

~~2500~~
2047



TECOM PROJECT NO. 9 CO 049 000 001

USATTC REPORT NO. 7209002

DA PROJECT NO. 1T061101A91A

AD _____

ANTHROPOMETRY OF THE LATIN-AMERICAN ARMED FORCES

AD0753049
01

FINAL REPORT
BY
D. A. DOBBINS
C. M. KINDICK
AUGUST 1972

~~2500~~
2047

This document has been approved for public release and sale; its distribution is unlimited.

UNITED STATES ARMY TROPIC TEST CENTER

FORT CLAYTON, CANAL ZONE



200301/0200

2047
~~2500~~

DISPOSITION INSTRUCTIONS*

Destroy this report when no longer needed. Do not return it to the originator.

DISCLAIMER

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents. The use of trade names in this report does not constitute an official endorsement or approval of the use of such commercial hardware or software. The report may not be cited for purposes of advertisement.

* These disposition instructions do not apply to the record copy (AR 340-18).



DEPARTMENT OF THE ARMY Mr. Crowell/lt/870-2775
HEADQUARTERS, U. S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005

21 MAR 1973

AMSTE-ME

SUBJECT: Final Report on Anthropometry of Latin-American Armed
Forces, TECOM Project No. 9-CO-049-000-001

Commander
US Army Tropic Test Center
ATTN: STETC-PD-M
Drawer 942
Ft Clayton, Canal Zone

Subject report has been reviewed by this headquarters and is approved.
Distribution may be effected in accordance with Appendix J of the
report with the following changes:

<u>Agency</u>	<u>Copies</u>
Commander US Army Test and Evaluation Command ATTN: AMSTE-ME Aberdeen Proving Ground, MD 21005	0
<u>Delete</u> Commander US Army Test and Evaluation Command ATTN: USACDC Liaison Officer Aberdeen Proving Ground, MD 21005	1
<u>Add</u> Combat Development LNO CONARC/TRADOC Field Element (Prov) Aberdeen Proving Ground, MD 21005	1

FOR THE COMMANDER:

Sidney Wise
SIDNEY WISE
Dir, Methodology Improvement

ABSTRACT

The United States Army Tropic Test Center made anthropometric measurements of a sample of Latin-American enlisted military personnel in the Canal Zone from September 1965 to February 1970.

A total of 1985 trainees were measured—1852 airmen at the USAF Inter-American Air Forces Academy and 133 army personnel at the US Army School of the Americas. Fifteen Latin-American countries are represented in the sample. The average age for the sample was 23 years, average height was 5 feet, 5 ½ inches, and average weight was 141 pounds.

Percentiles and ranges for 75 physical measurements are presented, including isometric strength and hand-grip measures. Country-by-country comparisons are also presented. In addition, 1790 ABO blood group types are presented by country.

These data represent the only known source of detailed anthropometric information on Latin-American military personnel.

FOREWORD

This is the final report of the US Army Tropic Test Center project, Anthropometry of the Latin-American Armed Forces. The work was completed under the Department of the Army In-House Laboratory Independent Research program (DA Project 1T061101A91A). An interim report bearing the same title was published in May 1967, presenting data for the first 733 persons measured (AD 654762). Although data collection ended in February 1970, publication was delayed until the present because of higher priority tasks. Nevertheless, the present publication is believed to be warranted because of the scarcity of scientific literature on the topic and the possible future civilian and military usefulness.

The Tropic Test Center remains 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 COL D. E. Straight, formerly US Air Force Systems Command Scientific and Technical Liaison Officer, for coordinating the excellent support provided by the US Air Forces Southern Command. Acknowledgement is made to the commandants and staff, past and present, of the USAF Inter-American Air Forces Academy and the US Army School of the Americas for making measurement time and facilities available.

Data collection and reduction efforts from June 1967 to March 1971 were under the supervision of Mr. A. U. Dubuisson, formerly Research Psychologist, Tropic Test Center.

TABLE OF CONTENTS

	PAGE
ABSTRACT	i
FOREWORD	ii
LIST OF TABLES AND FIGURES	iv
INTRODUCTION	1
METHOD	
Instruments	1
Procedure	3
RESULTS	
Distribution by Country	7
Composition of the Sample	8
Anthropometric Measurements	20
Strength Measurements	21
Comparison with Thai and US Personnel	21
A Note on Sampling	21
Blood Groups	22
APPENDIX A A BRIEF ETHNIC HISTORY OF LATIN AMERICA	26
APPENDIX B DESCRIPTION OF MEASUREMENTS	29
APPENDIX C COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY (Comparison of 1st Percentile in Inches)	35
APPENDIX D COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY (Comparison of 50th Percentile in Inches)	37
APPENDIX E COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY (Comparison of 99th Percentile in Inches)	39
APPENDIX F COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY (Comparison of 1st Percentile in Centimeters)	41
APPENDIX G COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY (Comparison of 50th Percentile in Centimeters)	43
APPENDIX H COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY (Comparison of 99th Percentile in Centimeters)	45
APPENDIX I PERCENTILES AND RANGES FOR STANDING, SITTING, BODY CIRCUMFERENCE, SURFACE, HEAD, HAND, FOOT, SPATIAL, STRENGTH AND WEIGHT MEASUREMENTS OF 1985 LATIN- AMERICAN MILITARY PERSONNEL	47
APPENDIX J DISTRIBUTION LIST	51
APPENDIX K SELECTED BIBLIOGRAPHY	55

LIST OF TABLES AND FIGURES

	PAGE
Figure 1.	Anthropometry Instruments 1
Figure 2.	Standing Measurement, Shoulder Height 2
Figure 3.	Sitting Measurement, Sitting Height 2
Figure 4.	Head Measurement, Head Breadth 3
Figure 5.	Hand Measurement, Hand Length 3
Figure 6.	Foot Measurement, Heel Breadth 4
Figure 7.	Circumference Measurement, Chest Circumference 4
Figure 8.	Spatial Measurement, Kneeling Length 5
Figure 9.	Strength Measurement: Right Hand Strength, Free (Left), Fixed (Right) 5
Figure 10.	Strength Measurements 6
Table I	Number of People Measured by Country of Longest Residence 7
Table II	Age in Years 8
Table III	Height in Inches 9
Table IV	Weight in Pounds 10
Table V	Years of Schooling Completed 11
Table VI	Number of Days in the Canal Zone at Time of Measurement 12
Table VII	Languages Spoken 13
Table VIII	Military Grades 14
Table IX	Percentiles and Ranges for Standing, Sitting, Body Circumference, Surface, Head, Hand, Foot, Spatial, Strength, and Weight Measurements of 1985 Latin- American Military Personnel 15
Table X	Comparison of Selected 50th Percentile Measurements between Latin-American Military Personnel, Royal Thai Armed Forces, and US Military Personnel 23
Table XI	Comparison of Selected Percentile Points between Interim Report Data and Final Report Data 24
Table XII	Percentages of ABO Blood Groups for Latin- American Countries 25

INTRODUCTION

This is the final report of a study to obtain measurements from Latin-American armed forces. The detailed physical measurements that are reported are those necessary for the human engineering of equipment and clothing. Measurements were 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 for possible use in military assistance programs in Latin America. When standard lots of clothing and equipment designed for United States 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.

No detailed anthropometric data for young Latin-American men, of the nature and extent reported in the present study, was found in the available literature in 1965. Most of the information available represented restricted numbers and types of measures made in connection with health surveys, racial groupings, and physical somatotyping (reference 10). This project was thus designed to contribute to the United States data bank on the anthropometry of foreign military populations.

An interim report bearing the same title was published in May 1967 (reference 15). That report presented a brief ethnic history of Latin America for interested readers. It is reprinted in Appendix A of the present report. The interim report (AD 654762) also contained selected photographs of survey participants that are not reproduced in the present report.

METHOD

Instruments. Standard anthropometric instruments were used to make the measurements. These are shown in figure 1.

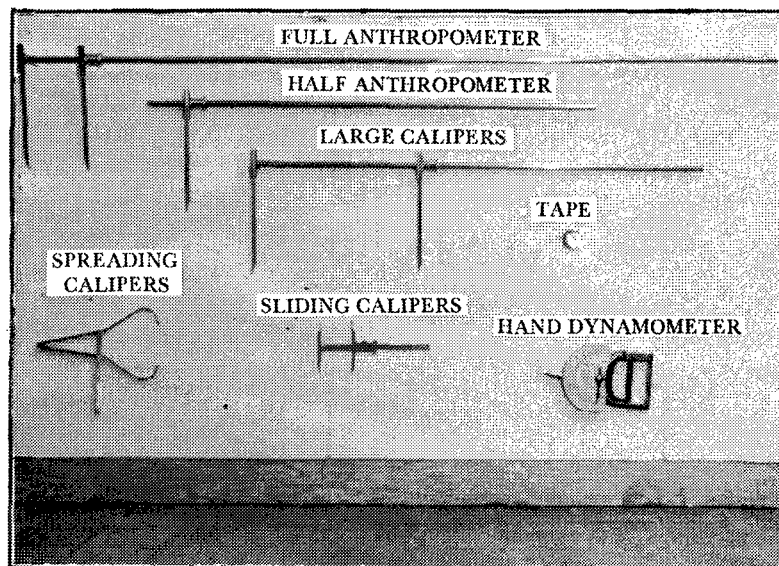


Figure 1. Anthropometry Instruments

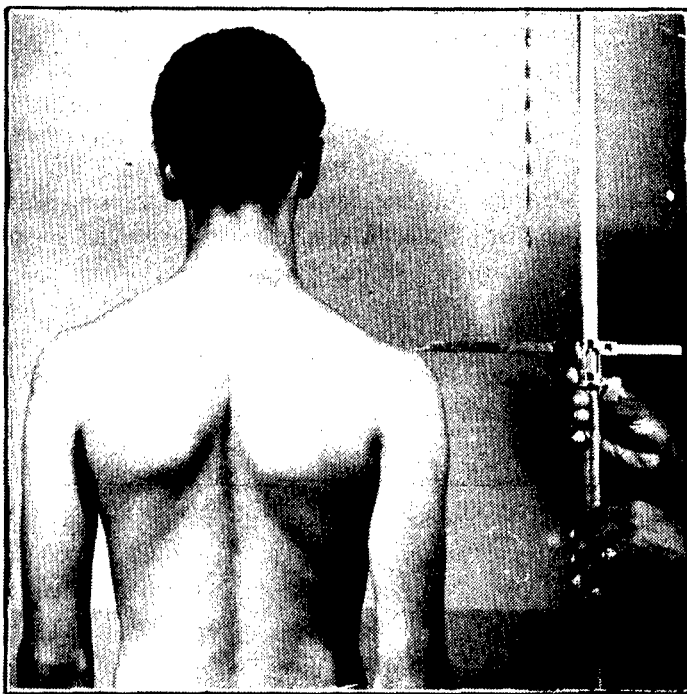


Figure 2. Standing Measurement, Shoulder Height

steel tape (figure 7). Spatial measures were made with an in-house-constructed measuring jig (figure 8). An adjustable hand dynamometer was used to measure hand strength (figure 9). Weight measurements were made with bathroom scales.

Body strength was measured using an isometric bar and an "Isotronic" evaluator (figure 10). 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 required. The two isometric measures chosen, the half-squat and the dead lift, require the simultaneous use of the large muscles

Anthropometers (a calibrated 2-meter stainless steel rod with a sliding caliper-type finger) were used for the larger standing measurements (figure 2).

The anthropometer may be modified into a half-anthropometer and/or large sliding calipers for those standing and sitting measurements that do not require the full anthropometer length (figure 3). The head, hand, and foot measurements were made with sliding and spreading calipers (figures 4, 5, and 6) and the surface and circumferential measurements were made using a 2-meter

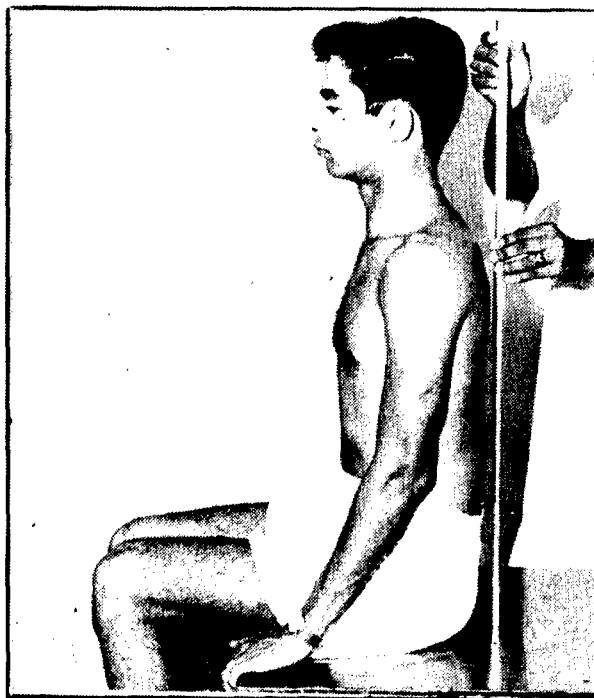


Figure 3. Sitting Measurement, Sitting Height

of the leg, back, and arm, and are considered a generalized measure of the static strength factor (reference 4). Unfortunately, no normative data are available for comparison with other populations. Hopefully, they will be forthcoming from other researchers.

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, and refresher sessions held as new team members were added. An anthropometry handbook was furnished to the team which contained sketches and photographs of each measurement procedure. 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.

A measurer and a recorder manned each of the two other stations. Seventy-five separate physical measurements were collected for each man measured (appendix B). The first 35 measures were made at one station and the remaining 40 at the other.

