Research Report No. 10

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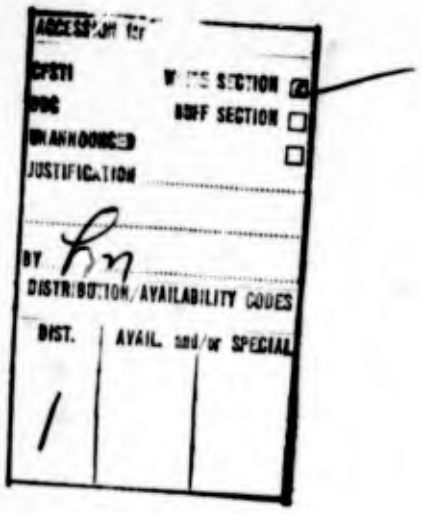

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ABSTRACT

The U.S. Army Tropic Test Center made anthropometric measurements of a sample of Latin-American military personnel in the Canal Zone from September, 1965 to September, 1966.

A total of 733 trainees were measured--600 airmen at the USAF Inter-American Air Force Academy and 133 army personnel at the US Army School of the Americas. Eighteen Latin-American countries are represented in the sample. The average age for the sample was 23 years, average height was 65.5 inches, and average weight 140 pounds.

Percentiles and ranges for 76 physical measurements are presented, including isometric strength and hand-grip measures. Reliability coefficients for strength measurements ranged from .73-.87.

Comparisons with Thai and U.S. personnel showed that the Latin-American sample was intermediate between the two on most physical dimensions, however, the Latin Americans were much closer in size to the Thai than to U.S. military personnel.

Photographs illustrating various body builds are shown.

FOREWORD

This is the tenth report of the US Army Tropic Test Center's In-House Laboratory Independent Research Program.

Seven previous studies have dealt with visual capabilities of the soldier in the jungle; two additional studies have dealt with jungle acoustics--the present study presents physical measurements for a sample of Latin-American military personnel.

The Tropic Test Center is indebted to Mr. Robert M. White, Chief Anthropologist, US Army Natick Laboratories for on-the-scene technical assistance and training; it is also indebted to LTC D. E. Straight, US Air Force Systems Command Scientific and Technical Liaison Officer, for coordinating the excellent support provided by the US Air Forces Southern Command; it is indebted to the Chief, Combat Developments Office, US Army Forces Southern Command for coordinating similar support provided by the US Army. Acknowledgement is made to the commandants and staff, past and present, of the USAF Inter-American Air Force Academy and the US Army School of the Americas for making measurement time and facilities available.

This survey was originally suggested by Mr. Seymour H. Deitchman, now Director, Remote Area Conflict (Project AGILE), OSD/ARPA. Mr. M. Gast and R. Ah Chu, Tropic Test Center, assisted in the historical review and translations.

INTRODUCTION

This is the first report of a continuing study to obtain physical measurements from samples of the Latin-American armed forces. The detailed physical measurements that are reported are those necessary for the human engineering of equipment and clothing. Measurements are taken on Latin-American armed forces personnel receiving military training in the Canal Zone.

These measurements were selected to provide design parameters for equipment and clothing should the United States expand its military assistance program in Latin America. When standard lots of clothing and equipment designed for U.S. troops are shipped to most foreign countries, there is a high likelihood of oversupply and wastage of larger sizes and undersupply of smaller sizes. Dimensions of weapons, vehicles and aircraft also are frequently less than optimum for foreign use. It has been necessary to collect similar data in Turkey, Greece, Italy, Korea, Vietnam and Thailand. Unfortunately, in some cases the data have been collected only after problems arose--as was the case with modifications of footwear necessary for Southeast Asian troops[1]. There is still time to prevent such mistakes in Latin America and it is to this end the present project is directed.

No detailed anthropometric data for Latin Americans, of the nature and extent reported in the present study, have been found in the available literature. Most of the present information represents restricted numbers and types of measures made in connection with health surveys, racial groupings and physical somatotyping (10). If sufficient numbers of personnel can be added to the present samples, the project eventually will contribute significantly to the expanding United States data bank on the anthropometry of foreign military populations.

BACKGROUND

The present report is not a treatise on the ethnic or cultural composition of Latin America; it is, as stated, a compilation of data necessary for the human engineering of equipment and clothing. However, to better understand the great variety of ethnic and cultural groups which are represented in Latin America today, and which ultimately determine the composition of the armed forces, a brief history follows. The history given is a paraphrased, highly condensed composite of three authors views (2,3,13)*.

The first inhabitants of the Americas are believed to have been a generalized Mongolian type. Indeed, even after some 10,000 years the American indians have certain physical traits identical with present-day

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[1] ARPA Program plan No. 103 (Rev), 18 April 1963.

* See Bibliography

Asians including tan to brown skins, straight black hair and scanty beards, broad faces and high cheek bones, shovel-like teeth and dark eyes. Differentiation has occurred with time, however, and the retreating foreheads and aquiline noses of some American Indians are not found in the present Asian. Physical isolation has also caused some differentiation between the separate Indian groups within the Western Hemisphere. In parts of southern Mexico, for example, oval faces and soft wavy hair are frequently seen. There are marked contrasts in height; the plains Indians are usually taller than the highland Indians. Occasionally, though, an unfriendly climate retards growth even on the plains, for example, the Yahgans of Tierra del Fuego are but little over five feet tall. Their Patagonian neighbors to the north average nearly six feet. Thus, even at the time of the conquest, and before European intermingling, these few examples illustrate that the Indian population of the Americas was not a single homogeneous group with respect to physical traits.

In the 15th century the Spaniards and Portugese began their conquest of Latin America. By the middle of the 16th century, the Spanish crown reigned from the southern United States to Patagonia, the largest individual colonial territory ever possessed by any nation. The only portion of the mainland not included was Portugese Brazil. It was during this period that large-scale importations of Negro slaves occurred.

During the colonial period, the Latin-American colonies were virtually closed to immigration from areas other than the Iberian peninsula. Even after the successful wars of independence, immigrants were reluctant to settle because of political instability. The English were the first to break the barriers and furnished large numbers of artisans and merchants to southern Latin America. This was the beginning of large scale European immigration--the so-called "second conquest"--in the middle of the 19th century.

These four major elements then--(1) native Indians, (2) Spanish conquerors, (3) Negro slaves, and later (4) European and Asian immigrants--have determined the present day racial composition of Latin America.

In a United Nation study, Latin America was divided into the following three different social and cultural zones (3) (the zones are related to some extent to racial and therefore physical heritages):

West Coast. The first region is formed by the countries of the West Coast and includes Bolivia, Peru, Ecuador, all of Central America, Panama and Mexico. The Spanish found in this region a dense Indian population of about 15 million and established societies in which the Indians were largely excluded. The largest group of Indians are the so-called "Andinos" living in valleys and hillsides along the Andes from Colombia through Ecuador, Peru, and Bolivia to the north of Argentina. Additionally, there were the Aztec and the dwindling Mayan groups of Mexico and Central America. To this day, Indians in the region have assimilated little of the European culture, and except along the coast, little intermarriage has

taken place. Where it has, the result has been the "mestizo" who generally speaks his country's language and shares the nation's political and religious tradition.

Immigrants during the 19th Century included Polynesians, Hindus, and Japanese to Peru, and Chinese to Mexico, Panama, Peru and Ecuador. However, even by the end of the 19th Century, the Andean region--Bolivia, Peru, Ecuador and the mountainous zones of Colombia and Venezuela--had experienced little modification of social and racial structure since colonial days: the Indians and mestizos constituted the bulk of the populations, but the elites of Spanish descent exercised political and economic control. The western coast of Central America, though culturally Spanish, had a large Negro population--descendents of slaves brought in by British buccaneer ships when sanctions against slave trading were sporadically enforced in the Antilles. In the rest of Central America, except in "white" Costa Rica (the Costa Rican Indian was almost completely extinguished during the conquest) the societal structure resembles that of the Andean countries.

Atlantic Plain. The Atlantic plain includes the Antilles, the coastal zone of Venezuela and Colombia, the Guianas, and the coast of Brazil. In these areas, the Europeans found a relatively scarce Indian population--the Caribbean "arawaks" (agriculturalists) and "caribes" (warriors). Only 100 years later, these Indians had been virtually annihilated. Those not killed outright did not survive the regime of enforced labor and were forced to decide between death or escape. Consequently, the developing plantation economy of the region, almost from the beginning, imported labor from Africa and to lesser extent from India. Negro slaves were imported into Brazil early in the 16th Century and continued without let-up for over 300 years. By the latter part of the 19th Century, there were also large Negro populations all along the northern coast of South America and in Cuba, the Dominican Republic, and Puerto Rico. Population movements of lesser importance in the 19th century also included Chinese to Venezuela and Cuba; Polish Jews and Germans to Colombia.

Countries of the South. This zone includes the temperate areas of South America--Argentina, Uruguay, South Brazil, Paraguay and most of Chile. At the time of the conquest the Indian warrior Guaranis were found in Paraguay, South Brazil, Argentina and Uruguay. These Indians were fierce but few and were eventually displaced.

The climate and rapid prosperity attracted many European immigrants. The style of life that developed is strongly European and independent of the Indian cultural influence as found in the West Coast countries as well as the Negro cultural influence of the Atlantic Plain area.

The single largest group of immigrants in total numbers were the Italians. Primarily, they settled in Argentina, but there is no country in Latin America without groups of Italians.

Additionally, there were the English--to Brazil, Argentina, Chile and Uruguay. Russians and Poles to Argentina, Chile, and Brazil; Germans--to Chile and Brazil; Scots--to Argentina and Chile; Dutch, Irish, and Welch to Argentina; Hindus, Chinese and Japanese to Brazil; and Australians to Paraguay.

Thus, by the end of the 19th Century, the countries of the south were fundamentally Caucasian, with a predominance of Spanish, except in Brazil, and a large number of Italians in Argentina. The important minority groups of German and English were rapidly assimilating. Brazil was well on its way to becoming a multiracial nation even though the Portugese element still predominated.

During the 20th Century, immigration has continued to all regions of Latin America. Large numbers of Scandinavians, Dutch, Syrian, Yugoslavian, and other Europeans continue to flow in.

METHOD

Schools. The Inter-American Air Force Academy located at Albrook Air Force Base in the Canal Zone, offers a curriculum of aviation, medical, and other technical skills for the benefit of the Latin-American air forces. The U. S. Army School of the Americas, located at Ft. Gulick in the Canal Zone, offers a broad service school curriculum for the benefit of the Latin-American ground forces. With the cooperation of the Commandants and staffs, 600 Latin-American airmen and 133 Latin-American army personnel were measured at the two schools between September, 1965 and September, 1966.

The country composition of the sample of the present study is thus entirely dependent on the input to the schools. In terms of their comparative populations, some countries are over-represented, some under-represented--other countries participate minimally or not at all. No navy personnel are included in the sample. At the very outset, then, it must be pointed out that the sample is by definition, not yet representative of "Latin-American military forces in general".

Even within a single country group, no claims for representativeness may be made. The present samples contain no officers; the trainees are probably better educated than their counterparts who are not selected for schooling. More subtle biases may operate with respect to who gets selected for a training course in the Canal Zone; however, the authors have no firm information.

At present, there are not enough subjects from any single country group to determine whether there are genuine physical differences among countries. Futhermore, the physical requirements for initial entrance into the armed forces are known to vary from country to country. Therefore, even with large samples from two countries, it would be erroneous to say that young males from country "X" are taller than those from country "Y" without

knowing the explicit restrictions to statistical variation caused by the requirements. (These standards will be published in a later report.) Many of the following tabulations are for the entire sample, considered a single group for purposes of this report.

Based on the historical settlement patterns, there is a good possibility that "anthropometric regions" can be statistically delineated eventually based on modal physical differences by geography. Possibly, these regions will bear some correspondence to the ethno-cultural regions drawn by the United Nations in the introduction to this report. However, several thousand more data cases and a better balance among countries will be necessary before this attempt can be made. The introductory portion of the report attempted to make clear that Latin America, unlike many Asian and African Areas, does not represent a single homogeneous racial group.

Because data acquisition is slow due to limited research facilities and administrative restrictions, the present interim report is issued to put on record some immediately available data--and to establish progress at the end of a one year period.

Instruments. Standard anthropometric instruments were used to make the measurements. These are shown in Figure 1. Anthropometers (a calibrated two meter stainless steel rod with a sliding caliper type finger) were used for the larger standing measurements.

