A STUDY OF THE METABOLISM OF THE MAYA QUICHÉ INDIAN

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During a recent expedition to Guatemala, Central America, 164 basal metabolism estimations were made on thirty-five male Maya Quiché Indians. Thirty of the subjects were soldiers with from 6 months to a year of army service. These men were stationed at Totonicipan at an altitude of 8100 feet. Five were coffee plantation laborers stationed on the Pacific slope at an altitude of 800 feet. In addition, eight tests were made upon one white male and one white female at 8100 feet and on one white male living at 800 feet altitude. All the tests were run in December, 1938, and January, 1939. The study on the soldiers was made possible through the courtesy and the assistance of the governor of Totonicipan Province, Colonel Carlos Cipriani.

To test the possible stimulatory effect of chili, twenty tests were run on ten soldiers 3 hours after they had ingested measured amounts of chili. As a check on the chili tests six subjects were tested 3 hours after eating from 1 to 10 gm. of tortillas (corn cakes). From four to eight tests were made upon each subject in the course of a week. The usual data necessary for making metabolism determinations were taken. The soldiers were tested in their barracks and after the initial test took little interest in the proceedings commonly falling asleep while waiting their turn to be tested. Following the evening meal on the night before the test, they remained in their bunks until the conclusion of the tests. During the tests

TABLE 1

Maya-Quiché metabolism data

NUMBER	AGE	HEIGHT	WEIGHT	TEMPERATURE	BLOOD PRESSURE		PULSE		NUMBER OF TESTS	O_2 CONSUMED PER MINUTE	DEVIATION FROM MAYO NORMAL STANDARD	PERCENTAGE CHANGE OVER SUBJECT'S OWN BASAL RATE AFTER CHILI FEEDING	PERCENTAGE CHANGE OVER SUBJECT'S OWN BASAL RATE AFTER TORTILLA FEEDING	DOSAGE OF CHILI OR TORTILLA
	years	*cm.*	*kg.*	*F.*	*Sys.*	*Dias.*	*Bef.*	*Aft.*		*cc.*	%	%	%	
1	22	154	54.0	98.6	111	79	61	64	7	242	+13	+10.8		1 gm. dry chili
2	18	154	50.1	97.5	108	77	58	60	6	232	+7			
3	26	161	62.5	98.0	105	79	80	86	5	258	+12			
4	22	154	55.2	97.5	128	85	56	48	7	222	+5		−2.86	10 gm. tortilla
5	19	159	57.1	97.6	105	81	64	56	7	240	+5	+11.5		1 gm. dry chili
6	22	157	54.9	97.8	108	77	64	48	6	222	+6			
7	19	162	61.5	97.2	122	85	56	54	7	244	+6	+13.3		11 gm. liquid chili = 3 gm. dry
8	22	158	56.1	97.0	108	90	58	52	8	243	+14		0.0	10 gm. tortilla
9	24	172	69.5	98.3	108	74	60	64	7	251	+2	+12.7		12.18 gm. liquid = 3 gm. dry
10	23	165	57.3	97.2	108	75	66	66	8	243	+7	+14.0		12.53 gm. liquid = 3 gm. dry
11	27	168	64.0	97.0	112	75	60	54	6	260	+10	+11.0		11.20 gm. liquid and corn = 3 gm. dry
12	21	166	69.0	98.0	100	73	66	60	4	280	+13			
13	22	152	53.9	98.6	118	85	90	96	4	243	+14			
14	19	157	62.0	98.4	128	77	62	62	4	235	0			
15	24	155	54.9	97.5	115	85	54	54	4	222	+6			
16	22	159	57.1	97.6	112	79	54	54	6	219	−1		0.0	10 gm. tortilla
17	24	155	55.2	97.2	108	65	48	52	6	236	+11		+10.8	10 gm. tortilla
18	20	161	57.1	97.6	110	70	68	64	4	234	+5			
19	20	160	64.0	97.8	115	71	66	68	6	254	+10	0.0		1 gm. dry chili
20	21	165	61.5	97.6	124	76	60	62	6	242	+3	10.6		1 gm. dry chili

21	24	168	65.0	98.0	108	75	60	66	4	237	0			
22	18	157	54.9	97.5	105	71	66	66	4	242	+11			
23	25	156	54.0	98.0	110	67	54	54	4	240	+13			
24	24	158	58.0	98.0	115	75	56	56	4	232	+7			
25	24	156	54.1	97.6	118	77	48	48	4	222	+5			
26	22	153	52.0	97.8	112	75	48	52	4	211	+1			
27	33	158	59.4	97.6	115	80	66	66	6	264	+22		−13.2	10 gm. tortilla
28	19	156	57.6	97.2	110	79	54	56	6	219	−1		+13.1	10 gm. tortilla
29	19	156	58.0	97.0	116	73	72	66	6	245	+8	+1.018		1 gm. dry chili
30	26	158	53.2	98.0	98	75	72	72	6	239	+16	−2.6		1 gm. dry chili
Average:														
	22.39	159.3	57.57	97.6	111	77	63	61	166		+8.20	+8.46	+1.30	
Coffee plantation laborers														
31M	20	149	42.0	97.4	105	75	60	57	6	212	+12			
33	23	167	52.1	97.5	108	79	66	63	6	243	+10			
35	19	167	48.0	97.5	95	70	64	61	6	229	+6			
37	22	165	50.1	97.4	114	73	60	58	6	200	−6			
39	24	159	57.1	97.4	108	68	62	63	6	228	+4			
Average:														
	21.6	161	49.8	97.4	104	73	62	60	30		+5.2			
White persons														
N.R(F.)	34	163	62.6	97.5	116	77	72	72	2	194	−6			
A.G(M.)	36	171	70.5	97.5	135	77	72	68	2	210	−13			
J.M(M.)	25	175	67.5	96.7	122	69	72	72	4	222	−12			
Average on two males:														
	30.5	173	69.0	97.1	128.5	73	72	70	8		−12.5			

[1] Unless indicated with a minus sign, all values are plus.

they were under constant observation. A Jones metabolism [1] unit provided with an oversized bellows and adapted for field work was used in this study.

