.61	97.1	62	7	175	21.9	+22.8	+20.5	+22.5
Grand Average	1.68	97.4	62	11	224	25.6	+ 7.1%	+ 4.1%	+ 3.4%

\*As advocated by DuBois the average of two lowest results from three trials on different days was made.  
†Heat production expressed in calories.

will not be definitely known until more experimental evidences are brought forth.

The basal metabolism of 38 apparently normal American-born men, college students attending 2 large universities† in California was measured indirectly in terms of oxygen consumption by a Sanborn apparatus. These subjects were descendants of Japanese immigrants who had been exposed to Western civilization for several decades. The average metabolic rate for the entire group according to the Harris-Benedict prediction normals is  $-3.4\%$  and according to the Aub-DuBois standards the mean deviation is  $-4.1\%$ . This result is slightly lower in regards to the Sanborn prediction tables, being  $-7.1\%$ . The average physical characteristics of the entire 38 subjects are as follows: age, 20.6 years; weight, 60.9 kg; height, 167.6 cm; and surface area according to height-weight of DuBois,<sup>3, 4</sup> 1.68 square meters.

The final results of the present investigation are remarkably in accordance with the average basal metabolic rate and physical characteristics of 38 Hawaiian-born Japanese college and high school students who were studied by Miller and Benedict.<sup>5</sup> They are also in a close agreement with those measurements of Okada and his associates on a group of 42 medical students in Japan, as shown in Table II. Although there are differences in nutritional and climatological factors of these 3 geographical localities, the final results of average basal metabolic rates are remarkably within a narrow range of  $4\%$ . This fact tends to support the conception that there is a

TABLE II.  
Average Metabolic Rates of Various Japanese Groups.

Investigators concerned	Subjects		Deviations from tables	
	No. and Local.		Aub-DuBois	Harris-Benedict
			%	%
Okada <i>et al.</i>	42	(Japan)	-2.0	-0.2
Miller-Benedict	38	(Hawaii)	-3.9	-2.8
Baldwin-Fujisaki	38	(America)	-4.1	-3.4
		Avg	-3.3	-2.1

† University of California at Berkeley, and the University of Southern California at Los Angeles.

<sup>3</sup> DuBois, Eugene F., *Basal Metabolism in Health and Disease*, 3d ed., Philadelphia, Lea and Febiger, 1936, 494 pp.

<sup>4</sup> DuBois, Eugene F., *J. Nutrition*, 1930, **3**, 217, 331.

<sup>5</sup> Miller, C. D., and Benedict, F. G., *Basal Metabolism of Normal Young Men and Women of Various Races in Hawaii and Basal Metabolism of Samoan Race*, *The University of Hawaii Research Publications*, No. 15, Honolulu, 1937, 77 pp.

hereditary retention of racial characteristics among the Japanese as far as their basal metabolism is concerned.

*Summary.* 1. The average metabolic rate of 38 American-born male Japanese university students is  $-3.4\%$  according to the Harris-Benedict and  $-4.1\%$  according to the Aub-DuBois prediction standards. 2. The results of the present study are remarkably in accordance with those data of Miller and Benedict in Hawaii and of Okada, *et al.*, in Japan. 3. A comparison of data from 3 different geographical localities seems to support the conception that racial characteristics are retained hereditarily as far as the basal metabolism of Japanese is concerned.

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### High Fat and High Carbohydrate Diets That Can Be Fed to Rats by Stomach Tube.\*

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In order to maintain body weight in hypophysectomized rats it was found necessary to develop diets which could be fed by stomach tube in amounts sufficient for adequate nutrition. Two examples of satisfactory diets follow :

High Carbohydrate diet		High Fat Diet	
	g		g
Dried egg albumin†	15	Dried egg albumin†	15
Corn starch	42	Melted butterfat‡	37.8
Dextrin (from corn)	21	Osborne-Mendel salt mixture	4
Cane-sugar	21	Cellu-Flour	10
Osborne-Mendel salt mixture	4	Vitamins B and D	
Activated charcoal	5	Enough water to make 125 cc	
Cellu-Flour	5		
Vitamins B and D			
Enough water to make 125 cc			

The salt mixture, Cellu-Flour, and casein should pass through a 100 mesh screen. The dry ingredients are mixed together and the melted butter or cream stirred in. Finally, small amounts of water are added until the required volume is reached and the whole then

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† 14.5 g of casein and 0.5 g of gelatin may be used in place of the albumin.

‡ 63 cc of 60% cream may be substituted.