The anthropometer may be modified into a half-anthropometer and/or large sliding calipers for those standing and sitting measurements

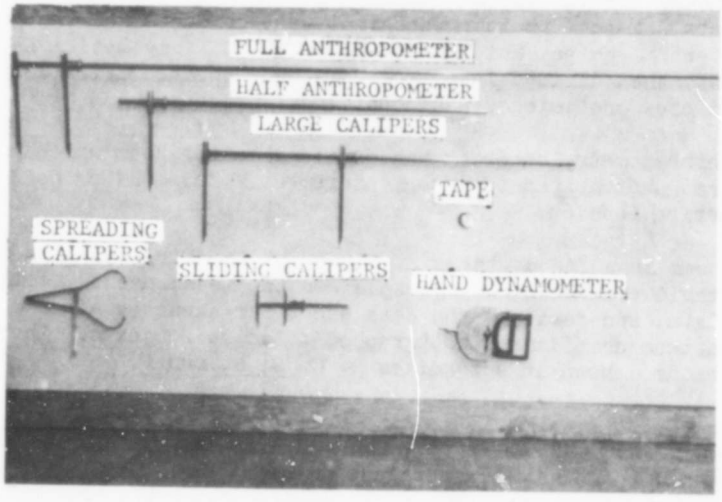


Figure 1. Anthropometry Instruments

that do not require the full anthropometer length. The head, hand and foot measurements were made with sliding and spreading calipers and the surface and circumferential measurements were made using a two-meter steel tape. Spatial measures were made with an in-house constructed measuring jig. An adjustable hand dynamometer was used to measure hand strength. Weight measurements were made with bathroom scales.

Body strength was measured using an isometric bar and an "Isotronic" evaluator. It might be noted that isometric strength measurements are not usually included in anthropometric measures. However, in the equipping of smaller-statured people, the question of load-carrying capability usually arises, and first-hand observers of the population in question can usually be counted on to disagree with one another on the question of physical prowess. Therefore, a more objective approach is called for. The two isometric measures chosen, the half-squat and the dead lift, require the simultaneous use of the large muscles of leg, back and arm, and are considered a generalized measure[1] of the static strength factor (4). Because this type of strength measurement has not been used over a span of years, it will not be possible to compare Latin Americans with U. S. groups or other groups at this time because normative data are not presently available for other groups. However, programs are underway to obtain such data and hopefully will be available for a later report.

Procedure. The measuring team was composed of five men, a team chief and four measurers. A thorough training program was conducted prior to measurements. Formal training sessions were conducted during June 1965, by Mr. Robert M. White, Chief Anthropologist, US Army Natick Laboratories. The team was then divided into two teams and repeated drill sessions were held until crew proficiency was considered satisfactory.

An anthropometry handbook was provided to the team which contained sketches and photographs of each measurement. This was on hand during each measuring session.

The team measured at three stations: at the first station the team chief interviewed each subject, explained the measurements, collected personal data, and reviewed the data sheet for accuracy after completion. The team chief also photographed selected subjects. These photographs are shown in Appendixes B, C, D, E, and F.

The remaining measurers were divided into two man teams; a measurer and a recorder. Seventy-six separate physical measurements were collected for each man measured (See Appendix A). The first 35 measures were made at one station and the remaining 41 at the other.

[1] A. U. Dubuisson, Personal communication, 16 Dec 63.

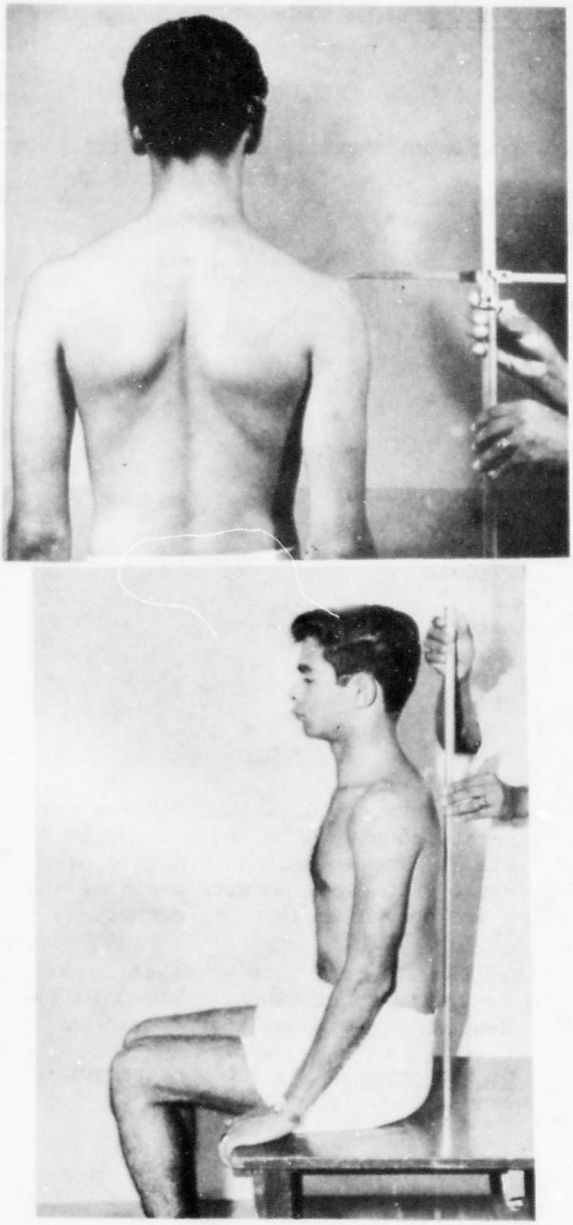


Fig. 2. Standing measurement, shoulder height, (above); Sitting measurement, sitting height, (below).

RESULTS

Distribution by Country. The number of people measured by country is shown below:

TABLE I

Number of people measured by country of residence.

Country	N
Chile	150
Ecuador	111
Colombia	82
Bolivia	60
Brazil	51
Panama	51
Peru	45
Honduras	40
Paraguay	28
Dominican Republic	25
Venezuela	22
Nicaragua	19
El Salvador	12
Uruguay	11
Guatemala	9
Mexico	8
Costa Rica	7
Argentina	2
TOTAL	733

Although 18 countries are represented, imbalances are great. On subsequent tabulations, separate country data are shown only for the first eight countries in Table I. The remaining countries have been combined into an "all other" category to avoid showing means of samples of 30 and less, which typically have very high sampling errors.

Even those subsamples with more than 40 cases do not contain a sufficient number to draw firm conclusions. Tables following may thus be considered merely descriptive of sample composition.

Characteristics of subsamples. Selected characteristics of different country groups are shown in the following tables:

(1) Age.

TABLE II

Age in years by country.

Country	Mean Age (years)	Standard Deviation (yrs)	N
Ecuador	23.8	4.9	111
Honduras	25.2	5.2	40
Panama	26.8	7.2	51
Colombia	19.9	1.8	82
Peru	22.3	2.8	45
Bolivia	25.8	5.6	60
Brazil	21.3	3.4	51
Chile	19.4	4.0	150
All Others	26.0	7.2	143
TOTAL (weighted)	23.1	5.8	733

Mean ages ranged from a low of 19.4 years for the Chile sample to a high of 26.8 years for Panama. In general, age differences were dependent (ρ = .87)[1] upon the percentage of Non-Commissioned officers in the sample (See Table VIII).

(2) Stature.

TABLE III

Height in Inches by Country.

Country	Mean Height (in.)	Standard Deviation (in.)	N
Ecuador	64.6	2.2	111
Honduras	65.0	2.1	40
Panama	66.1	2.9	51
Colombia	65.2	2.3	82
Peru	65.2	2.1	45
Bolivia	64.8	2.1	60
Brazil	67.0	2.2	51
Chile	66.1	2.3	150
All Others	65.4	2.2	143
TOTAL (weighted)	65.5	2.4	733

Mean height ranged from a low of nearly 5' 4-1/2" for the Ecuador sample to a high of 5' 7" for the Brazil sample. Some positive correlation (ρ = .68)[1] between height and weight among subsamples are noticeable.

[1] Spearman rank-difference coefficient (rho)

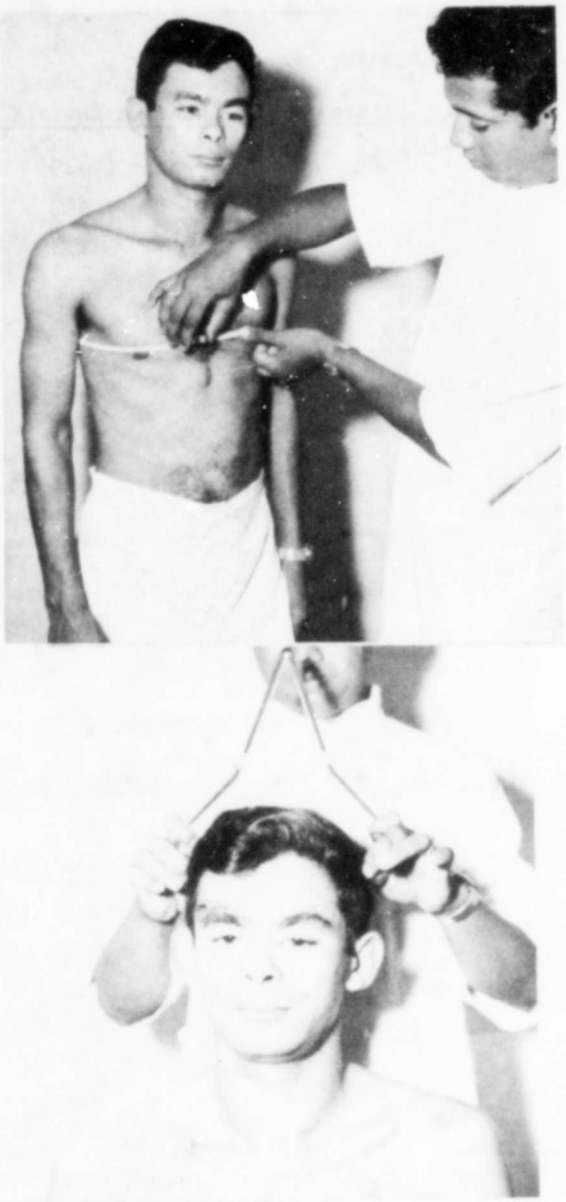


Fig. 3. Circumference measurement, Chest Circumference (above); Head measurement, Head breadth (below).

(3) Weight.

TABLE IV

Weight in pounds by Country.

Country	Mean Pounds	Standard Deviation (lbs)	N
Ecuador	136.0	14.3	111
Honduras	136.0	19.7	40
Panama	141.1	17.7	51
Colombia	134.5	14.4	82
Peru	141.1	11.7	45
Bolivia	136.2	17.1	60
Brazil	146.3	16.5	51
Chile	140.0	14.3	150
All Others	144.5	20.7	143
TOTAL (weighted)	139.7	17.0	733

Mean weight ranged from a low of 134.5 lbs for the Colombian sample to a high of 146.3 for the Brazil sample.

(4) Years Education. The total number of years of formal training completed was recorded for each trainee.

TABLE V

Years schooling completed by Country.

Country	Mean Years Education	Ranges (years)	N
Ecuador	10.1	4-15	111
Honduras	6.6	3-15	40
Panama	9.7	2-15	51
Colombia	9.8	6-14	82
Peru	10.2	8-15	45
Bolivia	10.8	6-16	60
Brazil	9.7	5-12	51
Chile	10.9	6-15	148
All Others	8.9	4-19	143
TOTAL (weighted)	9.8		731

The Honduras sample had the smallest amount of formal education (6.6 years) and Chile and Bolivia the largest amount (10.9 and 10.8 years).

(5) Time in Canal Zone. Table VI shows the mean number of months spent in the Canal Zone. This information was included because of the possible dependence of weight and some circumference measures on mere length of time exposed to US Army and Air Force diets. School officials had indicated that it was not unusual for men to gain weight during their attendance. This is a possible source of bias.

TABLE VI

Number of months in Canal Zone by Country at time of measurement.

Country	Mean Months	N
Ecuador	1.9	111
Honduras	2.4	40
Panama	1.8	51
Colombia	1.4	82
Peru	1.7	45
Bolivia	2.4	60
Brazil	1.1	51
Chile	1.4	150
All Others	2.1	143
TOTAL (weighted)	1.8	733

The average trainee had been in the Canal Zone slightly less than two months. While this amount of time is sufficient for a significant weight gain, there was not much difference from country to country and the effect, if any, should be approximately equal for all countries. The rank-difference correlation between time in the Canal Zone and weight was - .28 for the 9 subsamples--which is not meaningful.

(6) Languages Spoken. Frequently, the number and types of languages spoken present an index of the ethnic makeup in a culturally complex setting. Each trainee was asked to name the languages in which he had fluency. Indian dialects were of special interest. Of the total number measured, 81% claimed fluency in only one language, 18% in two languages and one percent in three or more languages. Table VII shows the distribution of the various combination for the sample as a whole.