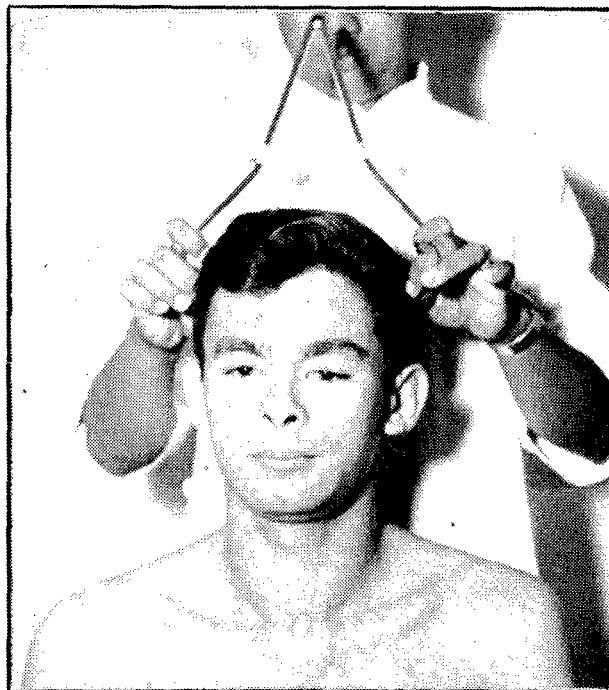


Figure 4. Head Measurement, Head Breadth

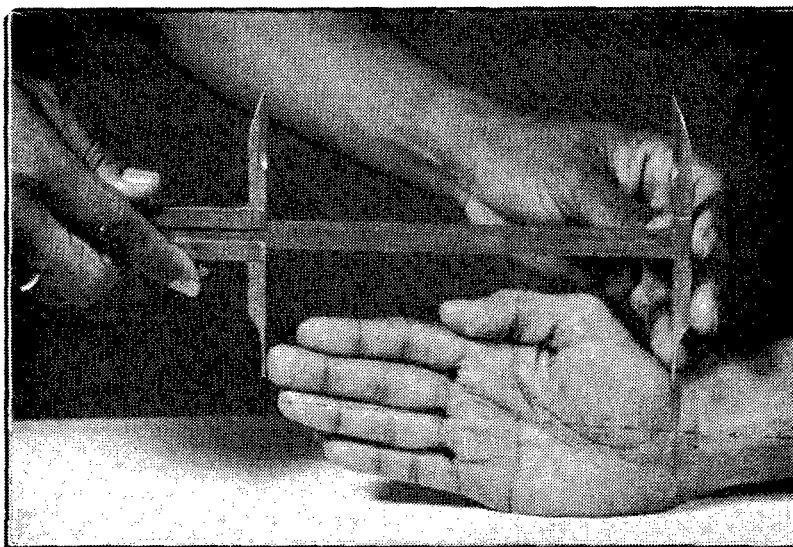


Figure 5. Hand Measurement, Hand Length



Figure 6. Foot Measurement, Heel Breadth

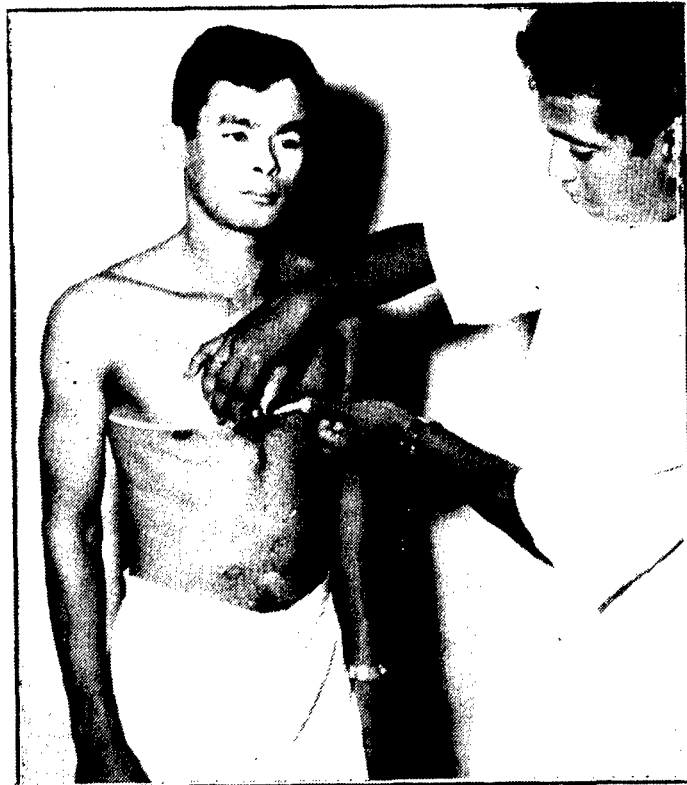


Figure 7. Circumference Measurement, Chest Circumference

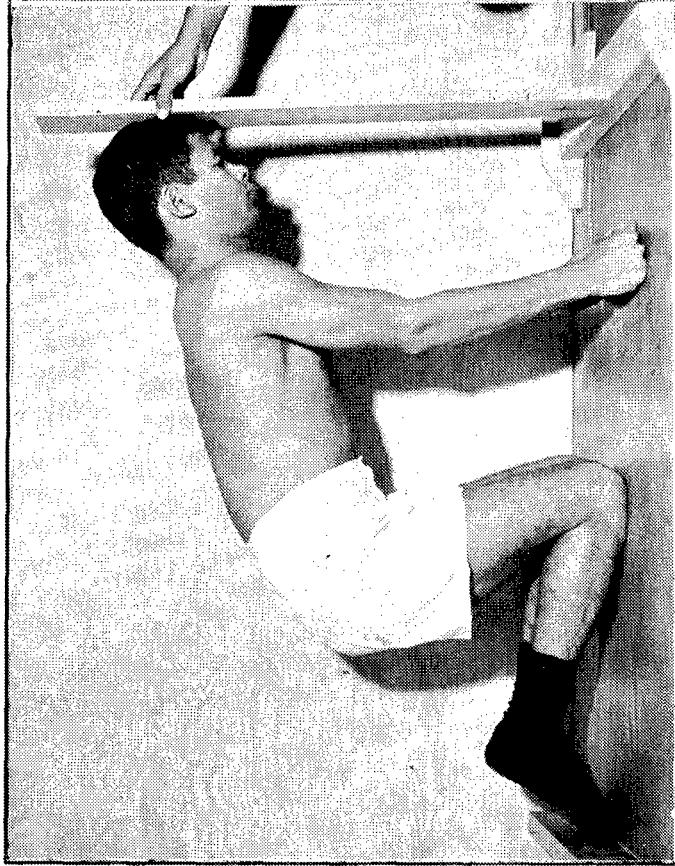


Figure 8. Spatial Measurement, Kneeling Length

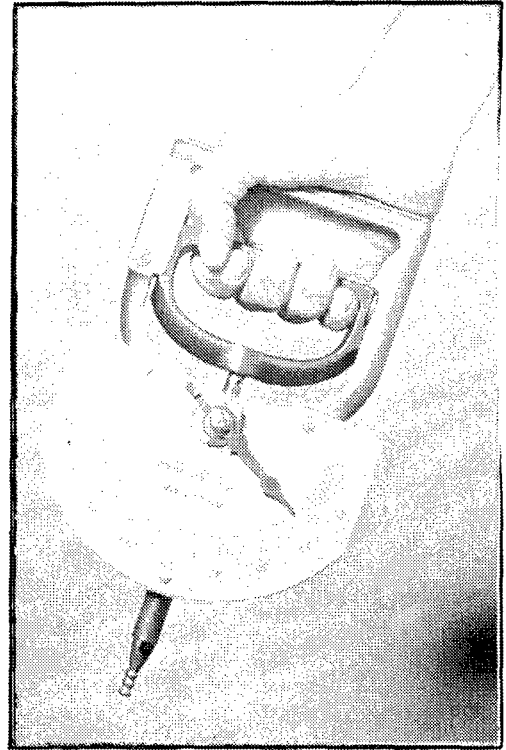
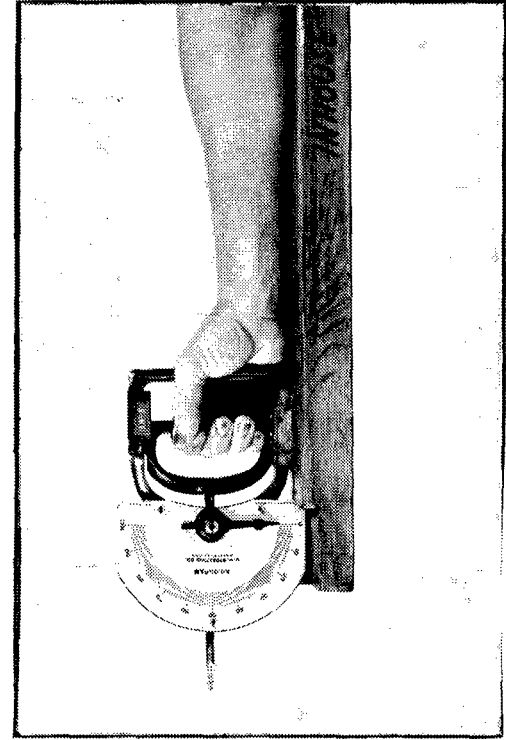
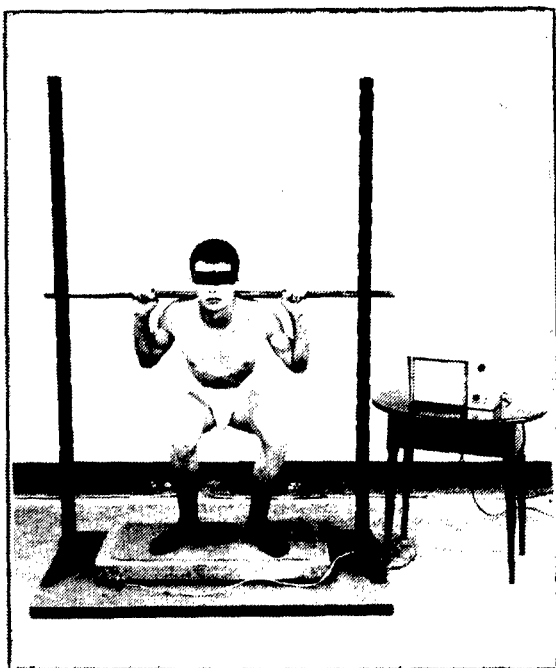
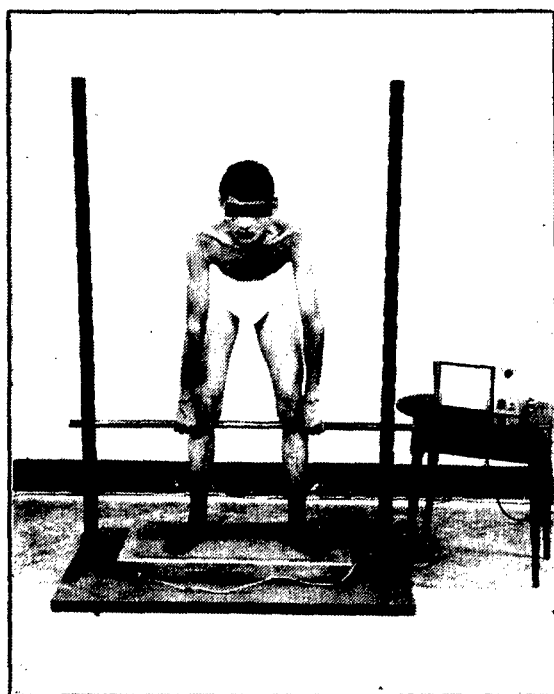


Figure 9. Strength Measurements, Right Hand Strength, Free (Left), Fixed (Right)





a. One-Half Squat



b. Dead Lift

Figure 10. Strength Measurements

RESULTS

The Inter-American Air Forces 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 US Army School of the Americas, located at Fort Gulick in the Canal Zone, offers a broad service school curriculum for the benefit of the Latin-American ground forces.

The country composition of the sample of the present study was thus entirely dependent on the input to the schools. In terms of their comparative populations, some countries are over-represented, some under-represented—others do not appear at all.

Distribution by Country.

Table I. NUMBER OF PEOPLE MEASURED BY COUNTRY OF LONGEST RESIDENCE

Country	N
Argentina	9
Bolivia	135
Brazil	94
Colombia	207
Costa Rica	8
Chile	411
Dominican Republic	84
Ecuador	210
El Salvador	47
Guatemala	62
Honduras	91
Mexico	8
Nicaragua	84
Panama	131
Paraguay	61
Peru	161
Uruguay	43
Venezuela	139
TOTAL	1985

Although 18 countries are represented, the imbalances are great. On subsequent tabulations, separate country data are shown only for those 15 countries with sufficient numbers; data for Argentina, Costa Rica, and Mexico are omitted from subsequent tables.

Composition of the Sample.

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

Table II. AGE IN YEARS

Country	Mean Age	Standard Deviation	N
Bolivia	26.0	5.8	135
Brazil	21.5	3.3	94
Colombia	19.7	1.5	207
Chile	18.9	2.6	411
Dominican Republic	26.3	5.3	84
Ecuador	25.6	5.5	210
El Salvador	24.1	6.3	47
Guatemala	22.9	4.7	62
Honduras	24.2	5.1	91
Nicaragua	22.5	7.5	84
Panama	27.7	6.2	131
Paraguay	24.3	5.4	61
Peru	21.7	3.5	161
Uruguay	23.6	3.4	43
Venezuela	26.9	7.5	139
TOTALS (weighted)	22.9	5.7	1960

NOTE: Range—Low 16 years; high 53 years.

Mean ages ranged from 18.9 years for the Chile samples to ²27.7 years for Panama. In general, age differences were dependent on the proportion of non-commissioned officers in the sample (table VIII). A Spearman rank-difference coefficient (ρ) computed between the mean age and percent NCOs was 0.78.

Table III. HEIGHT IN INCHES

Country	Mean Height	Standard Deviation	N
Bolivia	65.0	2.12	135
Brazil	66.9	2.39	94
Colombia	65.2	2.06	207
Chile	66.0	2.29	411
Dominican Republic	66.2	2.41	84
Ecuador	64.5	2.14	210
El Salvador	64.4	2.08	47
Guatemala	64.6	2.61	62
Honduras	65.1	2.17	91
Nicaragua	65.2	2.41	84
Panama	66.1	2.56	131
Paraguay	66.1	2.12	61
Peru	64.8	1.85	161
Uruguay	66.7	2.46	43
Venezuela	65.8	1.79	139
TOTALS (weighted)	65.5	2.19	1960

NOTE: Range—Low 58.5 inches; high 73.6 inches

Mean heights ranged from approximately 5 feet, 4 inches (El Salvador) to 5 feet, 7 inches (Brazil). However, samples from those countries with high Indian populations (Bolivia, Ecuador) were noticeably shorter than countries with high European or African influences (Uruguay, Chile, Paraguay, Panama, Brazil). There was some positive correlation between height and weight among the countries ($\rho = 0.68$).