DISCUSSION OF RESULTS

Tables 1 and 2 set forth the data secured and the mean metabolism rates respectively. The tests ranged from a —1 to +22% which represents the mean calculated percentage based upon the Mayo normal standard established for white

TABLE 2

Mean metabolism rates

LOCATION	NUMBER OF TESTS	SEX	NATURE OF TESTS	MEAN METABOLISM RATE	STANDARD DEVIATION	COEFFICIET OF VARIATION
Totonicapan	134	M	Basal	+8.20±0.958	5.24±0.674	63.92± 8.24
Totonicapan	20	M	3 hours after chili feeding	+8.46±1.34 [1]	6.01±0.949	71.03±11.22
Totonicapan	12	M	3 hours after tortilla feeding	+1.30±2.10	7.29±1.48	58.90±12.02
Samayac laborers	30	M	Basal	+5.20±1.14	6.26±0.808	120 ±15.5
White	2	F	Basal	—6		
White	6	M	Basal	—11.5±1.21	2.98±0.861	30.84± 8.90

[1] Increase over subjects' own basal rate.

individuals of similar sex, age, weight and height. The mean value of +8.20 ± 0.958% secured on the soldiers, we take to be a close approach to the true basal metabolic rate for this group. The tests were run at from 11.5 to 16°C. open

[1] The gauge of this apparatus delivers a constant volume of oxygen under varying degrees of temperature and pressure. In repeated comparative tests at varying pressures with a water spirometer we have found the variations in metabolism readings to run less than 3%. We have measured the accuracy of the machine at barometric pressures as low as 54.5 mm. of Hg. In repeated tests we find that the gauge measures within 1% the volume of the gas as measured under standard conditions with the water spirometer.

air temperatures. Since the subjects were well blanketed and appeared comfortable at all times, we believe that the outside temperature did not increase their basal metabolic rate. Apparently this temperature is within their habitat temperature range. By habitat temperature we include that temperature range to which the individual or the animal is normally subjected and apparently adapted. The barometric pressure which averaged 506 mm. of Hg. for six consecutive daily readings apparently does not affect the basal metabolic rate to any extent for the tests on the laborers at 800 feet altitude averaged $+5.20 \pm 1.14\%$. Five tests under basal conditions upon one white female and one white male subject at 8100 feet altitude gave an average value of -7.5%. Three tests upon another white male at 800 feet gave a value of -10%.

The twenty tests made 3 hours after chili feeding showed an average percentage increase over the subject's own basal rates of $+8.46\%$ while tortilla feeding increased the rate by $+1.30\%$.[2]

The average values for both the Maya soldiers and laborers are in keeping with the values of Benedict ('29) of $+5.2\%$ on thirty-two male Mayas at Chichin Itza Yucatan, secured by Williams and Benedict ('29) and with those of Shattuck and Benedict ('30) viz., $+5.8\%$ on thirty Indian subjects. Steggerda ('32) verified these earlier findings and secured an average of $+8\%$ above normal white metabolism standards.

It appears from the findings of MacLeod, Earle, Necheles, Heinbecker, Okada, Van Berkhout, to mention only a few workers in addition to those already cited, that definite racial differences in basal metabolic rates exist. A striking fact, however, is that the Indian of Yucatan, Guatemala and

[2] Recently we have tested the effect of chili on a number of guinea pigs and human subjects. Our maximum dosage was 1½ gm. of dry chili for the human subject and up to ½ gm. for the guinea pigs. These tests on the human subjects have given negative results to date. In the case of the guinea pigs, our first tests were negative but continued dosage over about 3 weeks increased the basal metabolic rate from 12 to 14% in some cases. It is possible that continued use of chili might have a stimulatory effect on the thyroid glands since there is evidence of hyperplastic change in some of our treated pigs.

the Navajo [3] of Arizona and the Eskimo, all run counter to the findings made on the Mongolians of China, Japan and Java.

BLOOD PRESSURES AND PULSE RATES

The blood pressure on the soldiers averaged 111 systolic and 77 diastolic, on the laborers it averaged 104 and 73. The average for the white subjects with an average age of 31.6 years was 126 systolic and 74 diastolic. The pulse rates on the soldiers ran 63 before and 61 after the tests while those of the laborers ran 62 before and 60 after. The white female had a pulse rate of 72 while the white males averaged 68.

GOITER

We have observed a high incidence of diffuse endemic goiter throughout the highland regions. All the Indian subjects with the exception of nos. 22 and 26 were examined by Doctor Crile for goiter, only in no. 31 was no evidence of goiter found.

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[3] In a personal communication from Dr. C. G. Salsbury of the Sage Memorial Hospital, Ganado, Arizona, he states, "We have recently compiled figures on 1136 basal metabolisms (Navajos) and these show an average of +2.4%; 1277 blood pressures show a systolic of 111.9 and a diastolic of 71.6."