Only 47 persons of the total sample spoke one of the indigenous indian dialects. The Paraguayans in the sample furnished all the Guarani speakers and Bolivians most of the Quechua (lowland Incan dialect) speakers. Significantly, only one person (a Bolivian) spoke Aymara--an Altiplano pre-Incan dialect. Panama and Chile contributed most of the English speakers. With few exceptions, most of the Portugese speakers were from the Brazil sample.

Fig. 4. Hand measurement, hand length (above); Foqt measurement, heel breadth (below).

TABLE VII

Languages spoken by trainees

Language	Number	Percent of total
Spanish only	577	79.4
Portugese only	15	2.1
Spanish and English only	46	6.3
Spanish and Guarani only	22	3.0
Spanish and Quechua only	19	2.6
Portugese and Spanish only	35	4.8
Other combinations of two languages	3	0.4
Combinations of three languages or more	10	1.4
TOTAL	727	100.0%

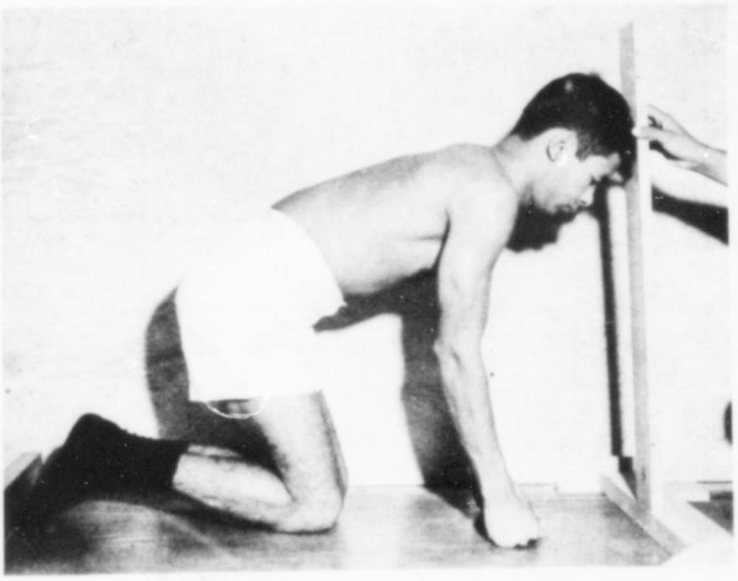
(7) Grade. Because of the great diversity of enlisted grading systems among the various countries, Table VIII distinguishes only between Non-Commissioned officers, enlisted men and others.

TABLE VIII

Military Grades of Trainees by Country

Grade	NCO	EM	Other	Total
Ecuador	11	100	-	111
Honduras	18	22	-	40
Panama	24	19	8	51
Colombia	1	80	1	82
Peru	7	38	-	45
Bolivia	43	7	10	60
Brazil	2	49	-	51
Chile	7	143	-	150
All Other	85	57	1	143
TOTAL	198	515	20	733
%	27.0%	70.3%	2.7%	100%

The Bolivia, Panama and Honduras samples were characterized by a high proportion of NCOs while Colombia, Brazil, Chile and Ecuador had relatively few NCOs. The 20 "other" trainees were nine civilians under special training programs and 11 cadets (officer trainees).



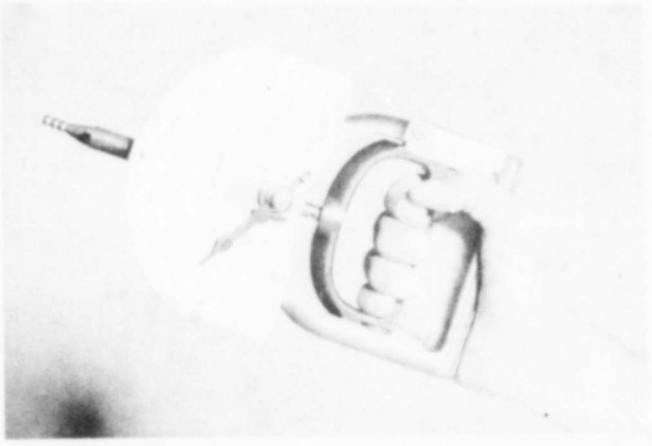


Fig. 5. Spatial measurement, Kneeling length (above); Strength measurement, Right hand strength (below).

TABLE IX

Percentiles and ranges for standing, sitting, body circumference, surface, head, hand, foot spatial, strength and weight measurements of 733 Latin American military personnel. (inches unless otherwise designated)

STANDING MEASUREMENTS	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
1. Stature	60.5	61.8	63.8	65.3	67.0	69.7	71.5	59.1	73.6
2. Shoulder Height	49.3	50.6	52.4	53.8	55.3	57.7	59.4	48.3	61.5
3. Waist Height	35.1	26.2	38.0	39.1	40.3	42.2	44.4	34.2	46.0
4. Crotch Height	26.6	27.6	29.1	30.2	31.4	33.1	34.5	25.5	36.2
5. Kneecap Height	17.1	17.8	18.8	19.4	20.0	21.0	22.0	16.2	23.6
6. Hip Breadth, standing	11.1	11.5	12.1	12.5	12.9	13.6	14.2	9.1	15.1
7. Cervical Height	51.2	52.4	54.4	55.8	57.3	59.7	62.0	50.3	64.0
8. Calf Height	11.5	12.0	12.8	13.4	14.0	15.0	15.7	10.7	16.8
9. Chest Depth	7.4	7.9	8.5	8.9	9.4	10.0	10.9	4.9	12.1
10. Chest Breadth	10.1	10.7	11.3	11.8	12.3	13.3	14.2	9.3	15.0
11. Functional Arm Reach	26.5	27.5	29.2	30.4	31.4	33.1	34.9	24.5	36.3
SITTING MEASUREMENTS									
12. Sitting Height	30.9	31.8	33.3	34.2	35.0	36.2	37.2	28.1	38.3
13. Eye Height, sitting	23.2	26.5	28.4	29.4	30.2	31.6	32.4	22.3	33.6
14. Shoulder-Elbow Length	12.2	12.6	13.3	13.7	14.2	15.0	15.3	11.4	16.1
15. Forearm-hand Length	15.9	16.5	17.3	17.8	18.4	19.2	20.2	13.7	22.7
16. Buttock-Knee Length	20.0	20.5	21.4	22.1	22.8	23.8	24.6	17.8	25.6
17. Buttock-Popliteal Length	15.9	16.5	17.3	18.0	18.6	19.4	20.3	15.4	22.0
18. Knee Height, sitting	17.6	18.3	19.1	19.8	20.4	21.6	22.4	16.2	23.2
19. Popliteal Height	13.9	14.6	15.5	16.0	16.6	17.5	18.4	13.1	19.4
20. Shoulder Breadth	15.1	15.7	16.4	17.0	17.6	18.5	19.3	13.4	20.2
21. Hip Breadth, sitting	11.4	11.8	12.5	12.9	13.5	14.2	15.1	9.1	16.1
22. Arm Reach, upward	47.1	48.4	50.4	51.8	53.1	55.1	56.7	45.9	57.8
23. Mid-shoulder Height, sitting	20.7	21.6	22.7	23.5	24.3	25.8	30.1	20.1	31.6

SITTING MEASUREMENTS (Cont'd)	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
24. Maximum Forearm-forearm breadth	14.5	15.3	16.1	16.9	17.8	19.2	20.3	12.1	22.7
BODY CIRCUMFERENCES									
25. Neck Circumference	11.9	12.8	13.5	14.0	14.4	15.5	17.0	10.7	19.0
26. Shoulder Circumference	37.8	38.7	40.6	41.9	43.5	46.1	48.2	35.5	50.6
27. Chest Circumference	31.4	32.7	34.4	35.7	37.2	39.6	42.1	30.3	45.3
28. Waist Circumference	26.1	26.9	28.5	29.8	31.5	34.9	38.1	24.0	44.6
29. Hip Circumference	31.3	32.4	34.5	35.6	37.0	39.0	41.0	28.5	42.9
30. Wrist Circumference	5.7	5.9	6.2	6.4	6.6	7.0	7.3	5.4	7.7
31. Crotch-Thigh Circ. (Upper Thigh)	16.7	18.1	19.6	20.6	21.5	22.8	24.0	16.0	26.4
32. Lower-Thigh Circumference	13.7	15.0	16.3	17.4	18.3	19.5	20.8	12.1	22.0
33. Calf Circumference	9.8	12.0	13.0	13.6	14.2	15.1	15.6	8.3	16.9
34. Ankle Circumference	7.6	7.9	8.3	8.7	9.0	9.6	10.0	7.0	11.8
35. Arm Scye*Circumference	14.1	15.0	15.8	16.5	17.2	18.6	19.5	13.3	20.9
36. Biceps Circumference, Extended	8.3	9.1	9.8	10.4	11.0	12.0	13.1	7.9	14.6
37. Biceps Circumference, Flexed	9.2	10.3	11.2	11.8	12.3	13.3	14.3	8.0	17.3
38. Forearm Circumference, Flexed	8.4	9.2	9.9	10.3	10.9	11.6	12.2	7.9	14.0
39. Vertical Trunk Circumference	44.9	46.8	59.0	60.7	62.8	65.7	68.5	41.1	72.6
SURFACE MEASUREMENTS									
40. Back-waist Length	13.3	14.2	15.2	15.9	16.7	18.3	19.6	10.6	21.9
41. Interscye Breadth (distance)	12.0	13.1	14.4	15.0	15.8	17.0	17.9	11.0	19.5
42. Sleeve, Inseam	15.7	16.3	17.3	17.9	18.6	19.6	20.6	13.5	21.8
43. Sleeve Length	23.6	29.5	31.2	32.2	33.3	35.0	36.0	21.6	37.2
44. Interscye Maximum	16.6	18.3	19.6	20.3	21.2	22.4	23.2	15.2	24.1

*** = Armhole.**

SURFACE MEASUREMENTS (Cont'd)	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
45. Shoulder Length	4.1	4.5	5.0	5.3	5.7	6.2	6.6	3.9	7.7
HEAD MEASUREMENTS									
46. Head Length	6.3	6.9	7.2	7.3	7.5	7.7	7.9	4.9	8.1
47. Head Height	4.0	4.2	4.6	4.8	5.0	5.3	5.6	3.8	5.9
48. Face Length	4.0	4.2	4.5	4.7	4.9	5.1	5.6	3.9	7.1
49. Head Breadth	5.3	5.5	5.8	5.9	6.1	6.3	6.6	5.2	7.3
50. Head Circumference	19.9	20.7	21.2	21.6	22.0	22.7	23.1	19.8	23.4
51. Interpupillary Distance	2.0	2.1	2.3	2.4	2.4	2.6	2.7	1.7	2.7
52. Face Breadth	4.2	4.4	4.7	4.8	5.1	5.3	5.5	4.0	6.3
53. Bitragion Diameter	4.7	4.9	5.1	5.3	5.4	5.7	5.9	4.6	7.5
HAND MEASUREMENTS									
54. Hand Length	6.3	6.5	6.9	7.1	7.3	7.7	8.0	5.2	9.0
55. Palm Length	3.5	3.7	3.9	4.0	4.2	4.4	4.6	3.3	4.8
56. Hand Breadth (Metacarpals)	3.0	3.1	3.2	3.3	3.4	3.6	3.8	2.6	3.9
57. Hand Circumference (Metacarpals)	7.2	7.5	7.9	8.2	8.6	9.1	9.5	6.8	11.1
FOOT MEASUREMENTS									
58. Foot Length	9.0	9.2	9.6	9.9	10.3	10.8	11.1	8.8	11.6
59. Instep Length (Ball of Foot)	5.1	6.5	7.1	7.4	7.7	8.0	8.3	4.6	8.7
60. Foot Breadth (Ball of Foot)	3.3	3.5	3.7	3.8	3.9	4.2	4.4	3.2	4.4
61. Ball of Foot Circumference	8.1	8.6	9.1	9.4	9.8	10.3	10.9	7.7	13.2
62. Heel Breadth	2.3	2.4	2.5	2.6	2.7	2.9	3.1	2.2	3.3
63. Heel Ankle Circumference)	9.2	11.9	12.6	13.0	13.4	14.0	14.4	8.7	15.6
64. Instep Circumference	8.1	8.9	9.4	9.8	10.1	10.6	11.6	7.9	14.4

SPATIAL MEASUREMENTS	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
65. Kneeling Height	27.2	28.4	29.7	30.9	32.1	34.2	35.5	25.3	37.5
66. Kneeling Length	40.3	42.3	45.3	47.4	49.4	52.7	56.2	35.0	59.4
67. Crawling Height	25.7	26.6	28.2	29.2	30.3	32.1	33.3	23.5	34.9
68. Crawling Length	41.2	43.8	46.8	48.6	50.7	53.8	57.2	39.8	64.1
69. Prone Height	9.4	10.5	11.3	12.1	12.8	14.0	15.1	8.2	17.2
70. Prone Length	76.2	78.9	82.6	84.6	86.6	90.2	93.9	73.1	97.8
STRENGTH MEASUREMENTS									
71. Left Hand Grip (lbs)	48.4	61.6	74.8	81.4	92.4	105.6	116.6	41.8	134.2
72. Right Hand Grip (lbs)	57.2	68.2	79.2	88.0	96.8	114.4	127.6	46.2	136.4
73. One-half Squat (lbs)	75.0	100.0	140.0	170.0	200.0	240.0	283.0	45.0	320.0
74. Dead Lift (lbs)	140.0	170.0	210.0	240.0	261.0	300.0	320.0	126.0	340.0
75. Weight (lbs)	105.0	115.0	128.0	139.0	150.0	172.0	189.0	100.0	215.0

DICHOTOMIZED OBSERVATIONS

Glasses Worn	Yes: 7.4%	No: 92.6%		(N=733)
Handedness	Left: 3.0%	Right: 93.6%	Ambidextrous 3.4%	(N=733)
Length of Toe	1st Toe Longer: 71.0%	2nd Toe Longer 29.0%		(N=733)

Anthropometric Measures. Table IX shows percentiles and ranges for the seventy-six measurements for the entire sample of 733 subjects combined. The unit of measurement is the inch unless otherwise specified. (Appendix G shows identical data with centimeters as the unit of measurement.)