Table IV. WEIGHT IN POUNDS

Country	Mean	Standard Deviation	N
Bolivia	138.7	16.8	135
Brazil	144.2	17.4	94
Colombia	135.6	13.2	207
Chile	139.5	15.6	411
Dominican Republic	143.0	23.8	84
Ecuador	136.1	14.6	210
El Salvador	138.7	23.4	47
Guatemala	139.5	24.2	62
Honduras	137.2	18.6	91
Nicaragua	139.6	23.0	84
Panama	145.1	21.0	131
Paraguay	148.1	18.3	61
Peru	140.1	12.9	161
Uruguay	149.1	20.6	43
Venezuela	150.0	17.8	139
TOTALS (weighted)	140.6	18.1	1960

NOTE: Range—Low 100 pounds; high 251 pounds

Mean weights ranged from a low of 135.6 pounds (Colombia) to a high of 150.0 pounds for Venezuela. Weight showed the same country pattern as stature, with differences between countries of strong Indian influences and countries of strong European and African influences.

Table V. YEARS OF SCHOOLING COMPLETED

Country	Mean Education	Range	Standard Deviation	N
Bolivia	10.8	6-16	1.8	135
Brazil	9.7	5-12	1.7	94
Colombia	9.4	5-14	1.5	207
Chile	10.4	0-15	1.4	411
Dominican Republic	8.1	2-12	1.6	84
Ecuador	9.5	4-16	2.2	210
El Salvador	8.6	5-13	1.9	47
Guatemala	7.4	6-13	1.7	62
Honduras	7.3	3-15	2.2	91
Nicaragua	7.7	3-19	1.9	84
Panama	9.2	2-16	2.6	131
Paraguay	10.3	4-18	2.3	61
Peru	10.0	7-15	1.1	161
Uruguay	9.1	5-12	1.6	43
Venezuela	7.8	3-14	1.5	139
TOTALS (weighted)	9.4	0-19	2.1	1960

The Honduras sample had the smallest amount of formal education (7.3 years) while Bolivia had the largest (10.8 years). These statistics may reflect the criteria for military selection to a Canal Zone school to a much greater extent than the level of general educational attainment in any given country.

Table VI. NUMBER OF DAYS IN THE CANAL ZONE AT TIME OF MEASUREMENT

Country	Mean	N
Bolivia	63.7	135
Brazil	58.2	94
Colombia	42.0	207
Chile	46.5	411
Dominican Republic	44.4	84
Ecuador	64.0	210
El Salvador	47.8	47
Guatemala	66.6	62
Honduras	62.1	91
Nicaragua	54.0	84
Panama	59.4	131
Paraguay	54.6	61
Peru	45.5	161
Uruguay	55.7	43
Venezuela	62.0	139
TOTALS (weighted)	53.6	1960

Table VI shows the mean number of months spent by samples 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. However, the bias, if it exists, is evenly spread among the country samples. The average participant had been in the Canal Zone for approximately 1.8 months at the time of measurement.

Table VII. LANGUAGES SPOKEN

Language	Number	Percent of Total
Spanish only	1652	83.4
Portuguese only	23	1.2
Spanish and English only	78	3.9
Spanish and Guarani only	53	2.7
Spanish and Quechua only	52	2.6
Portuguese and Spanish only	75	3.8
Two other languages	20	1.0
Three other languages	28	1.4
TOTALS	1981	100.0%

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, approximately 85 percent claimed fluency in only one language, 14 percent in two languages, and approximately 2½ percent in three or more languages. Table VII shows the distribution of the various combinations for the sample as a whole. Eighty-nine of the 98 Portuguese speakers were from Brazil. All of the 53 Guarani speakers were from Paraguay. Forty-four Quechua speakers were from Bolivia; 8 from Peru. Of the 78 English speakers, 28 were from Panama, 18 from Chile, 11 from Ecuador, with the remaining 18 widely scattered. In total, 15.4 percent of the sample was multilingual.

Table VIII. MILITARY GRADES

Country	Grade			Total
	NCO	EM	Other	
Bolivia	116	9	10	135
Brazil	45	49	-	94
Colombia	2	172	33	207
Chile	7	404	-	411
Dominican Republic	38	46	-	84
Ecuador	62	148	-	210
El Salvador	11	35	1	47
Guatemala	11	51	-	62
Honduras	26	65	-	91
Nicaragua	11	71	2	84
Panama	55	62	14	131
Paraguay	54	7	-	61
Peru	21	78	62	161
Uruguay	15	28	-	43
Venezuela	94	39	6	139
TOTALS	568	1264	128	1960
PERCENTAGES	30	64	6	100

Because of the diversity of enlisted grading systems among the various countries, table VIII distinguishes only between non-commissioned officers (NCOs), enlisted men and others. The "other" group includes officer trainees (cadets) and a few civilians. Only Bolivia, Paraguay, and Venezuela had heavy concentrations of NCOs in their samples.

Table IX. PERCENTILES AND RANGES FOR STANDING, SITTING, BODY CIRCUMFERENCE, SURFACE, HEAD, HAND, FOOT, SPATIAL, STRENGTH, AND WEIGHT MEASUREMENTS OF 1985 LATIN AMERICAN MILITARY PERSONNEL

(Inches Unless Otherwise Noted)

	Percentiles											Range	
	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th	Min.	Max.
STANDING MEASUREMENTS													
1. Stature	60.7	61.2	62.0	62.6	63.8	65.4	66.9	68.5	69.6	70.9	71.5	58.5	73.6
2. Shoulder Height	49.6	50.0	50.6	51.3	52.4	53.9	55.3	56.7	57.8	58.9	59.6	47.8	70.8
3. Waist Height	35.6	35.9	36.6	37.2	38.3	39.5	40.7	42.0	42.8	43.8	44.7	34.3	46.8
4. Crotch Height	26.4	26.8	27.5	28.1	28.9	29.9	31.1	32.1	32.8	33.8	34.2	22.9	36.6
5. Kneecap Height	17.3	17.5	17.9	18.3	18.9	19.6	20.2	21.0	21.4	22.1	22.5	16.2	32.4
6. Hip Breadth, Standing	11.2	11.3	11.5	11.7	12.1	12.5	13.0	13.3	13.7	14.1	14.4	9.1	15.5
7. Cervical Height	51.4	51.7	52.5	53.2	54.4	55.7	57.1	58.6	59.7	61.0	61.8	49.3	65.2
8. Calf Height	11.5	11.7	11.9	12.2	12.7	13.2	13.8	14.4	14.8	15.2	15.6	10.3	26.5
9. Chest Depth	7.5	7.6	7.9	8.1	8.4	8.9	9.3	9.7	10.0	10.5	10.8	4.9	13.6
10. Chest Breadth	10.1	10.3	10.6	10.9	11.3	11.8	12.4	13.0	13.5	14.1	14.4	8.4	16.7
11. Functional Arm Reach	26.3	26.7	27.3	27.9	29.0	30.2	31.4	32.7	33.5	34.5	35.1	23.1	36.4

SITTING MEASUREMENTS

12. Sitting Height	31.1	31.6	32.0	32.6	33.3	34.1	34.9	35.7	36.1	36.7	37.2	28.1	39.3
13. Eye Height, Sitting	23.7	25.4	27.0	27.7	28.5	29.4	30.3	31.1	31.5	32.1	32.4	16.6	33.6
14. Shoulder-Elbow Length	12.3	12.5	12.7	12.9	13.4	13.9	14.3	14.8	15.1	15.4	15.6	10.6	18.0
15. Forearm-Hand Length	16.1	16.3	16.6	16.9	17.4	17.9	18.5	19.0	19.4	20.0	20.4	13.4	30.2
16. Buttock-Knee Length	20.0	20.4	20.6	20.9	21.5	22.2	23.0	23.6	24.1	24.6	25.0	17.8	27.6
17. Buttock-Popliteal Length	15.9	16.1	16.5	16.8	17.3	18.0	18.6	19.2	19.6	20.1	20.3	15.4	22.0
18. Knee Height, Sitting	18.0	18.2	18.5	18.8	19.4	20.0	20.7	21.4	21.8	22.4	22.6	16.2	23.9
19. Popliteal Height, Sitting	14.1	14.4	14.7	15.0	15.5	16.1	16.6	17.2	17.6	18.0	18.2	13.1	19.4

	Percentiles										Range		
	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th	Min.	Max.
20. Shoulder Breadth	15.0	15.3	15.6	15.9	16.4	17.0	17.6	18.3	18.7	19.2	19.6	13.4	20.7
21. Hip-Breadth, Sitting	11.5	11.6	11.8	12.0	12.5	12.9	13.5	14.0	14.4	15.0	15.3	9.1	16.9
22. Arm Reach, Upward	47.4	48.1	48.7	49.4	50.6	51.9	53.2	54.5	55.3	56.3	56.9	45.9	60.0
23. Mid-shoulder Height, Sitting	20.7	21.1	21.6	22.0	22.6	23.4	24.1	24.9	25.5	27.7	29.4	19.8	31.7
24. Maximum Forearm— Forearm Breadth	14.2	14.5	15.0	15.4	15.9	16.8	17.7	18.6	19.3	20.1	20.8	11.3	23.9
BODY CIRCUMFERENCES													
25. Neck Circumference	12.3	12.6	12.9	13.1	13.5	14.0	14.4	15.0	15.4	15.8	16.2	10.7	19.0
26. Shoulder Circumference	37.9	38.3	39.1	39.7	40.9	42.3	44.0	45.6	46.8	48.2	49.2	35.5	55.3
27. Chest Circumference	31.4	31.9	32.7	33.4	34.4	35.7	37.2	39.0	39.8	41.7	42.7	27.1	48.5
28. Waist Circumference	26.0	26.5	27.0	27.6	28.7	30.0	31.7	33.9	35.6	37.6	38.7	24.0	46.5
29. Hip (Buttock) Circumference	31.6	32.0	32.7	33.3	34.4	35.6	36.9	38.3	39.3	40.5	41.4	28.5	72.9
30. Wrist Circumference	5.6	5.7	5.9	5.9	6.1	6.4	6.7	6.9	7.0	7.2	7.4	4.3	10.9
31. Crotch-Thigh Circum- ference (Upper Thigh)	17.2	18.0	18.5	18.9	19.8	20.8	21.7	22.8	23.5	24.4	25.2	13.0	28.9
32. Lower Thigh Circum- ference	12.8	13.1	13.5	14.0	15.0	16.3	17.7	18.6	19.2	19.7	20.2	8.2	22.2
33. Calf Circumference	11.3	11.8	12.2	12.5	13.0	13.6	14.2	14.8	15.2	15.7	16.1	6.5	17.8
34. Ankle Circumference	7.6	7.7	7.9	8.0	8.3	8.6	8.9	9.3	9.6	9.9	10.5	7.0	14.6
35. Arm Scye* Circum- ference	14.0	14.3	14.8	15.2	15.7	16.5	17.2	18.1	18.6	19.3	19.6	9.5	22.8
36. Biceps Circumference, Extended	8.6	8.9	9.2	9.4	9.9	10.4	11.0	11.7	12.0	12.7	13.2	5.2	16.9
37. Biceps Circumference, Flexed	9.8	10.0	10.4	10.6	11.1	11.7	12.3	13.0	13.4	14.0	14.5	8.0	17.3

*Armhole

38. Forearm Circumference, Flexed	8.7	9.0	9.4	9.6	10.0	10.5	11.0	11.5	11.8	12.2	12.8	6.3	14.4
39. Vertical Trunk Circumference	45.4	52.5	56.4	57.5	59.0	60.7	62.8	64.6	65.6	67.4	68.5	41.1	76.0

SURFACE MEASUREMENTS

40. Back-Waist Length	13.3	13.6	14.1	14.5	15.2	15.9	16.6	17.3	17.9	18.6	19.3	8.7	21.9
41. Interscye Breadth, Distance	12.1	12.4	13.0	13.6	14.3	15.0	15.8	16.5	16.9	17.5	17.9	11.0	19.5
42. Sleeve Inseam	15.9	16.2	16.6	16.9	17.6	18.3	19.0	19.7	20.1	20.7	21.3	13.0	30.9
43. Sleeve Length	28.2	29.1	29.9	30.5	31.5	32.4	33.5	34.4	35.2	35.8	36.6	21.7	42.0
44. Interscye Maximum	16.7	17.3	18.0	18.5	19.4	20.3	21.1	21.9	22.3	22.9	23.3	7.9	24.4
45. Shoulder Length	4.4	4.5	4.8	5.0	5.3	5.7	6.1	6.4	6.7	6.9	7.0	3.9	8.8

HEAD MEASUREMENTS

46. Head Length	6.7	6.8	6.9	7.0	7.2	7.3	7.5	7.7	7.8	7.9	8.0	4.4	8.3
47. Head Height	4.1	4.2	4.3	4.4	4.6	4.8	5.0	5.2	5.3	5.4	5.5	3.9	5.9
48. Face Length	4.1	4.2	4.3	4.4	4.5	4.7	4.8	5.0	5.1	5.2	5.4	3.9	6.7
49. Head Breadth	5.4	5.5	5.6	5.7	5.8	6.0	6.1	6.3	6.4	6.5	6.6	5.2	7.6
50. Head Circumference	20.2	20.5	20.7	20.9	21.3	21.7	22.0	22.4	22.7	22.9	23.1	5.6	23.6
51. Interpupillary Distance	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.7	1.7	2.9
52. Face Breadth	4.1	4.1	4.3	4.4	4.7	4.9	5.3	5.6	5.7	5.9	5.9	3.7	7.5
53. Bitragion Diameter	4.8	4.9	4.9	5.0	5.2	5.3	5.4	5.6	5.7	5.7	5.9	4.6	7.5

HAND MEASUREMENTS

54. Hand Length	6.4	6.5	6.6	6.7	6.9	7.1	7.4	7.6	7.8	7.9	8.0	4.3	9.1
55. Palm Length	3.6	3.6	3.7	3.8	3.9	4.1	4.2	4.4	4.4	4.6	4.6	3.3	7.7
56. Hand Breadth (Metacarpals)	3.0	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.7	2.5	3.9
57. Hand Circumference (Metacarpals)	7.2	7.3	7.5	7.6	7.9	8.2	8.5	8.8	9.0	9.3	9.5	4.3	16.1