The 50th percentile is the median, or central tendency, and is one type of an "average". The 1st and 99th percentiles represent the values within which 98% of a standard population lie, thus these two points often define the practical physical "envelope" of most interest to the equipment designer.

With the addition of many more trainees to the present sample, and with a better balance among countries, the extremes (1st, 5th, 95th, 99th percentiles) can be expected to "expand" for the purely statistical reason that the probability of including very large and very small persons increases with size of sample. The central tendencies of small samples, on the other hand, are frequently very close to those of much larger samples, when severe bias is not present.

Results for a few of the key body measurements will be described:

(1) The 50th percentile Latin American was 5 ft 5.3 in. tall. Ninety percent of all Latins were between 5 ft 1.8 in. and 5 ft 9.7 in.

(2) The 50th percentile Latin American had a neck circumference (collar size) of 14 in. Ninety percent of the sample were between 12-3/4 in. and 15-1/2 in.

(3) The 50th percentile Latin American had a chest circumference (unexpanded) of 35.7 in. Ninety percent were between 32.6 in. and 39.6 in.

(4) The 50th percentile Latin American had a waist size of 29.8 in. Ninety percent were between 26.9 in. and 35.0 in.

(5) The 50th percentile Latin American had a sleeve length of 32.2 in. Ninety percent were between 29.3 in. and 35.0 in.

(6) The 50th percentile Latin American had a crotch height (deduct approximately 3 in. for trouser inseam size) of 30.2 in. Ninety percent were between 27.6 in. and 33.1 in.

(7) The 50th percentile Latin American weighed 139 lbs. Ninety percent weighed between 115 and 172 lbs.

Strength Measurements and Reliability Estimates. The 50th percentile Latin American hefted 170 lbs on the half-squat, which was 22% greater than his average body weight; he lifted 240 lbs on the dead lift which was 73% higher than average body weight. These measurements represent short duration maxima. As stated previously, there are no normative

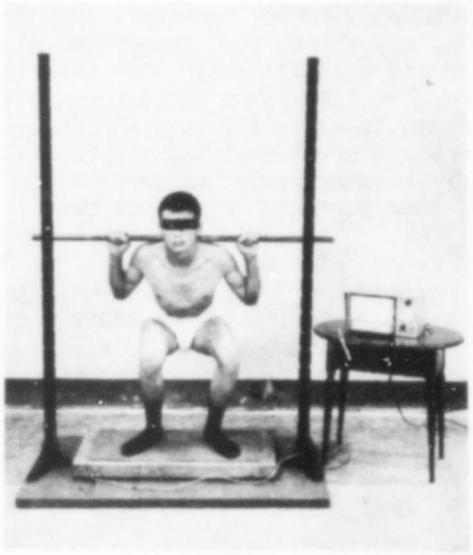


Fig. 6. Strength measurements, One-half squat (above); Dead lift (below).

data on other populations available to the authors at present, but comparisons will be made in a later report.

Table X shows comparative data for hand-grip scores. The Latin Americans averaged 11-12 lbs lower on the dynamometer squeeze than US groups with the left hand and 6-19 lbs lower with the right hand. Comparisons by t-tests showed the right hand differences between Latins and all three U.S. groups to be statistically significant beyond the 1% confidence level. There was a great deal less variability in hand strength within the Latin-American group; their standard deviations were from four to 13 lbs less than standard deviations for US groups.

TABLE X

Comparison of hand-grip (dynamometer) data for Latin Americans and several US groups.

Group	Mean Grip (lbs)	Standard Deviation (lbs)
Latin American		
Right Hand	89	14.1
Left Hand	83	14.0
US ROTC Students (17-21 yrs)[1]		
Right Hand	95	26.5
US College Students[2]		
Right Hand	108	21.0
Left Hand	95	18.0
US Air Force[3] Personnel (General)		
Right Hand	104	27.3
Left Hand	94	23.7

Fifty-five trainees received all strength measures twice in order that the reliability of the measurements could be estimated. These trainees were first strength-tested then retested after a 15-20 minute rest. The uncorrected test-retest reliability coefficients (N=55) were as follows:

Isometric				Hand grip			
Half-squat:	r	=	.78	Left hand:	r	=	.87
Dead Lift:	r	=	.73	Right hand:	r	=	.78

[1] from Fox, Katherine, Tech Rept EP-47, Natick Labs, June 57.

[2] from Tuttle, et al, 1950, in Human Engineering Guide to Equipment Design, McGraw Hill, 1963.

[3] from Barter, et al, 1956, in Human Engineering Guide to Equipment Design, McGraw Hill, 1963.

TABLE XI

Comparison of selected 50th percentile measurements between Latin-American Military personnel, Royal Thai Armed Forces, U.S. Military personnel. (inches unless otherwise noted)

MEASUREMENT	Thai Military Personnel (2950)[1]	Latin American Military Personnel (733)	U.S. Army Aviators[2] (500)	USAF Flying Personnel[3] (4000)
Stature	64.4	65.3	69.4	69.1
Weight (lbs)	124.0	139.0	166.5	161.9
Waist Height	39.0	39.1	41.7	42.1
Crotch Height	29.7	30.2	31.6	32.8
Kneecap Height	19.7	19.4	20.9	20.2
Sitting Height	34.1	34.2	35.6	36.0
Eye Height, sitting	29.5	29.4	30.9	31.5
Shoulder-elbow Length	13.8	13.7	15.0	14.3
Forearm-hand Length	18.1	17.8	19.1	18.9
Buttock-knee Length	21.3	22.1	23.8	23.6
Shoulder Breadth	16.3	17.0	18.2	17.9
Hip Breadth, sitting	12.4	12.9	14.1	13.9
Arm Reach Upward	51.8	51.8	54.1	--
Neck Circumference	13.3	14.0	15.1	14.9
Shoulder Circumference	40.9	42.0	45.3	45.1
Chest Circumference	33.5	35.7	37.7	38.?
Waist Circumference	27.2	29.8	32.7	31.7
Back Waist Length	16.9	15.9	18.2	17.7
Sleeve Length	30.7	32.2	--	33.7
Head Length	7.0	7.3	7.8	7.7
Head Height	5.0	4.8	5.0	5.1
Face Length	4.5	4.7	4.7	--
Head Breadth	6.0	5.9	6.1	6.1
Head Circumference	21.3	21.6	22.5	22.6
Face Breadth	5.2	4.8	5.6	5.5
Hand Length	7.1	7.1	7.5	7.5
Hand Breadth	3.3	3.3	3.5	4.1
Foot Length	9.7	9.9	10.6	10.5
Foot Breadth	3.9	3.8	4.0	3.8
Ball of Foot Circumference	9.7	9.4	9.8	9.6

[1] from White, R. M. Anthropometric Survey of the Royal Thai Armed Forces, Natick Labs, June 64.

[2] from White, R. M. Anthropometry of Army Aviators, Natick Labs, Jan 61.

[3] from Hertzberg, H.T.E. et al Anthropometry of flying personnel, 1950, Wright Air Development Center, Sep 54.

Reliability of scores was satisfactorily high for a maximum-strength task. Coefficients for hand grip scores are higher than those reported (r = .50-.69) by Fox (5) for longer retest intervals using US ROTC students as subjects.[1]

Comparison with Thai and US Armed Forces.

Table XI shows selected 50th percentile measurements for Thai military personnel, Latin American military, US Army aviators, and US Air Force flying personnel.

As a general rule, the Latins were larger than the Thai and smaller than US personnel. However, there was much more overlap between the Thai and the Latin-American measurements. For example, the Thai were larger than the Latin Americans on 10 of the 30 measures. The Thai were noticeably larger than Latins in face breadth, head height, back waist length, and ball of foot. The first three differences may reflect racial origins; the last may reflect clothing habits and/or racial origins. The 50th percentile Latin American did not exceed the US personnel on a single dimension; however, face length and foot breadth[2] were equal for the two groups.

It may be concluded from the data now at hand that the Latin American armed forces more nearly resemble the Southeast Asian military in physical dimensions than US personnel. It will be interesting to see if this relationship holds true with the further collection of data.

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[1] It is not known to what extent the preceding hand-grip comparisons in Table X are affected by method. Fox used a dynamometer fixed rigidly to a table; in the present study the dynamometer was held free. The methods used by Tuttle and Barter are not known. An experiment is now underway in which Latin Americans are allowed to grip both a fixed and a free dynamometer. For a very small sample, the fixed dynamometer scores are 8-9 lbs higher than the free-grip scores. Thus, Latins may more nearly approach US groups if this trend continues. More data will appear in a later report.

[2] Statement true for USAF flying personnel only.

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APPENDIX A

Description of Measurements

STANDING MEASUREMENTS (Subject standing, body erect; head oriented in Frankford Plane)

1. Stature: The vertical distance from the floor to the top of the head.

2. Shoulder Height: The vertical distance from the floor to right acromion.

3. Waist Height: The vertical distance from the floor to the waist point.

4. Crotch Height: (Inseam) The vertical distance from the floor to the midpoint of the crotch.

5. Kneecap Height: (Patella height) The vertical distance from the floor to the uppermost point of the right knee.

6. Hip Breadth: The horizontal distance across the widest portion of the hips.

7. Cervical Height: The vertical distance from the floor to bony bump at base of neck.

8. Calf Height: The vertical distance from the floor to the point of maximum circumference of the right calf.

9. Chest Depth: The depth of the chest at the level of the nipples during normal breathing.

10. Chest Breadth: The breadth across the chest during normal breathing measured at the level of the nipples.

11. Functional Arm Reach: (The subject is standing erect and shoulders pressed against a rear wall and the right arm and hand extended horizontally, except that the tips of the thumb and forefinger are pressed together). The distance is measured from the rear wall to the tip of the thumb.

SITTING MEASUREMENTS

12. Sitting Height: The vertical distance from the sitting surface to the top of the head, with the instrument arm firmly touching the scalp.

13. Eye Height, sitting: The vertical distance from the sitting surface to the inner corner of the eye.

14. Shoulder-elbow Length: (Right upper arm hanging to the side and forearm extended horizontally.) The vertical distance from the right acromion to the bottom of the elbow.

15. Forearm - Hand Length: (Position the same as for No. 18) The distance from the tip of the right elbow to the tip of the middle finger.

16. Buttock - Knee Length: (Feet resting on a surface so knees are bent at right angles.) The distance from the rearmost point on the buttock to the front of the kneecap.

17. Buttock - Popliteal Length: (Feet resting on a surface so knees are bent at right angles.) The distance from the rearmost point of the buttock to the back of the knee.

18. Knee Height, sitting: Feet resting on a surface so that knees are bent at about right angles. The vertical distance from the footrest surface to the top of the right knee (not the kneecaps).

19. Popliteal Height, sitting: With the position the same as number 18 the vertical distance from the footrest surface to the underside of the right knee (popliteal area).

20. Shoulder Breadth: (Bideltoid diameter) (Upper arms hanging to sides and forearms extended horizontally) The horizontal distance across the maximum lateral protrusion of the deltoid muscles.

21. Hip Breadth: The horizontal distance across the widest portion of the hips.

22. Arm reach, upwards: The distance from the sitting surface upward to the tip of the middle finger with the right arm and hand extended vertically above shoulder.

23. Mid-shoulder Height: The vertical distance from the sitting surface to the point midway between the junction of the neck and shoulder and the lateral edge of the right shoulder.

24. Maximum Forearm - forearm breadth: (Position same as No. 20) The maximum horizontal distance across the lateral surfaces of the forearms.

BODY CIRCUMFERENCES

25. Neck Circumference: The circumference of the neck measured in a plane perpendicular to the axis of the neck just below the "Adams Apple".

26. Shoulder Circumference: The circumference around the shoulders over the maximum lateral protrusion of the deltoid muscles.

27. Chest Circumference: The maximum circumference of the chest during normal breathing measured at the level of the nipples.

28. Waist Circumference: The circumference of the waist across the abdomen just above the level of the navel.

29. Hip Circumference: The circumference measured in a horizontal plane at the level of the greatest rearward protrusion of the buttock around the hip region.

30. Wrist Circumference: The minimum circumference of the wrist just proximal of the styloid process of the right ulna.

31. Upper Thigh Circumference: The girth of the right thigh just below the furrow formed by the buttock and upper thigh.

32. Lower Thigh Circumference: The girth of the lower thigh just above the right kneecap.

33. Calf Circumference: The maximum circumference of the right calf.

34. Ankle Circumference: The minimum circumference of the right leg just above the projections of the ankle bones.

35. Arm Scye Circumference: The circumference measured around the scye with the tape placed as high as possible in the right armpit and passing over the acromion.

36. Biceps Circumference, extended: The circumference of the arm at the level of the biceps muscle, midway between the shoulder and the elbow.

37. Biceps Circumference, flexed: (Subject bends right arm and makes a fist while holding the upper arm horizontal.) The maximum circumference around the biceps muscle.

38. Forearm Circumference, flexed: (position same as No. 37) The maximum circumference of the forearm measured at right angles to the long axis.

39. Vertical Trunk Circumference: The surface distance vertically around the torso. The tape passes through the crotch and over the mid-points of the right shoulder and the right buttock. The tape is pressed into the small of the back so that it follows the body contour at all points.

SURFACE MEASUREMENTS

40. Back-waist Length: The surface distance measured vertically from the base of the neck (cervicale) to the height of the waist.

41. Interscye Breadth (distance): (Subject sits, his hands on his knees) The minimum surface distance between the scye points across the back.

42. Sleeve inseam: (The right arm is extended with the hand no more than a foot from the body). The distance from the front edge of the armpit to the notch formed by the junction of the thumb and the wrist.

43. Sleeve Length: (Arms horizontal, and elbows bent at right angles, fists pressed together) The surface distance from the spine to the end of the ulna styloid process at the little finger side of the wrist with the tape passing over the tip of the elbow.

44. Interscye Maximum: (Arms extended horizontally forward as far as possible). The minimum surface distance across the back between the scye points.

45. Shoulder Length: The surface distance from the junction of the neck and shoulder to the lateral edge of the right shoulder (acromion).

HEAD MEASUREMENTS

46. Head Length: Maximum length of the head from glabella (on the forehead) to the occipital region.

47. Head Height: The vertical distance from the cartilaginous notch (tragion) just forward of the upper edge of the right ear hole to the highest point of the head with the instrument arm firmly touching the scalp.

48. Face Length: The distance from the depression in the nose between the eyes and the tip of the chin.

49. Head Breadth: Maximum breadth of the head in a plane perpendicular to the mid-sagittal plane.

50. Head Circumference: The maximum circumference of the head just above the brow ridges.

51. Interpupillary Distance: The distance between the center of the pupils while looking straight ahead.

52. Face Breadth: Maximum horizontal breadth of the face across the most laterally projecting bones of the cheek (zygomatic arches).

53. Bitragion Diameter: The diameter from the cartilaginous notch (tragion) just forward of the upper edge of the right ear hole to the corresponding notch in the left ear.

HAND MEASUREMENTS

54. Hand Length: (Right hand extended with palm up) The distance from the proximal edge of the varicular bone at the wrist to the tip of the middle finger.

55. Palm Length: (Position of right hand same as for No. 54) The distance from the proximal edge of the varicular bone at the wrist to the skin furrow formed where the middle finger folds upon the palm.

56. Hand Breadth (Metacarpals): The maximum breadth across the distal ends of the metacarpal bones (knuckles).

57. Hand Circumference (Metacarpals): The girth of the hand at the base of the fingers with fingers extended and joined.

FOOT MEASUREMENTS

58. Foot Length: The distance from the rearmost part of the heel to the point of the widest part of the foot.

59. Instep Length (Ball of foot): The distance from the rearmost part of the heel to the point of the widest part of the foot.

60. Foot Breadth (Ball of foot): The breadth of the widest part of the foot.

61. Ball of Foot Circumference: Subject is standing with weight evenly distributed between both feet. The maximum circumference of the foot is measured around the distal ends of the proturbances of the metatarsal bones.

62. Heel Breadth: (Subject stands with weight equally distributed on both feet) The maximum breadth of the right heel behind the projections of the ankle bones.

63. Heel Ankle Circumference: The diagonal circumference around the tip of the heel and over the instep at the juncture of the foot and leg.

64. Instep Circumference: The circumference of the foot measured over the instep and under the arch.

SPATIAL MEASUREMENTS

KNEELING MEASURES: For these measurements the subject kneels with his knees and feet together and his fists clenched and on the floor in front of his knees. The arms are vertically positioned, and the head is in line with the long axis of the body.

65. Kneeling Height: The vertical distance from the floor to the

highest point on the head.

66. Kneeling Length: From the most rearward point on the foot to the most forward point on the head.

CRAWLING MEASURES: For these measurements the subject rests on knees and flattened palms with his arms and thighs perpendicular to the floor and his feet comfortably extended and spaced. The body is straight with the head in line with the long axis of the body.

67. Crawling Height: The vertical distance from the floor to the highest point of the head.

68. Crawling Length: From the most rearward point on the foot to the most forward point on the foot.

PRONE MEASURES: In these measurements the subject lies prone on his stomach with his feet together and comfortably extended, his arms extended forward as far as possible without strain and his fists clenched.

69. Prone Height: The vertical distance from the floor to the highest point on the head when the head is raised as high as possible while the chest remains on the floor.

70. Prone Length: The horizontal distance from the most rearward point on the foot to the most forward point on the fist.

STRENGTH MEASUREMENTS

71. Left Hand Grip (lbs): The maximum strength reading is recorded from the dial.

72. Right Hand Grip (lbs): The maximum strength reading is recorded from the dial.

73. One-half Squat: The subject stands on the platform of the isotronic evaluator with the cross bar set to a height at which it will rest on the back of the neck and shoulders when he is in a squat position with the thighs parallel to the floor. A dial is available by which the Ss weight is set at zero, thus the score represents only the extent of his effort. The hands are placed on the bar in a comfortable position and the subject rises, pushing with legs as hard as possible for about ten seconds. The maximum deflection in pounds of the meter needle is recorded.

74. Dead Lift (lbs): The subject stands on the platform of the isotronic evaluator and the bar is set to a height about two inches below the knees, when the bar is held with the hands about shoulder width apart. A dial is available by which the Ss weight is set to zero, thus the score represents only the extent of his effort. Keeping the head and hip down and the back flat, he pushes hard with the legs and pulls up as hard as

possible for about ten seconds. The maximum deflection of the meter needle is recorded.

75. Weight: (pounds) Each subject is weighed to the nearest pound.

DICHOTOMIZED OBSERVATIONS

76. Eyeglasses: Subject is asked whether or not he must wear prescription eyeglasses. Important in equipment design.

77. Handedness: Subject is questioned as to whether right-handed, left-handed, or ambidextrous. Important in equipment design.

78. Length of Toe: Simple observation as to whether the first or second toe of the right foot is longer. (Important in design of footwear.)

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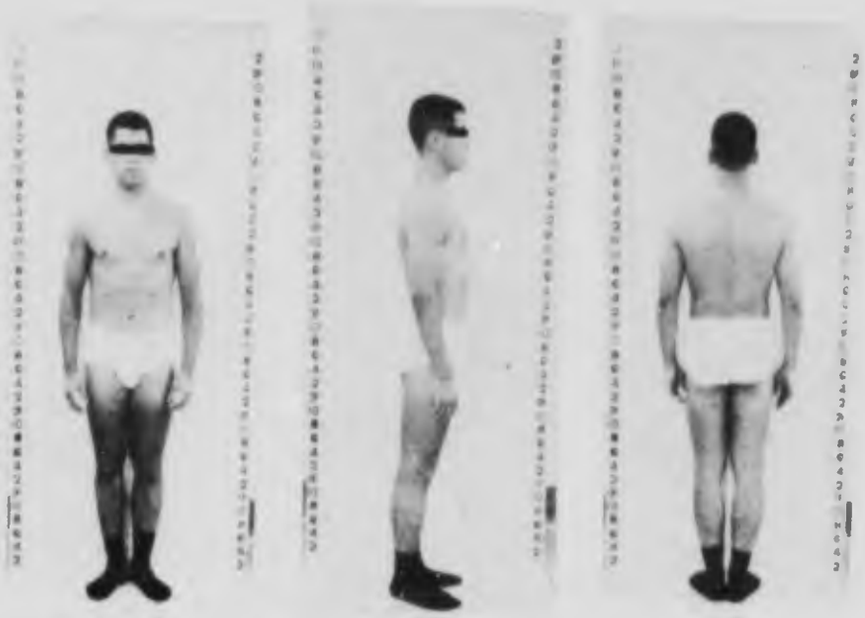
APPENDIX B

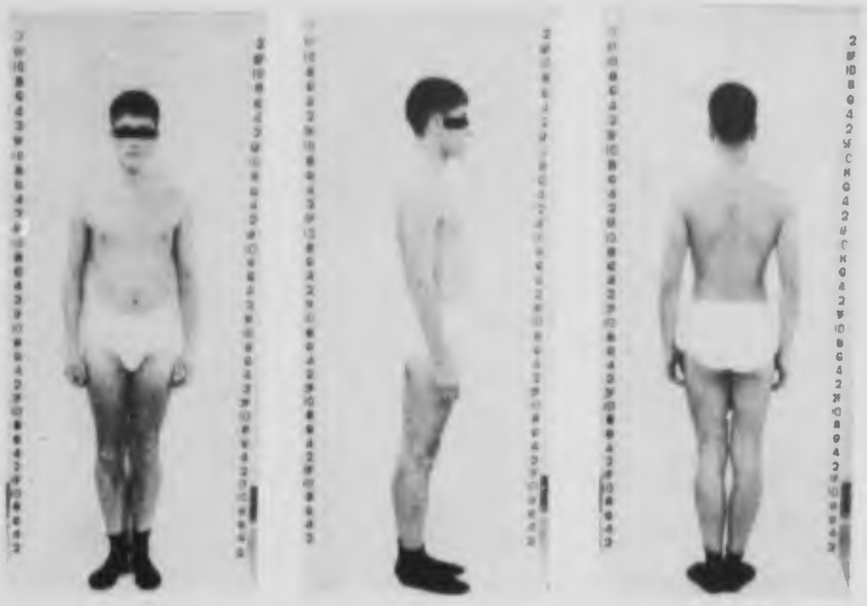
Photographs of subjects considered within the average range.

Country: Ecuador Height 65.7 Inches Weight 146 Pounds

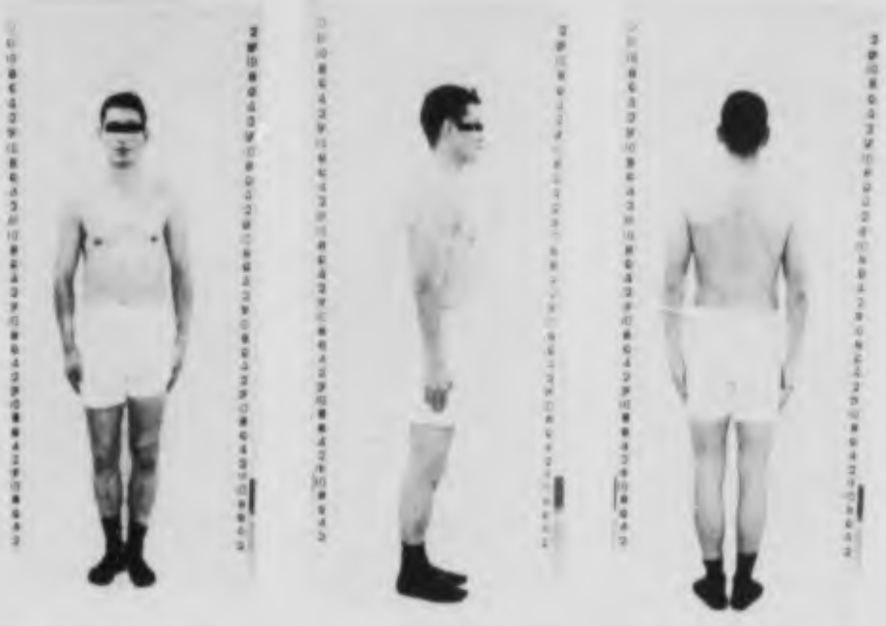


Country: Chile Height 65.2 Inches Weight 143 Pounds

NOTE: Each student whose photograph appears herein signed a statement to the effect that he had no objections to his photograph being published. Signed statements are on file in the US Army Tropic Test Center.