Percentiles Range

	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th	Min.	Max.
--	-----	-----	-----	------	------	------	------	------	------	------	------	------	------

FOOT MEASUREMENTS

58. Foot Length	9.0	9.1	9.3	9.4	9.7	10.0	10.3	10.6	10.8	11.1	11.1	6.4	11.8
59. Instep Length (Ball of Foot)	5.8	6.5	6.8	7.0	7.2	7.5	7.7	8.0	8.1	8.3	8.4	4.2	11.7
60. Foot Breadth (Ball of Foot)	3.3	3.4	3.5	3.5	3.7	3.8	4.0	4.1	4.2	4.4	4.4	3.2	4.7
61. Ball of Foot Circumference	8.2	8.4	8.7	8.8	9.1	9.4	9.7	10.1	10.3	10.6	10.8	7.8	17.6
62. Heel Breadth	2.3	2.3	2.4	2.4	2.5	2.6	2.8	2.8	2.9	3.0	3.1	2.1	3.3
63. Heel-Ankle Circumference	11.6	11.8	12.0	12.2	12.6	13.0	13.4	13.8	14.1	14.3	14.4	8.1	17.5
64. Instep Circumference	8.7	8.8	9.0	9.2	9.4	9.8	10.2	10.6	10.8	11.1	11.4	7.9	14.4

SPATIAL MEASUREMENTS

65. Kneeling Height	27.5	27.8	28.6	29.3	30.3	31.5	32.7	33.7	34.5	35.3	35.7	25.4	37.8
66. Kneeling Length	39.9	40.5	41.3	42.5	44.2	46.1	48.2	50.3	51.6	53.4	54.8	35.0	80.9
67. Crawling Height	25.5	26.0	26.6	27.2	28.2	29.4	30.6	31.7	32.5	33.1	33.8	23.5	48.3
68. Crawling Length	42.5	43.7	44.8	45.9	47.6	49.4	51.4	53.0	54.2	55.9	56.8	28.0	64.2
69. Prone Height	10.0	10.3	10.7	11.1	11.9	12.7	13.5	13.9	14.3	14.8	15.2	4.6	20.9
70. Prone Length	77.4	78.6	79.5	81.0	83.0	85.1	87.4	89.6	91.3	93.3	94.5	45.4	109.2

STRENGTH MEASUREMENTS

71. Left Hand Grip (lbs)*	50.6	55.0	61.6	66.0	72.6	81.4	92.4	101.2	107.8	116.6	121.0	35.2	140.8
72. Right Hand Grip (lbs)*	58.5	61.6	66.0	70.4	79.2	88.0	99.0	110.0	116.6	123.2	129.8	41.8	162.8
73. One-Half Squat (lbs)	90.0	100.0	110.0	120.0	150.0	180.0	210.0	250.0	280.0	300.0	320.0	45.0	380.0
74. Dead Lift (lbs)	149.1	160.0	180.0	200.0	220.0	250.0	280.0	310.0	320.0	340.0	360.0	110.0	410.0
75. Weight (lbs)	108.0	111.0	115.0	120.0	129.0	139.0	150.0	164.6	174.8	187.0	196.1	100.0	251.0

*Free-Grip Dynamometer

DICHOTOMIZED OBSERVATIONS

Glasses Worn	Yes (7%)	No (93%) (N=1984)	
Handedness	Left (3%)	Right (94%)	Ambidextrous (3%) (N=1985)
Length of Toe	First Toe Longer (78%)	Second Toe Longer (22%) (N=1985)	

Anthropometric Measurements.

Table IX shows percentiles and ranges for the 75 measurements for the entire sample of 1985 subjects combined. The unit of measurement is the inch unless otherwise specified. (Appendix I shows identical data with centimeters as the unit of measurement.)

The 50th percentile is the median, or central tendency, and is one type of "average." The 5th and 95th percentiles represent the values within which 90 percent of a standard population lie, thus these two points often define the practical physical "envelope" of most interest to the equipment or clothing designer.

Results of a few of the key body measurements:

(1) The 50th percentile Latin American was 5 feet, 5.4 inches tall. Ninety percent of all Latin Americans were between 5 feet, 2.0 inches and 5 feet, 9.6 inches tall.

(2) The 50th percentile Latin American had a neck circumference (collar size) of 14 inches. Ninety percent of the sample were between 12.9 inches and 15.4 inches.

(3) The 50th percentile Latin American had a chest circumference (unexpanded) of 35.7 inches. Ninety percent were between 32.7 inches and 39.8 inches.

(4) The 50th percentile Latin American had a waist size of 30.0 inches. Ninety percent were between 27.0 inches and 35.6 inches.

(5) The 50th percentile Latin American had a sleeve length of 32.4 inches. Ninety percent were between 29.9 inches and 35.2 inches.

(6) The 50th percentile Latin American had a crotch height (deduct approximately 3 inches for trouser inseam size) of 29.9 inches. Ninety percent were between 27.5 inches and 32.8 inches.

(7) The 50th percentile Latin American weighed 139 pounds. Ninety percent weighed between 115 and 175 pounds.

Country-by-country comparisons of 1st, 50th, and 99th percentile values appear in appendices C through H. Perusal of these tables will show variations among some countries. Referring to the 50th percentile measurements only, appendix D or G will show that Uruguay, for example, had 66 of the 75 (88 percent) anthropometric measures above the grand median for the entire sample. Other "large" countries and their corresponding percentages above the grand median are Paraguay (83 percent); Venezuela (81 percent); Panama (77 percent); and Brazil (69 percent). "Smaller" countries included Colombia with 61 of the 75 measures (81 percent) below the grand median as well as Ecuador, (75 percent); Honduras (73 percent); and Guatemala (72 percent). Countries not named in the preceding sentences were intermediate between the extreme groups. Extreme caution should be used in drawing conclusions from these comparisons. The

differences may be caused by true physical differences among countries, different military selection criteria among countries, or statistical sampling errors. Unfortunately, the differences cannot be explained from the data at hand.

Strength Measurements.

The 50th percentile Latin American hefted 180 pounds on the half-squat, which was 29.5 percent greater than average body weight; he lifted 250 pounds on the dead lift which was 80 percent higher than average body weight. These measurements represent short duration maxima. As stated previously, there are no normative data available on other populations.

In terms of hand-grip scores the Latin Americans were in the same general range as United States groups. Fixed-grip¹ scores for Latin Americans averaged 99 pounds for the left hand and 104 pounds for the right hand; US Air Force personnel gripped 94 pounds for the left and 104 pounds for the right (7); US college students gripped 95 pounds for the left and 108 pounds for the right (7); ROTC students gripped 95 pounds for the right hand (5).

Comparison with Thai and US Personnel.

Table X shows selected 50th percentile measurements for Thai military personnel, Latin-American military, and US Army aviators.

As a general rule, the Latins were larger than the Thai and smaller than United States 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 eight 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 exceeded the US personnel only in face length and was approximately equal in head breadth and ball of foot circumference.

A Note on Sampling.

Sample size is a continuing problem in anthropometric surveys. Knowing when to quit measuring is difficult, particularly when measuring from possibly heterogeneous subpopulations, as in the present survey. In table XI, the results of the first 733 measurements from the interim report¹ are compared with the final 1985 measures. For all practical purposes, the survey could have ceased after the first 700 data cases. The mean net percent change from interim to final measurement was only 0.33 percent at the

¹In the USATTC interim report of May 1967 (15), only free-grip scores were shown, however, it was then postulated that fixed-grip scores would be higher. Subsequently, both scores were taken. Comparison of a randomly drawn sample of 300 data cases confirmed the hypothesis. Fixed versus free means for right hand were 104 versus 99 pounds respectively; for the left hand, 99 versus 81 pounds respectively. With an N of 300, t-tests for correlated means showed that the fixed mode was significantly higher than the free mode for either hand ($P < .001$). The reader is cautioned that all hand-grip data shown in table IX and all appendices are free-grip only.

50th percentile, 1.63 percent at the 1st percentile and 0.55 percent at the 99th percentile. The average change in inches between the two samples was only 0.07 inch at the 50th percentile, 0.30 inch at the first percentile, and 0.13 inch at the 99th percentile.

Blood Groups.

Geneticists use blood groupings to make inferences about the racial composition of populations. For example, the frequency of the "A" group is high in Europeans while the "O" predominates for North and South American Indian groups. Table XII shows the country by country distributions of 1790 blood types taken from medical records. Bolivia, Ecuador, El Salvador, Nicaragua, Peru, and Panama show distributions more similar to those of Chippewa Indians than Europeans. On the other hand Chile, Colombia, Dominican Republic, Guatemala, and Honduras more nearly approximate European (particularly Scottish) distributions.

Table X. COMPARISON OF SELECTED 50TH PERCENTILE MEASUREMENTS
 BETWEEN LATIN-AMERICAN MILITARY PERSONNEL, ROYAL THAI ARMED
 FORCES, AND US MILITARY PERSONNEL
 (Inches Unless Otherwise Noted)

MEASUREMENTS	Thai Military Personnel (2950)*	Latin American Military Personnel (1985)	US Army Aviators** (1482)
Stature	64.4	65.4	68.7
Weight (lbs)	124.0	139.0	170.5
Waist Height	39.0	39.5	41.8
Crotch Height	29.7	29.9	32.2
Kneecap Height	19.7	19.6	20.1
Sitting Height	34.1	34.1	35.8
Eye Height, Sitting	29.5	29.4	35.8
Shoulder-Elbow Length	13.8	13.9	14.4
Forearm-Hand Length	18.1	17.9	18.9
Buttock-Knee Length	21.3	22.2	23.7
Shoulder Breadth	16.3	17.0	18.7
Hip Breadth, Sitting	12.4	12.9	14.8
Arm Reach, Upward	51.8	51.9	56.5
Neck Circumference	13.3	14.0	14.8
Shoulder Circumference	40.9	42.3	45.8
Chest Circumference	33.5	35.7	38.7
Waist Circumference	27.2	30.0	34.2
Back-Waist Length	16.9	15.9	18.4
Sleeve Length	30.7	32.4	34.9
Head Length	7.0	7.3	7.8
Head Height	5.0	4.8	5.2
Face Length	4.5	4.7	4.4
Head Breadth	6.0	6.0	6.0
Head Circumference	21.3	21.7	22.2
Face Breadth	5.2	4.9	5.5
Hand Length	7.1	7.1	7.6
Hand Breadth (Metacarpals)	3.3	3.3	3.5
Foot Length	9.7	10.0	10.4
Foot Breadth (Ball of Foot)	3.9	3.8	3.9
Ball of Foot Circumference	9.7	9.4	9.6

*Reference 12

**Reference 11

Table XI. COMPARISON OF SELECTED PERCENTILE POINTS BETWEEN INTERIM REPORT DATA AND FINAL REPORT DATA

MEASUREMENTS (inches)	1st Percentile		50th Percentile		99th Percentile	
	N=733	N=1985	N=733	N=1985	N=733	N=1985
Stature	60.5	60.7	65.3	65.4	71.5	71.5
Waist Height	35.1	35.6	39.1	39.5	44.4	44.7
Crotch Height	26.6	26.4	30.2	29.9	34.5	34.2
Kneecap Height	17.1	17.3	19.4	19.6	22.0	22.5
Sitting Height	30.9	31.1	34.2	34.1	37.2	37.2
Eye Height, Sitting	23.2	23.7	29.4	29.4	32.4	32.4
Shoulder-Elbow Length	12.2	12.3	13.7	13.9	15.3	15.6
Forearm-Hand Length	15.9	16.1	17.8	17.9	20.2	20.4
Buttock-Knee Length	20.0	20.0	22.1	22.2	24.6	25.0
Shoulder Breadth	15.1	15.0	17.0	17.0	19.3	19.6
Hip Breadth, Sitting	11.4	11.5	12.9	12.9	15.1	15.3
Arm Reach, Upward	47.1	47.4	51.8	51.9	56.7	56.9
Neck Circumference	11.9	12.3	14.0	14.0	17.0	16.2
Shoulder Circumference	37.8	37.9	41.9	42.3	48.2	49.2
Chest Circumference	31.4	31.4	35.7	35.7	42.1	42.7
Waist Circumference	26.1	26.0	29.8	30.0	38.1	38.7
Back-Waist Length	13.3	13.3	15.9	15.9	19.6	19.3
Sleeve Length	23.6	28.2	32.2	32.4	36.0	36.6
Head Length	6.3	6.7	7.3	7.3	7.9	8.0
Head Height	4.0	4.1	4.8	4.8	5.6	5.5
Face Length	4.0	4.1	4.7	4.7	5.6	5.4
Head Breadth	5.3	5.4	5.9	6.0	6.6	6.6
Head Circumference	19.9	20.2	21.6	21.7	23.1	23.1
Face Breadth	4.2	4.1	4.8	4.9	5.5	5.9
Hand Length	6.3	6.4	7.1	7.1	8.0	8.0
Hand Breadth (Metacarpals)	3.0	3.0	3.3	3.3	3.8	3.7
Foot Length	9.0	9.0	9.9	10.0	11.1	11.1
Foot Breadth (Ball of Foot)	3.3	3.3	3.8	3.8	4.4	4.4
Ball of Foot Circumference	8.1	8.2	9.4	9.4	10.9	10.8

Table XII. PERCENTAGES OF ABO BLOOD GROUPS
FOR LATIN-AMERICAN COUNTRIES

Country	Phenotypes				N
	A	AB	B	O	
Bolivia	13.4	0.0	11.9	74.6	67
Ecuador	15.6	0.0	8.9	75.6	45
El Salvador	25.5	0.0	3.9	70.6	51
Nicaragua	17.2	2.6	5.2	75.0	116
Peru	18.3	1.8	8.3	71.6	169
Panama	14.6	2.1	9.4	74.0	96
Guatemala	33.7	1.1	11.2	53.9	89
Honduras	31.2	5.2	5.2	58.4	77
Venezuela	26.5	1.3	10.8	61.4	223
Paraguay	38.3	0.0	4.3	57.4	47
Chile	32.0	2.3	7.8	57.9	347
Colombia	35.8	3.4	7.2	53.6	293
Dominican Republic	27.8	3.7	15.7	52.8	108
Other	25.8	1.6	6.5	66.1	62
TOTALS	27.2	2.2	8.5	62.1	1790
Chippewa Indians*					
a. (Full-blooded)	12.4	0.0	0.0	87.6	161
b. (Three-fourths)	32.5	1.0	4.4	62.1	206
Scottish*	34.2	2.7	11.8	51.2	2610
French*	47.1	3.3	8.0	41.6	10433
Serbians*	41.9	7.3	18.2	32.5	Unk
Ethiopians*	32.7	7.7	21.1	38.5	104
Minnesota Whites*	46.0	2.7	11.7	40.0	300

*Reference 14, pp. 339-343

APPENDIX A

A BRIEF ETHNIC HISTORY OF LATIN AMERICA

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 Asians including tan-to-brown skins, straight black hair, scanty beards, broad faces, 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 5 feet tall, while their Patagonian neighbors to the north average nearly 6 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 Portuguese 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 Portuguese 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 Nations' study, Latin America was divided into the following three different social and cultural zones (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 traditions.

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—descendants 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 annihilated 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 a lesser extent, from India. Importation of Negro slaves into Brazil began 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 number was 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 German and English minority groups were rapidly assimilating. Brazil was well on its way to becoming a multiracial nation even though the Portuguese element still predominated.

During the 20th century, immigration continued to all regions of Latin America. Large numbers of Scandinavians, Dutch, Syrians, Yugoslavians, and various other Europeans continue to flow in.

NOTE: Acknowledgement is due to Ricardo Ah Chu and M. Gast, former USATTC staff scientists, for assistance in translation and compilation.

APPENDIX B

DESCRIPTION OF MEASUREMENTS

STANDING MEASUREMENTS

[The subject is standing, body erect, head oriented in Frankford Plane (measurements 1 through 10).]

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, Standing:** 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 horizontal distance 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 on 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:** (Position the same as No. 18.) The vertical distance from the footrest surface to the underside of the right knee (popliteal area).

20. **Shoulder Breadth:** (Bilateral 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, Upward:** 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 "Adam's 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. **Crotch-Thigh Circumference (Upper Thigh):** 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 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:** The 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:** The 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:** The maximum horizontal breadth of the face across the most laterally projecting bones of the cheek (zygomatic arches).

53. **Bitracion 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 stands with weight equally distributed on both feet.) The maximum circumference of the foot is measured around the distal ends of the protuberances 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

NOTE: 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:** The distance from the most rearward point on the foot to the most forward point on the head.

NOTE: 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:** The distance from the most rearward point on the foot to the most forward point on the head.

NOTE: 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:** The maximum strength reading is recorded from the dial.

72. **Right Hand Grip:** 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 10 seconds. The maximum deflection in pounds of the meter needle is recorded.

74. **Dead Lift:** The subject stands on the platform of the isotronic evaluator and the bar is set to a height about 2 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 10 seconds. The maximum deflection of the meter needle is recorded.

75. **Weight:** Each subject is weighed to the nearest pound.

DICHOTOMIZED OBSERVATIONS

Eyeglasses: Each subject is questioned as to whether he wears prescription eyeglasses (important in equipment design).

Handedness: Each subject is questioned as to whether he is right-handed, left-handed, or ambidextrous (important in equipment design).

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

APPENDIX C

COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY

(Comparison of 1st Percentile in Inches)

	Bolivia	Brazil	Colombia	Chile	Dominican Republic	El Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela	
1. Stature	60.8	62.0	61.7	61.7	61.7	60.0	60.9	59.8	61.2	60.3	60.4	61.9	61.1	60.8	62.1
2. Shoulder Height	49.9	49.9	49.9	49.9	50.7	49.1	49.6	49.9	50.1	49.6	49.9	50.9	49.9	49.8	50.9
3. Waist Height	36.0	36.1	35.9	36.1	36.9	34.6	35.0	35.1	36.5	35.3	36.5	35.3	35.8	36.4	36.8
4. Crotch Height	26.5	27.4	26.9	26.6	27.6	26.2	26.5	24.3	27.1	27.3	26.4	25.7	26.4	27.4	27.2
5. Kneecap Height	17.5	17.7	17.4	17.4	17.6	16.9	17.2	17.1	17.5	17.4	17.9	17.7	17.6	17.8	17.9
6. Hip Breadth, Standing	11.4	11.5	11.2	11.3	10.8	11.4	11.6	11.4	10.9	10.9	11.2	11.7	11.6	11.7	11.5
7. Cervical Height	51.5	52.9	51.1	52.1	52.5	50.9	51.5	50.8	51.7	51.6	51.7	52.2	51.4	51.4	52.1
8. Calf Height	11.7	11.5	11.5	11.6	11.9	11.2	11.8	11.3	12.0	11.8	11.8	11.4	11.5	11.7	12.0
9. Chest Depth	7.8	7.5	7.6	7.6	7.2	7.6	7.2	7.8	7.5	7.4	7.3	7.6	7.7	7.8	7.7
10. Chest Breadth	10.5	10.1	9.8	10.2	10.0	10.2	10.5	9.4	9.9	10.0	10.4	11.0	10.5	10.6	10.4
11. Functional Arm Reach (from Wall)	26.6	26.5	26.6	26.1	27.8	25.9	26.7	24.8	26.3	26.5	27.9	28.5	26.1	27.7	27.4
12. Sitting Height	31.2	32.0	31.3	31.7	31.1	30.8	31.3	31.5	31.1	30.9	30.8	32.0	31.5	32.0	32.1
13. Eye Height, Sitting	24.4	23.0	24.7	23.7	24.1	23.3	26.5	26.5	24.1	25.6	24.4	26.5	24.3	27.5	27.6
14. Shoulder-Elbow Length	12.4	12.2	12.3	12.4	12.4	12.3	12.5	12.3	12.3	12.5	12.5	12.8	12.5	13.1	12.7
15. Forearm-Hand Length	16.2	16.5	16.4	16.3	17.0	15.7	16.2	16.2	16.3	16.8	16.5	16.5	16.3	17.0	16.7
16. Buttock-Knee Length	19.9	20.6	20.4	20.2	19.9	20.1	19.9	20.1	20.2	19.9	20.1	20.5	20.3	20.4	20.5
17. Buttock-Popliteal Length	15.8	16.8	16.1	16.2	16.4	16.0	15.7	16.0	16.0	15.9	16.1	16.1	15.8	16.3	16.3
18. Knee Height, Sitting	17.6	17.9	18.1	18.2	18.7	17.4	18.0	18.0	17.6	18.5	18.4	18.2	18.3	18.6	18.7
19. Popliteal Height, Sitting	14.1	14.8	13.5	14.6	14.6	13.8	14.4	14.0	13.7	14.8	14.9	14.6	14.6	14.6	14.7
20. Shoulder Breadth	15.1	15.3	14.8	15.0	14.9	15.2	15.5	15.1	14.9	15.2	15.4	15.9	15.6	15.5	15.6
21. Hip Breadth, Sitting	11.6	11.3	11.4	11.5	11.4	11.5	11.7	11.8	11.4	11.2	11.6	12.0	11.9	12.0	11.7
22. Arm Reach, Upward	47.0	48.4	48.3	47.7	49.2	46.9	47.0	46.6	47.9	47.1	48.3	47.1	48.2	48.0	49.1
23. Mid-shoulder Height, Sitting	21.3	20.6	20.6	21.1	20.3	20.8	20.5	21.1	21.1	20.7	21.0	21.6	21.2	21.0	21.2
24. Maximum Forearm-Forearm Breadth	15.0	14.2	14.3	13.7	14.6	14.3	14.6	14.6	14.2	14.4	14.4	15.7	15.0	14.5	14.8
25. Neck Circumference	12.7	12.5	12.4	12.0	12.2	12.7	12.4	12.7	12.5	12.1	12.4	12.9	12.8	13.1	13.0
26. Shoulder Circumference	38.5	38.2	38.0	37.0	38.0	37.9	37.8	38.7	37.4	38.1	38.5	39.1	37.5	38.6	39.0
27. Chest Circumference	33.2	32.0	32.1	31.5	30.4	32.0	30.8	32.2	32.1	30.7	30.4	32.9	31.7	32.5	32.8
28. Waist Circumference	26.5	26.8	26.8	25.6	26.1	26.4	24.9	26.4	26.2	25.7	25.7	27.4	26.8	25.7	27.2
29. Hip (Buttock) Circumference	31.0	32.2	32.2	31.8	31.3	31.7	30.8	32.6	31.8	31.4	31.3	32.9	32.2	32.3	32.9
30. Wrist Circumference	5.6	5.7	5.6	5.5	5.7	5.7	5.5	5.6	5.7	5.6	5.7	5.9	5.7	5.8	5.8
31. Crotch-Thigh Circumference (Upper)	17.3	18.1	17.6	16.8	16.6	17.7	16.7	17.8	18.1	17.3	17.7	18.8	18.2	18.2	17.7
32. Lower Thigh Circumference	13.0	13.5	13.0	13.0	12.4	13.2	11.8	12.6	13.2	12.4	13.0	13.1	13.1	12.9	13.0
33. Calf Circumference	11.8	11.6	10.1	10.5	11.8	10.8	9.8	11.7	11.2	11.6	12.1	10.8	12.4	12.2	12.0
34. Ankle Circumference	7.5	7.6	7.7	7.6	7.4	7.7	7.5	7.5	7.7	7.8	7.5	7.9	7.7	7.7	7.6
35. Arm Scye Circumference	14.2	14.4	14.2	13.6	14.4	13.8	14.4	14.6	13.9	13.6	14.0	15.0	14.4	15.2	14.6

El
Dominican Republic

Bolivia Brazil Colombia Chile Ecuador Salvador Guatemala Honduras Nicaragua Panama Paraguay Peru Uruguay Venezuela

36. Biceps Circumference, Extended
37. Biceps Circumference, Flexed
38. Forearm Circumference, Flexed
39. Vertical Trunk Circumference
40. Back-Waist Length

41. Interscye Breadth, Distance

42. Sleeve Inseam

43. Sleeve Length

44. Interscye Maximum

45. Shoulder Length

46. Head Length

47. Head Height

48. Face Length

49. Head Breadth

50. Head Circumference

51. Interpapillary Distance

52. Face Breadth (Bisymphomatic)

53. Bitracion Diameter

54. Hand Length

55. Palm Length

56. Hand Breadth (Metacarpals)

57. Hand Circumference (Metacarpals)

58. Foot Length

59. Instep Length (Ball of Foot)

60. Foot Breadth (Ball of Foot)

61. Ball of Foot Circumference

62. Heel Breadth

63. Heel-Ankle Circumference

64. Instep Circumference

65. Kneeling Height

66. Kneeling Length

67. Crawling Height

68. Crawling Length

69. Prone Height

70. Prone Length

71. Left Hand Grip (lbs)*

72. Right Hand Grip (lbs)*

73. One-half Squat (lbs)

74. Dead Lift (lbs)

75. Weight (lbs)

*Free-Grip Dynamometer

8.4	8.9	8.8	8.1	8.4	9.0	8.5	9.2	8.6	8.7	8.9	9.1	8.8	8.8	9.1
10.0	10.3	10.0	8.7	9.7	10.1	9.5	10.3	10.3	9.8	10.0	10.1	9.8	9.9	10.2
9.0	9.0	8.7	8.1	8.8	9.1	9.0	9.4	9.0	8.8	9.0	9.0	8.5	9.6	9.1
55.5	56.7	44.8	45.3	55.4	45.4	49.9	55.0	52.9	54.2	48.5	57.0	56.0	54.9	55.6
13.7	13.5	13.3	13.3	12.9	13.1	14.3	13.6	13.4	13.3	14.1	13.9	14.0	13.9	13.8
13.2	12.6	12.1	12.1	12.2	13.2	12.9	12.1	11.9	12.4	11.6	12.8	12.6	13.1	13.4
15.9	16.4	15.9	15.9	16.6	15.6	16.1	15.6	16.1	16.4	16.5	15.3	16.1	17.5	16.6
28.1	30.0	23.4	23.7	29.4	28.7	29.9	28.5	28.7	28.1	29.4	29.5	29.7	30.3	29.9
18.5	17.3	17.3	16.1	17.0	18.0	17.8	16.9	16.3	17.0	15.8	17.2	16.6	17.4	17.6
4.4	4.8	4.1	4.4	4.7	4.3	4.7	5.0	4.1	4.5	4.4	4.5	4.9	4.6	4.8
6.9	6.7	6.4	6.6	6.6	6.7	6.9	6.5	6.6	6.6	6.8	6.9	6.7	7.1	7.0
3.9	4.2	4.1	4.1	4.2	4.1	4.4	4.3	4.0	4.2	4.2	4.3	4.2	4.2	4.2
4.3	4.2	4.1	4.1	4.2	4.3	4.1	4.1	4.2	4.2	4.0	4.3	4.2	4.4	4.2
5.4	5.5	5.4	5.4	5.4	5.4	5.6	5.5	5.4	5.4	5.5	5.7	5.6	5.3	5.5
20.5	20.8	19.8	19.9	20.5	20.2	20.5	20.6	20.3	20.4	20.4	20.3	20.5	21.0	21.1
2.0	2.0	2.1	2.1	2.1	2.0	2.1	2.1	2.2	2.1	2.2	2.2	2.1	2.1	2.1
4.2	4.1	4.0	4.1	4.3	4.0	4.1	4.2	4.1	4.3	4.0	4.6	4.4	4.2	4.1
4.9	4.7	4.8	4.8	4.8	4.8	4.8	4.9	4.9	4.9	4.9	5.0	4.9	5.0	4.9
6.5	6.3	6.3	6.3	6.4	6.3	6.4	6.4	6.6	6.5	6.5	6.7	6.4	6.6	6.6
3.6	3.7	3.6	3.6	3.6	3.5	3.5	3.6	3.7	3.7	3.6	3.8	3.7	3.9	3.7
3.0	3.0	3.0	3.0	3.1	3.0	2.9	2.9	2.8	2.8	3.0	3.0	3.0	3.1	3.0
7.3	7.1	7.3	7.2	7.5	7.3	5.6	7.4	7.3	7.2	7.4	7.4	7.2	7.2	7.6
9.0	9.1	9.1	8.9	9.0	8.9	9.0	8.9	9.1	9.1	9.2	9.3	9.1	9.1	9.2
4.9	6.6	6.7	5.7	6.8	5.8	6.6	6.8	5.1	6.6	5.9	5.7	6.9	6.7	6.8
3.4	3.5	3.3	3.3	3.4	3.2	3.4	3.3	3.3	3.3	3.4	3.5	3.4	3.5	3.4
8.6	8.8	8.2	8.1	8.6	8.2	8.1	8.2	8.3	8.5	8.4	8.7	8.6	8.7	8.7
2.3	2.3	2.3	2.3	2.4	2.3	2.2	2.2	2.3	2.3	2.3	2.3	2.3	2.4	2.4
11.8	12.0	11.6	9.6	11.4	9.5	11.7	11.8	9.3	11.9	11.9	10.7	12.1	12.0	11.7
8.9	8.9	8.6	8.1	8.9	8.7	8.4	8.9	8.8	8.7	8.7	9.2	8.8	9.0	8.9
28.3	27.3	27.5	27.3	27.7	27.3	27.9	28.0	27.5	26.6	28.4	28.8	27.9	28.0	28.1
40.2	40.6	39.8	40.3	41.7	39.7	39.8	39.7	40.6	39.0	40.9	40.6	40.8	39.5	40.6
26.2	26.1	24.8	25.4	27.1	25.4	26.9	25.7	25.2	26.1	25.0	27.0	26.7	26.4	26.4
40.7	41.5	42.8	43.7	45.3	43.4	34.1	43.2	41.7	41.4	44.1	45.0	44.3	45.1	43.8
10.2	10.5	9.7	10.0	9.6	10.0	10.7	6.8	10.4	10.7	9.9	9.7	10.4	11.0	10.6
76.2	49.6	73.3	78.9	81.8	75.6	78.4	77.0	78.0	78.6	78.6	79.5	79.0	80.6	79.8
46.9	65.8	52.8	55.0	62.5	52.8	55.9	47.5	48.2	43.1	55.0	51.7	50.8	65.6	52.8
59.4	66.0	59.4	59.4	59.0	66.0	58.1	62.0	52.8	59.0	51.5	49.5	61.6	69.1	61.8
86.5	100.0	89.6	90.0	96.2	100.0	94.8	95.9	86.0	88.1	58.4	104.0	100.0	114.1	100.0
125.0	183.2	140.0	150.0	150.0	170.0	163.5	173.1	147.8	151.9	132.7	155.6	140.0	174.6	163.0
105.6	116.8	111.0	108.1	108.1	110.0	100.0	112.2	110.9	105.0	107.2	121.6	113.4	111.5	120.0