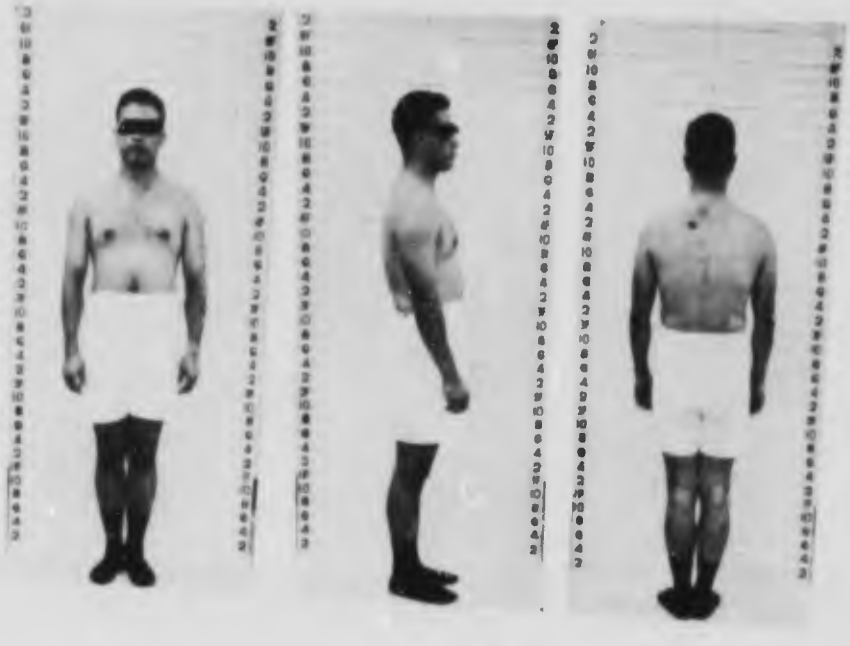


Country: Chile Height 65.6 Inches Weight 134 Pounds



Country: Ecuador Height 64.4 Inches Weight 134 Pounds

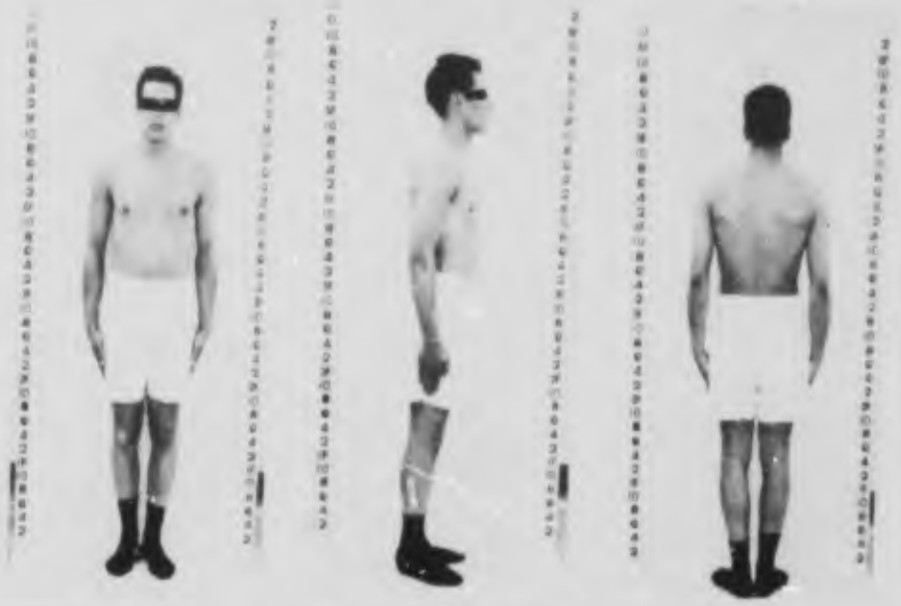
Country: Dominican Republic Height 66.8 Inches Weight 136 Pounds



Country: Ecuador Height: 64.0 Weight 139 Pounds

Country: Chile Height 64 Inches Weight 131 Pounds

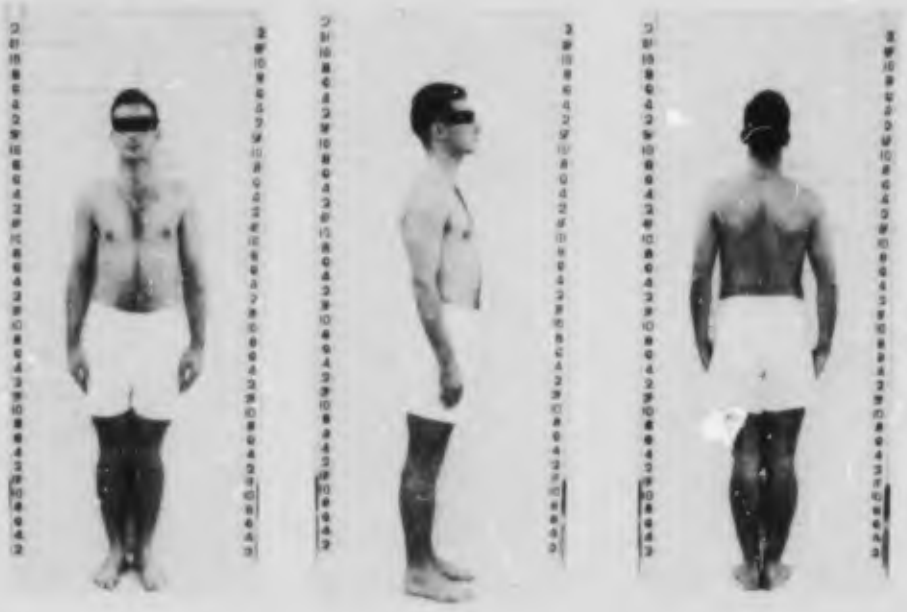
Country: Ecuador Height 64.6 Inches Weight 143 Pounds



Countrv: Ecuador Height 66.3 Inches Weight 135 Pounds

Country: Brazil Height 65.6 Inches Weight 130 Pounds

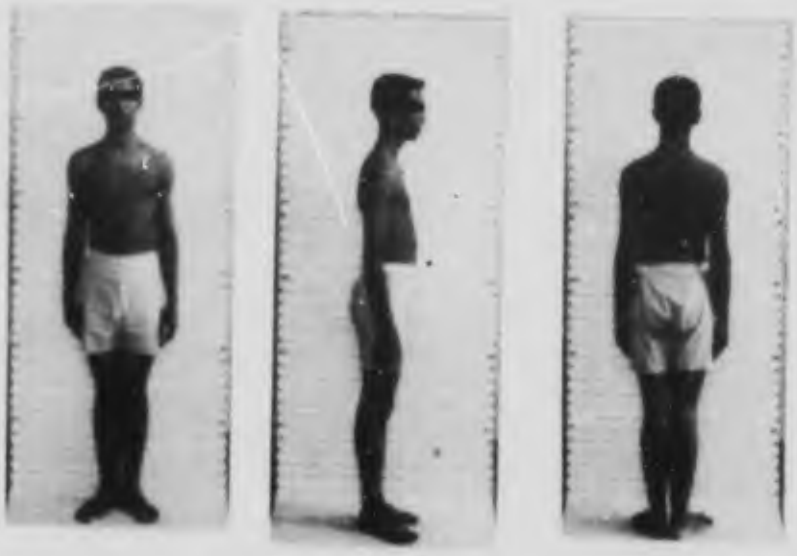
Country: Brazil Height 66.9 Inches Weight 140 Pounds



Country: Brazil Height 64.8 Inches Weight 130 Pounds

APPENDIX C

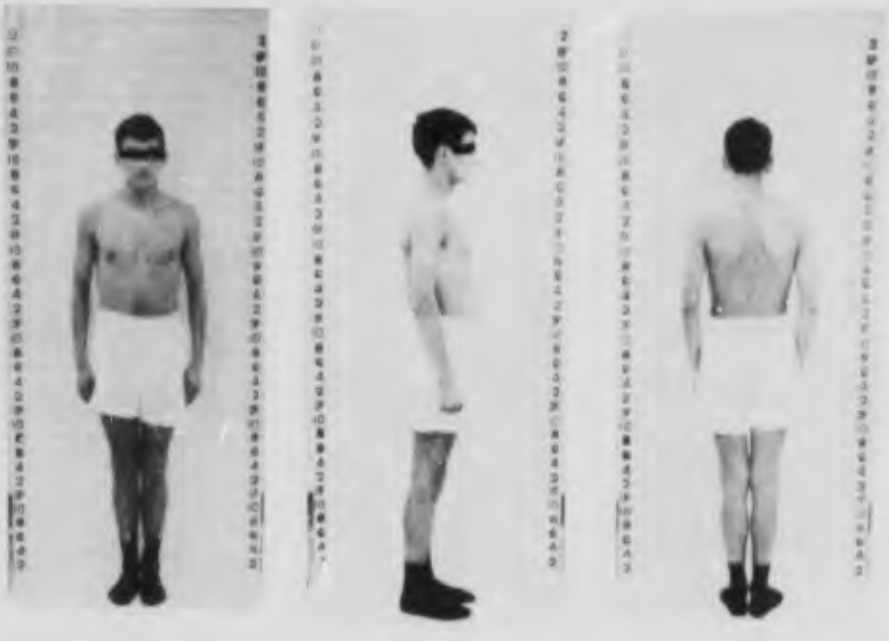
Photographs of Subjects Who Were More Slender Than Average



Country: Panama Weight: 131 Lbs.

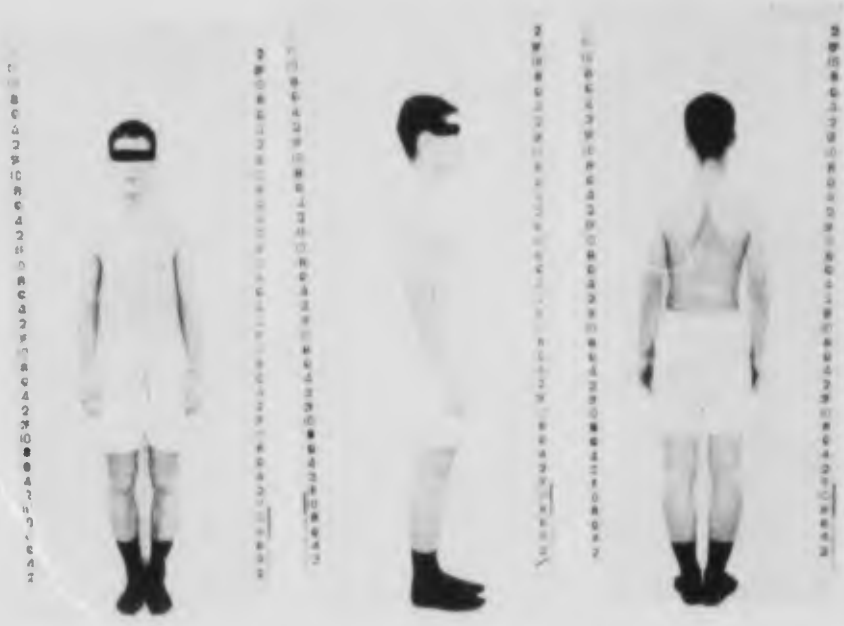
Country: Honduras Weight: 125 Lbs.

Country: Dominican Republic Weight: 115 Lbs.



Country: Chile Weight: 110 Lbs.