APPENDIX D
COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY

(Comparison of 50th Percentile in Inches)

	Dominican El														
	Bolivia	Brazil	Colombia	Chile	Republic Ecuador	Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela	
1. Stature	65.0	66.9	65.0	65.7	66.0	64.5	64.3	64.7	64.9	65.5	66.0	66.6	64.7	67.4	65.7
2. Shoulder Height	53.5	54.8	53.6	54.0	54.4	52.9	53.2	53.2	53.5	53.9	54.3	55.0	53.5	55.5	54.2
3. Waist Height	38.8	40.1	39.4	39.7	40.3	38.4	38.7	38.8	39.1	39.5	40.1	40.3	39.0	40.7	39.9
4. Crotch Height	29.5	31.0	30.3	30.0	30.4	29.2	29.4	29.4	29.8	29.8	30.4	30.3	29.6	31.1	30.0
5. Kneecap Height	19.2	19.8	19.5	19.5	20.2	18.9	19.6	19.1	19.6	19.8	19.9	20.1	19.4	20.2	19.9
6. Hip Breadth, Standing	12.6	12.5	12.4	12.5	12.2	12.4	12.7	12.4	12.3	12.4	12.6	12.8	12.8	12.8	12.8
7. Cervical Height	55.4	57.0	55.5	56.0	56.3	55.0	55.0	55.2	55.3	55.6	56.3	56.9	54.9	57.0	56.1
8. Calf Height	12.8	13.8	13.0	13.4	13.7	12.8	13.0	13.0	13.5	13.2	13.6	13.3	12.9	13.5	13.3
9. Chest Depth	9.2	8.8	8.6	8.8	8.7	9.0	8.8	8.9	8.8	8.8	8.7	9.1	9.0	9.1	9.1
10. Chest Breadth	12.0	11.4	11.5	11.9	11.6	11.8	11.7	11.7	11.6	11.7	11.8	12.1	12.0	12.0	12.2
11. Functional Arm Reach (from Wall)	30.3	30.0	29.6	30.3	31.7	29.8	30.2	29.5	30.2	30.1	30.6	31.6	29.5	30.9	30.7
12. Sitting Height	34.4	34.4	33.9	34.4	33.3	33.9	33.6	33.7	33.6	33.9	34.3	34.0	34.0	34.5	34.0
13. Eye Height, Sitting	29.7	29.8	29.2	29.6	29.8	29.1	29.1	29.5	28.9	29.4	29.7	29.3	29.6	29.6	29.5
14. Shoulder-Elbow Length	13.8	14.0	13.7	13.9	14.2	13.5	13.5	13.6	13.8	13.9	14.0	14.3	13.7	14.3	14.0
15. Forearm-Hand Length	17.5	18.2	17.7	17.8	18.7	17.3	17.9	17.6	18.0	18.2	18.4	18.3	17.6	18.6	18.1
16. Buttock-Knee Length	21.9	22.9	22.2	22.4	22.6	21.9	21.6	22.0	22.0	22.0	22.5	22.5	21.8	23.1	22.5
17. Buttock-Popliteal Length	17.6	18.7	18.0	18.1	18.2	17.7	17.3	17.8	17.6	17.7	18.2	18.0	17.6	18.4	18.1
18. Knee Height, Sitting	19.6	20.4	20.0	20.1	20.5	19.4	20.0	19.8	20.0	20.3	20.4	20.4	19.9	20.6	20.4
19. Popliteal Height, Sitting	15.5	16.6	16.0	16.3	16.4	15.6	15.8	15.8	16.1	16.1	16.3	16.0	15.9	16.3	16.1
20. Shoulder Breadth	17.2	16.9	16.7	16.9	17.1	16.7	17.1	16.7	16.9	16.9	17.4	17.4	17.2	17.2	17.6
21. Hip Breadth, Sitting	13.0	12.8	12.8	13.0	12.6	12.7	13.1	12.8	12.7	12.9	13.1	13.4	13.1	13.2	13.2
22. Arm Reach, Upward	51.6	52.7	51.4	52.1	52.7	51.2	51.3	51.8	51.5	51.8	52.4	52.2	51.7	52.8	51.7
23. Mid-shoulder Height, Sitting	23.7	23.5	23.1	23.5	22.9	23.3	23.0	23.4	23.0	23.1	23.6	23.3	23.6	23.3	23.4
24. Maximum Forearm-Forearm Breadth	17.1	16.4	16.3	16.7	17.0	16.8	16.6	16.6	16.5	16.8	17.1	17.5	16.9	17.3	17.5
25. Neck Circumference	14.0	14.0	13.8	13.9	13.9	14.0	14.0	14.0	13.9	13.9	14.1	14.2	14.0	14.3	14.4
26. Shoulder Circumference	42.8	41.8	41.7	41.8	42.8	42.1	42.1	41.7	42.0	41.6	42.5	42.8	42.9	42.9	44.1
27. Chest Circumference	36.4	34.7	35.2	35.5	35.3	35.9	35.6	35.8	35.0	35.2	35.3	36.2	36.0	36.3	36.8
28. Waist Circumference	29.9	29.9	29.5	29.6	30.4	30.1	29.9	29.9	29.8	30.3	30.0	31.4	30.5	31.1	31.5
29. Hip (Buttock) Circumference	35.4	35.7	35.2	35.8	34.9	35.5	35.6	35.2	35.0	35.1	35.4	36.4	35.6	36.3	36.4
30. Wrist Circumference	6.5	6.4	6.3	6.4	6.3	6.4	6.3	6.3	6.3	6.4	6.3	6.5	6.3	6.6	6.4
31. Crotch-Thigh Circumference (Upper)	20.6	20.8	20.5	20.8	20.4	20.6	20.6	20.7	20.3	20.7	20.9	21.6	20.8	21.3	21.3
32. Lower Thigh Circumference	16.3	16.7	16.3	16.5	15.1	16.7	15.6	16.0	16.5	16.1	16.3	15.7	15.9	15.9	16.1
33. Calf Circumference	13.3	13.9	13.5	13.8	13.5	13.3	13.2	13.2	13.3	13.5	13.7	13.9	13.8	14.0	13.7
34. Ankle Circumference	8.5	8.7	8.6	8.8	8.4	8.6	8.7	8.4	8.3	8.5	8.5	8.7	8.7	8.9	8.6
35. Arm Seye Circumference	16.6	16.5	16.2	16.3	16.4	16.5	16.5	16.5	16.3	16.5	16.7	16.8	16.3	16.6	16.9

	El Salvador										Peru									
	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela						
36. Biceps Circumference, Extended	10.2	10.5	10.4	10.3	10.3	10.4	10.3	10.4	10.2	10.5	10.6	10.3	10.5	10.8						
37. Biceps Circumference, Flexed	11.7	11.8	11.6	11.3	11.7	11.8	11.8	11.8	11.6	11.8	11.8	11.6	11.9	12.1						
38. Forearm Circumference, Flexed	10.2	10.5	10.3	10.3	10.8	10.4	10.5	10.4	10.8	10.5	10.8	10.4	10.7	10.9						
39. Vertical Trunk Circumference	61.1	62.1	59.8	60.4	61.2	60.1	59.8	61.1	59.9	59.8	61.7	61.5	60.9	61.3						
40. Back-Waist Length	15.8	15.8	15.9	15.8	15.8	15.9	16.1	15.6	15.6	15.6	16.1	15.9	15.9	16.1						
41. Interscye Breadth, Distance	15.2	15.1	14.7	15.0	14.7	15.4	14.8	15.1	14.8	14.4	15.0	15.1	15.4	15.5						
42. Sleeve Inseam	18.0	18.6	18.0	18.3	19.3	17.5	18.1	17.7	18.3	18.4	18.9	18.7	18.9	18.5						
43. Sleeve Length	32.3	33.1	32.0	32.3	33.1	32.1	32.2	31.9	32.4	32.3	32.9	33.1	32.3	32.9						
44. Interscye Maximum	20.5	20.0	20.0	20.0	20.1	20.7	20.1	20.1	20.0	19.7	20.2	20.6	20.2	20.6						
45. Shoulder Length	5.4	5.9	5.7	5.7	5.8	5.7	5.6	5.6	5.4	5.5	5.7	5.4	5.7	5.7						
46. Head Length	7.3	7.5	7.2	7.3	7.7	7.3	7.3	7.3	7.3	7.3	7.4	7.5	7.3	7.4						
47. Head Height	4.8	4.8	4.8	4.8	4.8	4.8	4.9	4.8	4.7	4.8	4.9	4.9	4.8	4.8						
48. Face Length	4.8	4.7	4.6	4.7	4.6	4.7	4.6	4.6	4.6	4.6	4.6	4.6	4.7	4.7						
49. Head Breadth	5.9	5.9	6.0	5.9	5.8	5.9	6.0	5.9	5.9	6.0	6.1	6.1	5.9	6.0						
50. Head Circumference	21.6	21.9	21.6	21.7	21.9	21.5	21.5	21.5	21.5	21.5	21.7	22.0	21.5	22.0						
51. Interspillary Distance	2.4	2.3	2.4	2.4	2.4	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4						
52. Face Breadth (Bisymphomatic)	5.0	4.7	4.8	4.9	5.2	4.8	5.3	4.8	5.0	5.0	5.1	5.3	5.3	5.2						
53. Bitrignon Diameter	5.3	5.3	5.2	5.3	5.2	5.3	5.3	5.2	5.3	5.3	5.4	5.4	5.3	5.4						
54. Hand Length	7.0	7.3	7.1	7.1	7.3	7.0	7.2	7.1	7.2	7.2	7.2	7.3	7.0	7.2						
55. Palm Length	4.1	4.1	4.0	4.1	4.2	3.9	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1						
56. Hand Breadth (Metacarpals)	3.3	3.4	3.3	3.3	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3						
57. Hand Circumference (Metacarpals)	8.1	8.3	8.1	8.2	8.3	8.3	8.1	8.2	8.1	8.1	8.2	8.2	7.9	8.5						
58. Foot Length	9.7	10.0	10.0	10.0	10.1	9.6	9.9	9.9	10.0	10.1	10.1	10.1	9.9	10.1						
59. Instep Length (Ball of Foot)	7.4	7.5	7.4	7.5	7.6	7.3	7.4	7.4	7.5	7.6	7.5	7.6	7.7	7.6						
60. Foot Breadth (Ball of Foot)	3.8	3.9	3.8	3.8	3.9	3.7	3.8	3.7	3.8	3.8	3.9	4.1	3.9	3.8						
61. Ball of Foot Circumference	9.4	9.6	9.4	9.4	9.5	9.3	9.3	9.2	9.4	9.2	9.4	9.8	9.3	9.4						
62. Heel Breadth	2.6	2.6	2.6	2.6	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.6	2.7						
63. Heel-Ankle Circumference	13.0	13.2	12.9	13.0	13.0	13.3	13.0	12.8	12.8	12.9	13.0	13.3	12.9	13.3						
64. Instep Circumference	9.7	10.0	9.8	9.8	9.8	9.6	9.6	9.9	9.8	9.7	9.8	9.9	9.8	9.8						
65. Kneeling Height	31.5	31.7	31.5	31.3	32.1	30.7	31.7	31.5	30.5	31.7	32.0	32.0	31.6	32.1						
66. Kneeling Length	45.3	46.9	45.9	47.2	46.8	46.1	45.6	45.4	46.5	45.7	46.5	46.1	45.3	45.9						
67. Crawling Height	29.8	29.5	29.2	29.1	30.3	28.7	29.8	28.7	28.5	29.5	30.2	31.0	29.3	31.2						
68. Crawling Length	48.5	49.5	49.3	50.3	50.5	48.6	48.9	48.6	49.3	49.3	49.3	49.8	48.7	49.8						
69. Prone Height	12.8	11.9	12.4	12.6	12.8	12.5	12.7	12.9	12.4	12.9	12.8	12.8	12.9	13.0						
70. Prone Length	83.9	86.2	84.5	85.6	87.8	83.2	83.9	84.1	84.8	85.8	86.1	86.5	84.4	87.2						
71. Left Hand Grip (lbs)*	79.2	86.9	79.2	81.4	85.8	79.2	83.6	84.7	77.0	83.6	83.6	81.4	79.2	84.6						
72. Right Hand Grip (lbs)*	85.8	90.2	88.0	88.0	90.2	85.8	85.8	90.2	90.2	92.4	90.2	92.4	85.8	99.0						
73. One-half Squat (lbs)	180.0	180.0	177.5	170.0	170.0	170.0	200.0	180.5	170.0	190.0	180.0	185.0	190.0	203.5						
74. Dead Lift (lbs)	250.0	260.0	250.0	250.0	240.0	255.0	250.0	260.0	240.0	240.0	245.0	250.0	250.0	270.0						
75. Weight (lbs)	136.0	143.0	135.0	140.0	136.0	134.0	135.0	133.0	133.0	134.0	143.0	147.0	140.0	151.0						