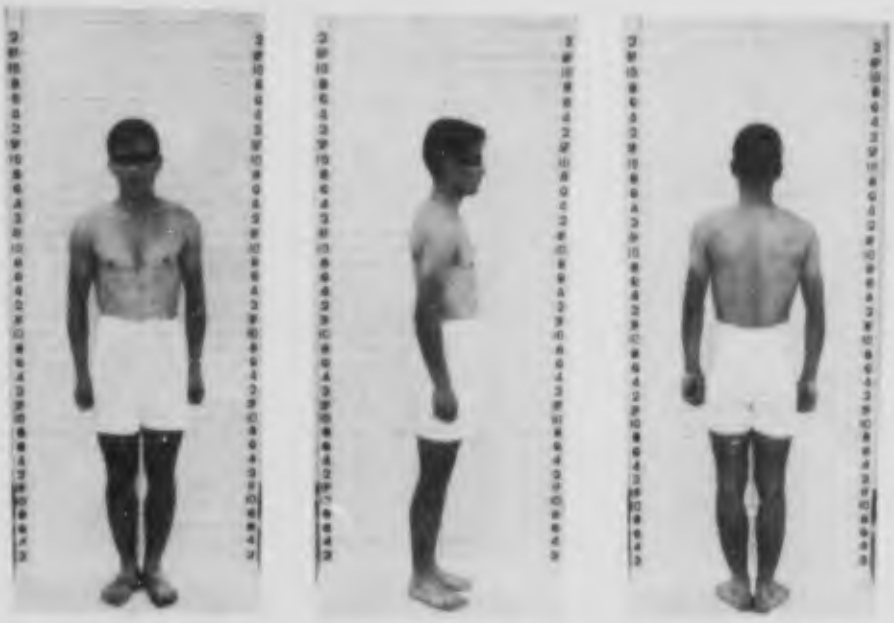
Country: Panama Weight: 123 Lbs.



Country: Chile Weight: 119 Lbs.

APPENDIX D

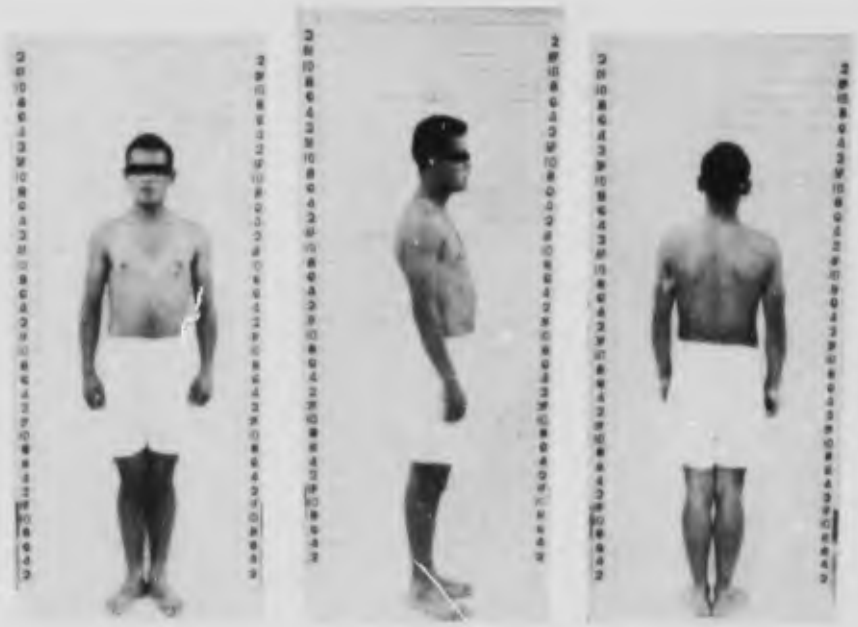
Photographs of Subjects Who Were Shorter than Average



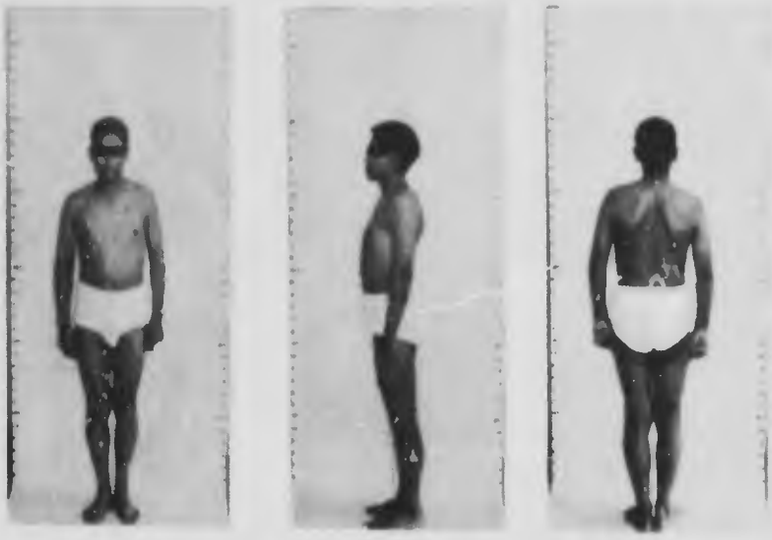
Country: Bolivia Height: 62.6 Inches

Country: Ecuador Height: 61.9 Inches

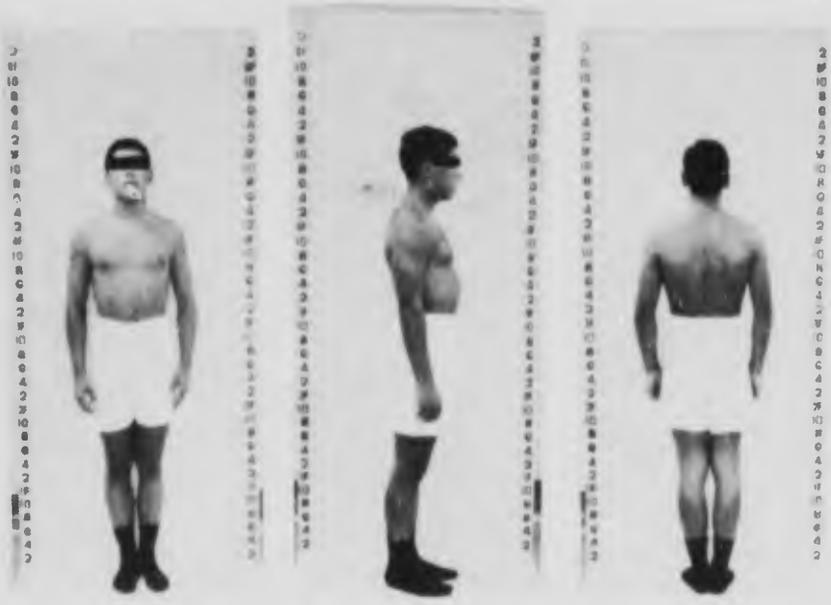
Country: Ecuador Height: 60.5 Inches



Country: Bolivia Height: 63.3 Inches



Country: Bolivia Height: 60.0 Inches



Country: Chile Height: 60.6 Inches

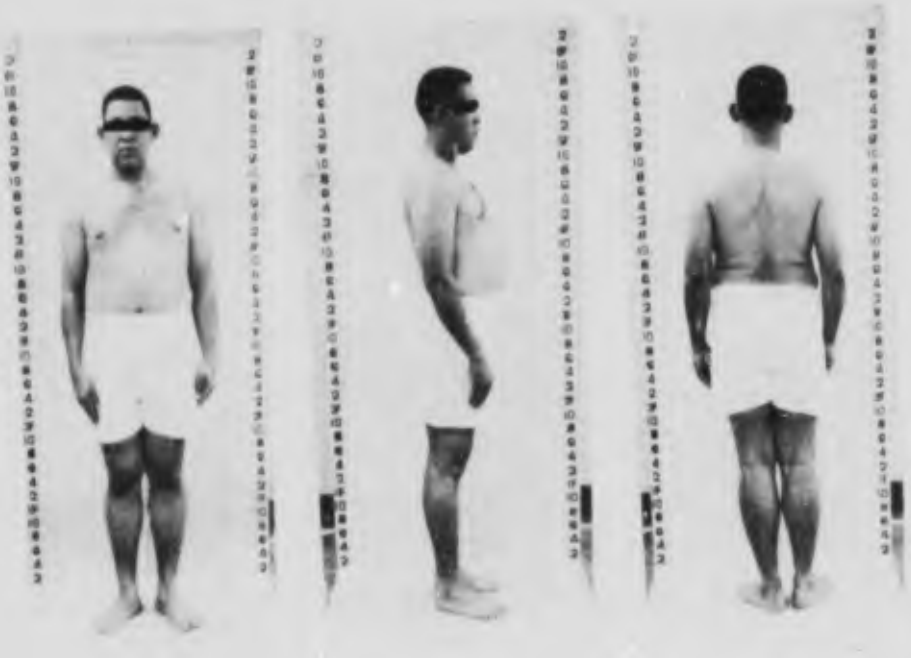
APPENDIX E

Photographs of Subjects Who Were Heavier Than Average

Country: Dominican Republic Weight: 178 Lbs.

Country: Costa Rica Weight: 158 Lbs.

Country: Colombia Weight: 150 Lbs.



Country: Dominican Republic Weight: 200 Lbs.

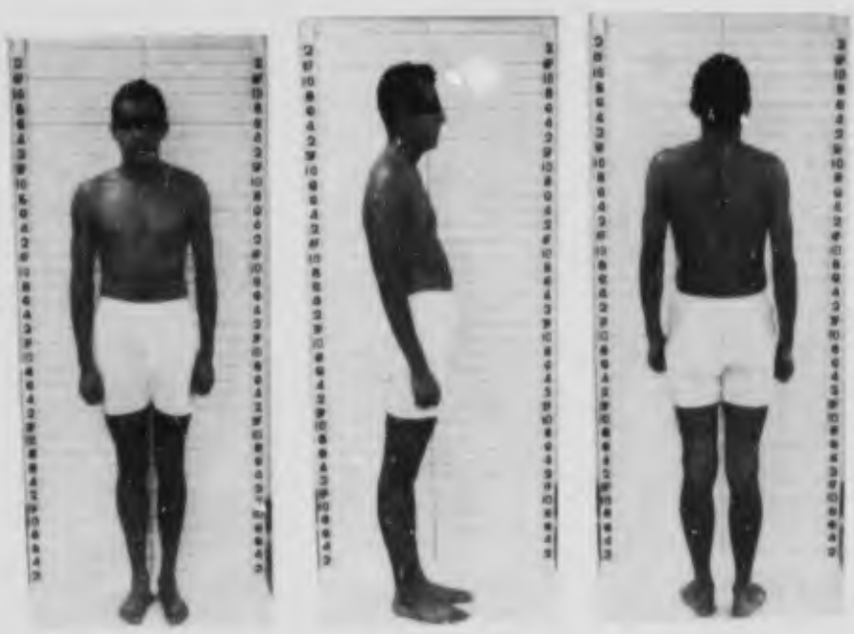
Country: Paraguay Weight: 189 Lbs.

Country: Argentina Weight: 192 Lbs.