*Free-Grip Dynamometer

APPENDIX E

COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY

(Comparison of 99th Percentile in Inches)

	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
1. Stature	71.0	71.7	70.6	72.0	71.9	69.6	69.5	70.5	72.1	72.5	71.2	69.9	71.1	70.2
2. Shoulder Height	58.3	59.5	58.3	59.6	59.7	58.9	57.3	58.7	60.2	60.1	59.3	58.1	59.4	58.4
3. Waist Height	43.8	44.7	43.2	45.0	46.0	42.5	42.8	44.7	45.2	45.4	43.8	42.7	44.1	43.8
4. Crotch Height	32.8	35.2	33.8	34.0	34.0	33.4	32.5	34.0	34.0	36.1	34.0	32.8	35.4	34.2
5. Kneecap Height	22.2	22.0	21.7	22.2	23.4	21.1	22.0	22.6	22.2	22.9	22.7	22.2	22.3	22.9
6. Hip Breadth, Standing	14.1	13.8	13.6	14.1	14.1	13.9	14.8	14.8	14.4	14.7	14.8	14.1	14.5	14.2
7. Cervical Height	60.8	62.7	60.7	61.9	62.0	60.1	59.9	60.6	62.7	63.1	61.1	59.8	60.6	60.3
8. Calf Height	15.0	16.0	14.7	15.4	15.9	14.7	14.8	15.5	15.1	16.1	15.9	15.6	16.0	15.5
9. Chest Depth	11.1	10.1	9.9	10.3	10.6	10.7	11.1	11.8	10.8	10.8	10.9	10.2	10.3	10.8
10. Chest Breadth	14.0	12.9	13.4	14.4	14.0	13.9	15.7	13.9	15.0	14.3	14.7	14.1	14.7	14.3
11. Functional Arm Reach (from Wall)	34.6	34.0	34.1	35.7	36.1	33.6	34.0	34.2	34.6	34.2	34.7	33.9	35.2	34.7
12. Sitting Height	37.7	38.1	36.5	37.4	36.5	36.3	36.0	36.6	37.4	36.9	37.1	36.4	36.7	36.5
13. Eye Height, Sitting	32.3	33.2	32.2	32.6	31.2	31.9	31.8	32.3	32.4	32.4	32.6	32.0	31.7	32.0
14. Shoulder-Elbow Length	15.3	15.8	15.2	15.7	15.8	15.1	14.8	15.3	16.0	15.7	15.5	15.2	15.8	15.4
15. Forearm-Hand Length	19.3	20.0	19.5	19.8	20.8	18.9	20.1	19.4	20.5	21.6	20.4	19.6	19.9	20.2
16. Buttock-Knee Length	24.8	24.9	24.1	24.9	25.4	24.3	23.8	24.3	24.5	25.4	24.5	23.9	24.9	24.6
17. Buttock-Popliteal Length	19.7	20.7	19.8	20.5	21.0	19.8	18.8	20.2	20.0	20.9	19.8	19.9	20.3	19.9
18. Knee Height, Sitting	22.1	22.7	21.9	22.6	23.6	21.5	22.6	22.8	22.7	23.2	22.6	22.1	22.4	22.3
19. Popliteal Height, Sitting	17.3	18.4	17.6	18.4	18.3	17.5	17.4	17.8	18.1	18.8	18.0	18.1	18.1	17.9
20. Shoulder Breadth	19.2	18.6	18.5	18.8	19.8	18.9	19.9	20.5	20.0	19.6	19.5	19.2	18.7	19.5
21. Hip Breadth, Sitting	15.2	14.6	14.2	14.9	15.2	14.6	15.8	16.1	15.5	15.6	15.2	14.7	15.4	15.1
22. Arm Reach, Upward	56.0	56.6	55.5	56.8	56.9	55.5	55.7	56.7	57.9	57.6	55.5	55.9	57.4	56.1
23. Mid-shoulder Height, Sitting	28.4	29.2	28.9	30.1	29.2	29.5	26.0	28.2	28.2	28.1	28.2	30.0	25.5	25.8
24. Maximum Forearm-Forearm Breadth	20.8	19.0	18.6	19.6	21.1	19.9	20.6	21.8	21.5	20.9	21.0	19.5	19.9	21.3
25. Neck Circumference	16.0	15.8	17.3	16.0	15.9	16.0	15.8	16.4	17.0	15.8	16.3	15.3	15.8	16.1
26. Shoulder Circumference	48.7	46.9	46.1	47.3	49.5	47.3	49.5	53.3	51.7	49.2	47.8	47.7	48.8	49.6
27. Chest Circumference	43.6	40.1	39.3	40.3	41.7	41.7	43.3	45.7	44.0	42.3	42.3	40.5	42.5	42.4
28. Waist Circumference	39.1	36.5	33.7	35.3	40.7	37.9	40.1	42.4	43.2	39.6	38.2	35.7	36.5	40.7
29. Hip (Buttock) Circumference	40.0	41.1	39.0	40.0	47.5	40.9	42.6	44.1	42.2	41.5	41.7	39.4	40.5	41.5
30. Wrist Circumference	7.2	7.1	7.2	7.3	7.3	7.1	7.5	7.1	7.5	7.5	8.4	7.1	7.8	7.6
31. Crotch-Thigh Circumference (Upper)	24.3	24.3	23.7	24.3	25.3	23.6	25.6	26.6	26.0	26.3	25.3	23.7	24.9	24.9
32. Lower Thigh Circumference	19.6	19.8	20.3	20.0	19.6	19.7	18.5	20.9	19.6	20.0	20.8	20.1	19.6	19.8
33. Calf Circumference	15.2	15.8	15.4	15.6	16.0	15.1	15.9	16.7	16.6	16.1	16.2	16.0	16.0	16.3
34. Ankle Circumference	9.8	10.4	9.8	10.2	9.9	12.7	11.6	10.9	10.1	10.9	11.4	10.1	13.0	9.9
35. Arm Scye Circumference	20.4	19.6	19.2	19.6	19.2	19.3	19.2	20.7	20.5	19.6	19.9	18.3	19.4	19.8

	Bolivia	Brazil	Colombian	Chile	Dominican Republic	Ecuador	Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
36. Biceps Circumference, Extended	12.3	12.6	13.4	12.2	13.3	12.3	13.4	13.0	12.9	14.2	13.2	12.9	12.1	13.6	13.0
37. Biceps Circumference, Flexed	13.9	14.0	13.4	14.0	14.6	13.7	14.7	14.7	13.9	15.3	14.8	13.8	13.3	13.4	14.3
38. Forearm Circumference, Flexed	11.7	12.9	11.7	11.9	13.1	12.2	12.6	12.4	13.2	12.7	13.3	11.9	12.0	12.2	12.9
39. Vertical Trunk Circumference	68.2	68.5	66.0	67.7	69.0	66.2	68.1	70.2	66.1	69.1	68.9	67.4	66.2	68.7	68.6
40. Back-Waist Length	19.2	18.8	19.3	19.3	18.6	19.1	18.9	18.2	18.8	18.3	19.5	19.8	17.9	18.4	18.4
41. Interscye Breadth, Distance	17.8	19.4	17.3	17.8	17.6	17.4	17.5	17.7	17.1	18.0	18.1	17.9	17.3	17.8	18.0
42. Sleeve Inscam	20.6	21.3	20.5	21.3	21.9	19.9	20.3	20.0	20.8	21.6	21.2	21.2	20.1	20.6	21.1
43. Sleeve Length	36.0	37.7	35.7	35.9	37.8	35.3	35.4	37.4	35.6	36.4	36.2	36.5	35.4	36.4	36.0
44. Interscye Maximum	23.3	23.3	22.4	22.8	23.4	22.7	23.6	23.8	22.9	22.4	23.5	22.6	23.6	22.9	23.6
45. Shoulder Length	6.6	7.1	6.8	6.9	7.3	7.0	6.8	7.1	6.7	7.3	7.0	6.5	7.0	7.1	6.9
46. Head Length	7.9	8.0	7.9	7.9	8.2	7.9	7.8	8.0	7.7	7.9	8.1	7.9	7.7	8.0	8.0
47. Head Height	5.5	5.3	5.6	5.5	5.2	5.5	5.4	5.6	5.5	5.3	5.6	5.4	5.5	5.5	5.5
48. Face Length	5.5	5.6	5.1	5.3	5.3	5.5	5.1	5.4	5.3	5.2	5.3	5.2	5.2	5.2	5.3
49. Head Breadth	6.4	6.5	6.6	6.5	6.5	6.4	7.0	6.3	6.5	6.5	6.6	6.6	6.7	6.3	6.5
50. Head Circumference	22.7	23.2	23.0	23.0	23.5	22.7	22.8	23.2	22.8	23.0	23.2	23.3	22.6	23.0	23.1
51. Interpupillary Distance	2.6	2.7	2.7	2.8	2.7	2.7	2.6	2.6	2.6	2.7	2.7	2.7	2.6	2.6	2.7
52. Face Breadth (Bisymphomatic)	6.0	5.4	5.7	5.8	6.0	5.7	6.0	5.9	5.9	6.0	5.8	5.9	6.0	5.7	6.0
53. Bitragon Diameter	5.9	5.8	5.7	5.7	5.8	5.7	5.8	5.8	6.0	5.8	5.9	6.0	5.8	5.7	5.9
54. Hand Length	7.9	7.9	7.9	8.0	8.1	7.7	8.2	8.2	7.9	8.1	8.2	8.0	8.0	8.1	8.0
55. Palm Length	4.5	4.6	4.5	4.6	4.7	4.4	4.7	4.6	4.5	4.7	4.7	4.6	4.5	4.6	4.5
56. Hand Breadth (Metacarpals)	3.7	3.8	3.7	3.7	3.8	3.7	3.7	3.7	3.7	3.8	3.7	3.7	3.7	3.8	3.6
57. Hand Circumference (Metacarpals)	9.6	9.3	9.4	9.5	9.5	9.5	9.2	9.3	9.1	9.3	9.4	9.6	8.9	9.7	9.3
58. Foot Length	10.7	11.0	10.9	11.1	11.2	10.6	10.9	11.3	10.8	11.1	11.5	11.3	11.0	11.3	11.1
59. Instep Length (Ball of Foot)	8.0	8.3	8.1	8.5	8.5	8.1	8.0	8.3	8.1	8.7	9.5	8.3	8.2	8.6	8.2
60. Foot Breadth (Ball of Foot)	4.3	4.4	4.3	4.4	4.6	4.3	4.3	4.3	4.2	4.4	4.4	4.6	4.5	4.3	4.5
61. Ball of Foot Circumference	10.7	10.8	10.7	10.7	10.7	10.8	10.4	10.4	10.3	11.6	10.8	10.8	10.7	10.6	10.6
62. Heel Breadth	3.0	3.0	3.0	3.1	3.1	3.0	2.9	3.1	3.0	3.0	3.0	3.1	3.0	3.0	3.0
63. Heel-Ankle Circumference	14.6	14.3	14.3	14.4	14.6	14.3	16.2	14.8	14.3	14.4	14.4	14.5	14.3	14.4	14.3
64. Instep Circumference	11.2	11.4	11.7	11.7	11.5	11.2	10.8	11.1	11.6	10.9	11.4	11.2	11.1	11.0	11.0
65. Kneeling Height	35.2	35.0	34.9	35.9	35.8	35.1	35.5	36.3	34.9	35.4	35.1	35.6	34.1	37.3	35.6
66. Kneeling Length	52.8	52.4	54.7	55.1	51.8	52.6	48.3	51.5	54.0	64.8	55.2	54.6	50.4	50.7	51.8
67. Crawling Height	33.0	33.4	33.2	33.4	34.5	32.6	41.6	33.4	32.4	32.9	33.6	34.7	32.6	35.8	33.0
68. Crawling Length	54.8	56.9	54.5	57.6	55.6	55.2	54.1	56.4	56.4	57.2	58.3	57.8	53.3	54.8	56.1
69. Prone Height	14.9	14.2	14.6	15.2	14.9	15.4	15.3	15.4	15.1	14.8	14.6	15.0	14.9	14.9	15.6
70. Prone Length	91.4	94.5	90.1	94.9	96.2	89.9	92.8	92.2	93.4	95.3	94.5	94.6	91.5	93.4	92.8
71. Left Hand Grip (lbs)*	106.9	132.4	107.6	116.4	118.8	118.6	110.0	115.1	110.2	123.4	124.1	117.5	118.4	132.2	123.6
72. Right Hand Grip (lbs)*	118.8	136.6	122.8	127.4	127.6	120.8	113.5	120.3	130.0	124.1	129.4	122.8	127.2	135.3	134.6
73. One-half Squat (lbs)	336.9	287.2	283.4	270.5	281.9	289.8	346.8	342.3	316.0	320.0	307.2	327.6	334.4	311.8	330.0
74. Dead Lift (lbs)	360.0	300.0	341.4	350.0	361.9	330.0	340.0	344.1	321.0	361.8	367.3	310.0	354.4	345.9	377.0
75. Weight (lbs)	189.6	192.0	165.9	179.8	211.0	179.5	201.7	227.8	186.2	212.8	197.9	193.4	177.0	193.9	199.3

*Free-Grip Dynamometer

APPENDIX F

COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY

(Comparison of 1st Percentile in Centimeters)