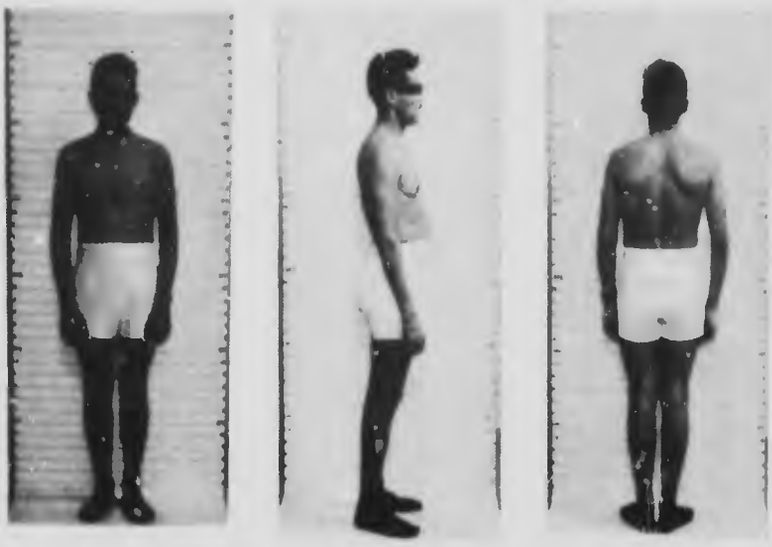
APPENDIX F

Photographs of Subjects Who Were Taller Than Average

Country: Ecuador Height: 69.2 Inches

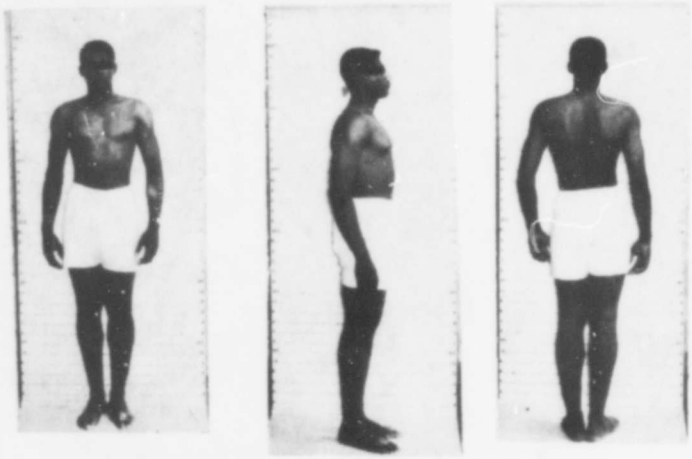


Country: Colombia Height: 70.6 Inches

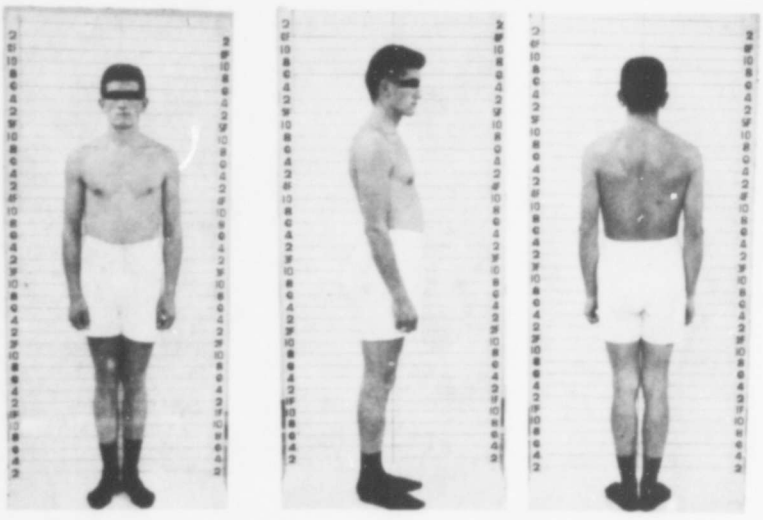


Country: Chile Height: 69.1 Inches

Country: Chile Height: 70.4 Inches



Country: Panama Height: 71.8 Inches



Country: Bolivia Height: 68.3 Inches

APPENDIX G

Percentiles and ranges for standing, sitting, body circumference, surface, head, hand, foot spacial, strength and weight measurements of 733 Latin American military personnel (centimeters unless otherwise designated)

	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
STANDING MEASUREMENTS									
1. Stature	153.7	157.0	162.1	165.9	170.1	177.0	181.6	150.0	186.9
2. Shoulder Height	125.3	128.6	133.1	136.7	140.4	146.6	151.0	122.8	156.2
3. Waist Height	89.1	92.1	96.4	99.2	102.4	107.2	112.7	87.0	116.8
4. Crotch Height	67.5	70.1	73.8	76.7	79.7	84.1	87.7	64.7	92.0
5. Kneecap Height	43.4	45.3	47.7	49.3	50.9	53.4	55.9	41.2	59.9
6. Hip Breadth, Standing	28.3	29.2	30.7	31.7	32.8	34.5	36.1	23.2	38.4
7. Cervical Height	130.2	133.0	138.2	141.8	145.5	151.7	157.5	127.7	162.7
8. Calf Height	29.3	30.5	32.5	34.1	35.6	38.1	39.9	27.3	42.7
9. Chest depth	18.9	20.0	21.5	22.7	23.8	25.5	27.7	12.5	30.8
10. Chest Breadth	25.7	27.3	28.8	30.1	31.3	33.8	36.1	23.7	38.2
11. Functional Arm Reach	67.4	69.9	74.2	77.1	79.7	84.0	88.6	62.3	92.3
SITTING MEASUREMENTS									
12. Sitting Height	78.4	80.9	84.7	86.9	88.9	91.9	94.6	71.5	97.4
13. Eye Height, Sitting	58.9	67.4	72.2	74.7	76.8	80.2	82.3	56.6	85.3
14. Shoulder-Elbow Length	31.1	32.0	33.8	34.9	36.2	38.0	38.8	28.9	41.0
15. Forearm-Hand Length	40.5	41.9	43.9	45.2	46.7	48.9	51.3	34.8	57.7
16. Buttock-Knee Length	50.8	52.0	54.4	56.2	58.0	60.6	62.5	45.1	65.0
17. Buttock-Popliteal Length	40.4	41.9	44.0	45.6	47.2	49.4	51.6	39.0	56.0
18. Knee Height, Sitting	44.7	46.4	48.6	50.3	51.9	54.8	56.8	41.2	59.0
19. Popliteal Height	35.3	37.2	39.3	40.6	42.1	44.4	46.7	33.3	49.2
20. Shoulder Breadth	38.3	39.9	41.7	43.2	44.8	47.1	49.0	34.0	51.4
21. Hip Breadth, Sitting	28.9	30.0	31.7	32.8	34.2	36.2	38.3	23.1	40.8
22. Arm Reach Upwards	119.6	123.0	127.9	131.6	134.9	140.0	144.0	116.6	146.9
23. Mid-Shoulder Height, Sitting	52.7	54.9	57.7	59.6	61.8	65.5	76.4	51.0	80.4
24. Maximum Forearm-forearm Breadth	36.9	38.8	40.9	42.9	45.2	48.8	51.6	30.8	57.7

BODY CIRCUMFERENCES	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
25. Neck Circumference	30.2	32.4	34.2	35.5	36.7	39.4	43.1	27.3	48.2
26. Shoulder Circumference	95.9	98.3	103.2	106.5	110.4	117.1	122.5	90.2	128.4
27. Chest Circumference	79.8	83.0	87.4	90.7	94.5	100.5	107.0	76.9	115.0
28. Waist Circumference	66.3	68.3	72.4	75.6	80.0	88.7	96.7	60.9	113.2
29. Hip Circumference	79.5	82.4	87.6	90.4	94.0	99.2	104.1	72.5	109.1
30. Wrist Circumference	14.5	15.0	15.7	16.2	16.9	17.9	18.6	13.7	19.6
31. Crotch-Thigh Circumference (Upper thigh)	42.5	46.1	49.9	52.3	54.7	58.0	60.9	40.7	67.2
32. Lower Thigh Circumference	34.7	38.2	41.5	44.1	46.6	49.6	52.9	30.7	55.8
33. Calf Circumference	24.8	30.5	33.0	34.5	36.1	38.3	39.7	21.0	42.9
34. Ankle Circumference	19.2	20.0	21.1	22.0	23.0	24.5	25.4	17.7	30.0
35. Arm Scye Circumference	35.9	38.0	40.2	42.0	43.8	47.2	49.5	33.9	53.0
36. Biceps Circumference, Extended	21.1	23.2	25.0	26.4	27.9	30.5	33.3	20.2	37.0
37. Biceps Circumference, Flexed	23.5	26.2	28.4	29.9	31.2	33.8	36.3	20.3	44.0
38. Forearm Circumference, Flexed (Lower)	21.4	23.3	25.2	26.3	27.6	29.5	31.0	20.2	35.5
39. Vertical Trunk Circumference	114.0	119.0	150.0	154.2	159.6	166.8	173.9	104.3	184.3
SURFACE MEASUREMENTS									
40. Back-Waist Length	33.9	36.1	38.7	40.5	42.5	46.5	49.9	27.0	55.7
41. Interscye distance	30.6	33.3	36.5	38.2	40.2	43.1	45.5	28.0	49.5
42. Sleeve, Inseam	40.0	41.5	44.0	45.5	47.3	49.7	52.4	34.4	55.4
43. Sleeve Length (spine-to-wrist)	60.0	74.9	79.2	81.8	84.5	88.9	91.4	55.0	94.5
44. Interscye Maximum	42.2	46.5	49.5	51.5	54.0	57.0	58.9	38.7	61.2
45. Shoulder Length	10.4	11.5	12.7	13.5	14.5	15.7	16.9	10.0	19.7
HEAD MEASUREMENTS									
46. Head Length	16.0	17.5	18.2	18.6	19.0	19.7	20.1	12.5	20.7
47. Head Height	10.1	10.8	11.6	12.1	12.6	13.5	14.3	9.8	15.0

	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
HEAD MEASUREMENTS (Cont'd)									
48. Face Length	10.2	10.8	11.4	11.9	12.4	13.1	14.2	10.0	18.0
49. Head Breadth	13.6	14.1	14.7	15.1	15.6	16.1	16.7	13.3	18.6
50. Head Circumference	50.5	52.6	54.0	55.0	56.0	57.7	58.6	50.2	59.5
51. Interpupillary distance	5.0	5.4	5.8	6.0	6.2	6.6	6.8	4.4	6.9
52. Face Breadth	10.7	11.2	11.9	12.3	12.9	13.5	14.1	10.2	16.1
53. Bitragion Diameter	12.0	12.4	13.1	13.4	13.8	14.4	14.9	11.7	19.0
HAND MEASUREMENTS									
54. Hand Length	16.1	16.6	17.5	18.0	18.6	19.6	20.4	13.3	23.0
55. Palm Length	9.0	9.3	9.9	10.2	10.6	11.2	11.8	8.5	12.2
56. Hand Breadth (Metacarpals)	7.6	7.8	8.1	8.5	8.8	9.2	9.6	6.7	9.9
57. Hand Circumference (Metacarpals)	18.3	19.0	20.2	21.0	21.9	23.2	24.2	17.3	28.2
FOOT MEASUREMENTS									
58. Foot Length	22.9	23.4	24.5	25.2	26.1	27.4	28.2	22.3	29.6
59. Instep Length (Ball of Foot)	13.1	16.6	18.1	18.8	19.5	20.4	21.0	11.6	22.0
60. Foot Breadth (Ball of Foot)	8.5	8.8	9.3	9.7	10.0	10.7	11.1	8.1	11.3
61. Ball of Foot Circumference	20.7	21.9	23.2	24.0	24.9	26.2	27.8	19.7	33.5
62. Heel Breadth	5.8	6.1	6.5	6.7	7.0	7.4	7.9	5.5	8.4
63. Heel-Ankle Circumference	23.4	30.3	32.0	33.0	34.1	35.7	36.7	22.2	39.6
64. Instep Circumference	20.6	22.6	23.9	24.8	25.7	27.0	29.5	20.0	36.7
SPATIAL MEASUREMENTS									
65. Kneeling Height	69.0	72.1	75.5	78.6	81.6	86.9	90.1	64.4	95.2
66. Kneeling Length	102.4	107.5	115.2	120.4	125.5	133.8	142.8	88.8	151.0
67. Crawling Height	65.2	67.5	71.7	74.1	77.1	81.5	84.5	59.6	88.6
68. Crawling Length	104.7	111.4	118.8	123.4	128.8	136.8	145.4	101.1	163.0

SPATIAL MEASUREMENTS (Cont'd)	PERCENTILES							RANGE	
	1st	5th	25th	50th	75th	95th	99th	Minimum	Maximum
69. Prone Height	23.8	26.6	28.8	30.7	32.5	35.7	38.3	20.8	43.6
70. Prone Length	193.6	200.4	209.9	215.0	219.9	229.2	238.5	185.7	248.5
STRENGTH MEASUREMENTS									
71. Left Hand Grip (Kg)	22	28	34	37	42	48	53	19	61
72. Right Hand Grip (Kg)	26	31	36	40	44	52	58	21	62
73. One-half Squat (pounds)	75	100	140	170	200	240	283	45	320
74. Dead Left (pounds)	140	170	210	240	261	300	320	126	340
75. Weight (pounds)	105	115	128	139	150	172	189	100	215

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13. ABSTRACT

The U.S. Army Tropic Test Center made anthropometric measurements of a sample of Latin-American military personnel in the Canal Zone from September, 1965 to September 1966.

A total of 733 trainees were measured--600 airmen at the USAF Inter-American Air Force Academy and 133 army personnel at the US Army School of the Americas. Eighteen Latin-American countries are represented in the sample. The average age for the sample was 23 years, average height was 65.5 inches, and average weight 140 pounds.

Percentiles and ranges for 76 physical measurements are presented, including isometric strength and hand-grip measures. Reliability coefficients for strength measurements ranged from .73-.87.

Comparisons with Thai and U.S. personnel showed that the Latin-American sample was intermediate between the two on most physical dimensions, however, the Latin Americans were much closer in size to the Thai than to U.S. military personnel.

Photographs illustrating various body builds are shown.

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14. KEY WORDS	LINK A		LINK B		LINK C	
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