	Bolivia	Brazil	Colombia	Chile	Republic	Ecuador	Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
1. Stature	154.5	157.5	156.7	156.8	156.8	152.5	154.6	152.0	155.5	153.2	153.4	157.3	155.1	154.5	157.6
2. Shoulder Height	126.8	126.7	126.8	128.7	128.7	124.6	126.0	124.3	127.2	126.0	126.8	129.3	126.6	126.5	129.3
3. Waist Height	91.4	91.6	91.3	91.7	93.7	87.9	88.9	89.2	92.6	89.5	92.8	89.7	91.0	92.3	93.4
4. Groch Height	67.3	69.5	68.3	67.6	70.1	66.5	67.2	61.7	68.8	69.2	67.2	65.4	67.0	69.7	69.1
5. Kneecap Height	44.3	44.9	44.1	44.2	44.8	43.0	43.6	43.4	44.4	44.2	45.6	44.9	44.7	45.1	45.5
6. Hip Breadth, Standing	28.8	29.1	28.5	28.7	27.5	29.0	29.4	29.0	27.8	27.7	28.4	29.7	29.4	29.8	29.3
7. Cervical Height	130.8	134.3	130.8	132.3	133.4	129.4	130.8	129.0	131.3	131.4	131.4	132.7	130.6	130.5	132.3
8. Calf Height	29.7	29.2	29.1	29.5	30.3	28.5	30.0	28.6	30.4	29.9	29.9	29.1	29.2	29.8	30.4
9. Chest Depth	19.7	19.0	19.2	19.4	18.2	19.3	18.4	19.8	19.0	18.8	18.5	19.2	19.5	19.8	19.6
10. Chest Breadth	26.6	25.7	25.0	25.8	25.4	25.9	26.7	23.9	25.2	25.5	26.3	27.9	26.8	27.0	26.4
11. Functional Arm Reach (from Wall)	67.6	67.2	67.5	66.3	70.7	65.7	67.9	63.0	66.8	67.4	70.8	72.4	66.3	70.3	69.5
12. Sitting Height	79.3	81.4	79.4	80.5	79.1	78.2	79.5	80.0	78.9	78.5	78.3	81.2	80.1	81.2	81.6
13. Eye Height, Sitting	62.1	58.4	62.8	60.2	61.2	59.2	67.3	67.4	61.3	64.9	62.0	67.2	61.6	69.8	70.0
14. Shoulder-Elbow Length	31.4	31.0	31.2	31.5	31.4	31.2	31.7	31.3	31.1	31.7	31.7	32.6	31.7	33.2	32.3
15. Forearm-Hand Length	41.4	41.9	41.6	41.4	43.1	40.0	41.2	41.1	41.5	42.7	41.8	42.0	41.4	43.1	42.4
16. Buttock-Knee Length	50.5	52.3	51.9	51.2	50.7	51.0	50.5	51.1	51.4	50.5	51.0	52.0	51.5	51.7	52.0
17. Buttock-Popliteal Length	40.1	42.6	40.8	41.2	41.7	40.7	40.0	40.7	40.6	40.4	40.9	41.0	40.1	41.4	41.4
18. Knee Height, Sitting	44.6	45.4	46.0	46.1	47.5	44.2	45.8	45.7	44.8	46.9	46.8	46.3	46.4	47.3	47.4
19. Popliteal Height, Sitting	35.9	37.6	34.3	37.2	37.0	35.0	36.5	35.5	34.8	37.6	37.8	37.2	37.0	37.1	37.3
20. Shoulder Breadth	38.3	38.9	37.6	38.1	37.9	38.6	39.4	38.4	37.9	38.6	39.2	40.5	39.7	39.4	39.8
21. Hip Breadth, Sitting	29.5	28.8	29.0	29.1	28.8	29.3	29.8	30.0	29.0	28.5	29.5	30.4	30.2	30.5	29.8
22. Arm Reach, Upward	119.3	122.8	122.7	121.2	125.0	119.1	119.3	118.4	121.7	119.6	122.7	119.6	122.3	122.0	124.8
23. Mid-shoulder Height, Sitting	54.1	52.2	52.2	53.7	51.5	52.8	52.0	53.7	53.7	52.5	53.3	54.7	53.8	53.3	53.9
24. Maximum Forearm-Forearm Breadth	38.1	36.0	36.3	34.9	37.1	36.3	37.0	37.0	36.1	36.6	36.5	39.8	38.2	36.9	37.5
25. Neck Circumference	32.3	31.9	31.6	30.4	31.0	32.1	31.5	32.4	31.8	30.7	31.4	32.7	32.5	33.2	33.0
26. Shoulder Circumference	97.8	97.1	96.4	94.1	96.6	96.3	96.1	98.4	94.9	96.7	97.8	99.3	95.4	98.1	99.1
27. Chest Circumference	84.3	81.2	81.5	80.1	77.2	81.2	78.3	81.9	81.6	78.0	77.3	83.7	80.6	82.6	83.2
28. Waist Circumference	67.4	68.0	68.0	65.1	66.2	67.1	68.2	67.2	66.4	65.4	65.3	69.7	68.0	65.3	69.0
29. Hip (Buttock) Circumference	78.6	81.7	81.7	80.8	79.5	80.6	78.2	82.8	80.7	79.8	79.4	83.6	81.9	82.0	83.5
30. Wrist Circumference	14.2	14.6	14.2	14.0	14.5	14.6	14.0	14.1	14.5	14.1	14.5	15.0	14.4	14.8	14.7
31. Groch-Thigh Circumference (Upper)	44.0	46.1	44.6	42.6	42.1	44.9	42.3	45.2	45.9	43.9	44.9	47.8	46.3	46.1	45.1
32. Lower Thigh Circumference	33.0	34.2	33.0	33.1	31.6	33.5	30.0	31.9	33.4	31.6	33.2	33.2	33.3	32.8	33.1
33. Calf Circumference	30.0	29.5	25.7	26.6	29.9	27.3	25.0	29.7	29.5	29.5	30.9	27.5	31.5	31.0	30.5
34. Ankle Circumference	19.0	19.2	19.5	19.2	18.7	19.6	19.0	19.1	19.6	19.7	19.1	20.0	19.5	19.6	19.4
35. Arm Scye Circumference	36.1	36.5	36.0	34.6	36.7	35.2	36.7	37.0	35.3	34.4	35.6	38.2	36.5	38.5	37.0

	El										Peru	Uruguay	Venezuela		
	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	Salvador	Guatemala	Honduras	Nicaragua				Panama	Paraguay
36. Biceps Circumference, Extended	21.4	22.5	22.3	20.5	21.4	22.9	21.6	23.3	21.9	22.2	22.7	23.0	22.4	22.4	23.2
37. Biceps Circumference, Flexed	25.4	26.2	25.5	22.0	24.7	25.6	24.2	26.3	26.1	24.9	25.5	25.7	25.0	25.2	26.0
38. Forearm Circumference, Flexed	23.0	22.9	22.1	20.6	22.3	23.2	22.8	23.9	23.0	22.4	22.9	22.8	21.5	24.3	23.1
39. Vertical Trunk Circumference	141.1	144.1	113.8	115.0	140.8	115.2	126.7	139.6	134.3	137.7	123.3	144.8	142.2	139.5	141.2
40. Back-Waist Length	34.7	34.3	33.7	33.7	32.7	33.3	36.4	34.6	33.9	33.9	35.7	35.3	35.7	35.2	35.2
41. Interscye Breadth, Distance	33.4	32.1	30.8	30.6	30.9	33.4	32.8	30.7	30.3	31.5	29.4	32.6	32.0	33.2	34.1
42. Sleeve Inseam	40.3	41.7	40.3	40.4	42.3	39.7	40.9	39.7	40.8	41.7	42.0	38.9	40.9	44.5	42.3
43. Sleeve Length	71.3	76.2	59.5	60.3	74.7	72.8	76.1	72.4	72.9	71.3	74.6	75.4	75.4	76.8	75.9
44. Interscye Maximum	47.0	44.0	44.0	40.8	43.1	45.6	45.1	43.0	41.5	43.1	40.2	43.8	42.1	44.2	44.6
45. Shoulder Length	11.1	12.3	10.5	11.2	11.8	10.9	11.9	12.7	10.5	11.5	11.2	11.5	12.5	11.8	12.2
46. Head Length	17.4	17.0	16.2	16.7	16.9	17.1	17.4	16.5	16.9	16.8	17.3	17.6	17.0	18.0	17.7
47. Head Height	10.0	10.8	10.4	10.4	10.6	10.4	11.2	10.9	10.2	10.6	10.3	10.9	10.7	10.7	10.6
48. Face Length	10.9	10.6	10.4	10.5	10.6	10.8	10.4	10.5	10.6	10.8	10.3	10.9	10.6	11.1	10.7
49. Head Breadth	13.6	14.0	13.7	13.6	13.7	13.7	14.1	13.9	13.8	13.8	13.9	14.5	14.2	13.6	13.9
50. Head Circumference	52.0	52.8	50.3	50.5	52.1	51.2	52.0	52.3	51.7	51.8	51.7	51.6	52.1	53.4	53.5
51. Interpupillary Distance	5.0	5.1	5.4	5.3	5.3	5.0	5.4	5.4	5.5	5.5	5.5	5.6	5.3	5.3	5.3
52. Face Breadth (Bisymphomatic)	10.6	10.3	10.2	10.3	10.9	10.1	10.5	10.7	10.4	10.8	10.2	11.6	11.3	10.6	10.3
53. Bitragion Diameter	12.4	12.0	12.1	12.1	11.9	12.1	12.1	12.5	12.5	12.3	12.3	12.7	12.5	12.8	12.4
54. Hand Length	16.6	15.9	16.1	16.3	16.9	15.9	16.2	16.2	16.8	16.6	16.6	16.9	16.3	16.9	16.8
55. Palm Length	9.1	9.5	9.2	9.1	9.3	9.0	8.9	9.2	9.3	9.5	9.2	9.6	9.4	9.8	9.4
56. Hand Breadth (Metacarpals)	7.6	7.7	7.5	7.5	7.9	7.5	7.3	7.5	7.1	7.1	7.6	7.7	7.6	7.8	7.7
57. Hand Circumference (Metacarpals)	18.5	17.9	18.6	18.4	19.0	18.6	14.3	18.8	18.5	18.4	18.9	18.9	18.2	18.4	19.2
58. Foot Length	22.9	23.2	23.1	22.7	22.9	22.7	22.9	22.6	23.2	23.1	23.4	23.6	23.2	23.2	23.4
59. Instep Length (Ball of Foot)	12.5	16.8	17.0	14.4	17.3	14.7	16.9	17.3	13.0	16.7	15.1	14.5	17.5	17.0	17.3
60. Foot Breadth (Ball of Foot)	8.6	8.9	8.4	8.4	8.6	8.1	8.5	8.3	8.3	8.5	8.7	8.8	8.7	8.9	8.6
61. Ball of Foot Circumference	21.9	22.4	20.9	20.5	21.8	20.9	20.5	20.9	21.2	21.6	21.4	22.1	21.8	22.2	22.0
62. Heel Breadth	5.8	5.9	5.9	5.9	6.0	5.9	5.6	5.6	5.8	5.8	5.9	5.9	5.8	6.0	6.0
63. Heel-Ankle Circumference	29.9	30.6	29.4	24.4	29.0	24.1	29.7	30.0	23.7	30.3	30.1	27.2	30.6	30.5	29.8
64. Instep Circumference	22.5	22.7	21.8	20.6	22.5	22.0	21.4	22.7	22.5	22.0	22.1	23.3	22.4	22.9	22.5
65. Kneeling Height	71.8	69.4	69.8	69.3	70.5	69.3	70.9	71.0	69.7	67.5	72.0	73.1	70.8	71.1	71.3
66. Kneeling Length	102.1	103.1	101.0	102.3	106.0	100.8	101.1	100.9	103.2	99.1	103.9	103.2	103.5	100.4	103.0
67. Crawling Height	66.7	66.3	62.9	64.4	68.8	64.5	68.2	65.3	63.9	66.3	63.4	68.6	67.8	67.1	67.2
68. Crawling Length	103.3	105.5	108.7	111.0	115.1	110.3	86.5	109.8	106.0	105.2	111.9	114.3	112.6	114.5	111.4
69. Prone Height	26.0	26.7	24.7	25.3	24.3	25.4	27.1	17.3	26.4	27.1	25.0	24.7	26.4	27.9	26.9
70. Prone Length	193.7	126.1	186.3	200.5	207.9	192.0	199.1	195.5	198.2	199.6	199.8	201.9	200.6	204.7	202.8
71. Left Hand Grip (kg)*	21.3	29.9	24.0	25.0	28.4	24.0	25.4	21.6	21.9	19.6	25.0	23.5	23.1	29.8	24.0
72. Right Hand Grip (kg)*	27.0	30.0	27.0	27.0	26.8	30.0	26.4	28.2	24.0	26.8	23.4	22.5	28.0	31.4	28.1
73. One-half Squat (kg)	39.3	45.5	40.7	40.9	43.7	45.5	43.1	45.6	39.1	40.0	26.5	47.3	45.5	51.9	45.5
74. Dead Lift (kg)	56.8	83.3	63.6	68.2	68.2	77.3	74.3	78.7	67.2	69.0	60.3	70.7	63.6	79.4	74.1
75. Weight (kg)	48.0	53.1	50.5	49.1	49.1	50.0	45.5	51.0	50.4	47.7	48.7	55.3	51.5	50.7	54.5

*Free-Grip Dynamometer

APPENDIX G

COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY

(Comparison of 50th Percentile in Centimeters)

	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	El Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
1. Stature	165.0	170.1	165.2	166.9	167.8	163.9	163.2	164.3	164.9	166.4	167.6	169.2	164.4	171.1	167.0
2. Shoulder Height	135.9	139.2	136.1	137.2	138.2	134.5	135.1	135.1	135.8	136.9	137.9	139.6	135.8	141.0	137.6
3. Waist Height	98.6	101.8	100.0	100.9	102.5	97.6	98.4	98.6	99.4	100.4	101.9	102.4	99.0	103.3	101.3
4. Crotch Height	74.9	78.8	77.0	76.3	77.3	74.2	74.2	74.6	76.1	75.8	77.2	76.9	75.2	78.9	76.2
5. Kneecap Height	48.4	50.4	49.6	49.6	51.2	48.1	49.9	48.4	49.8	50.2	50.7	51.1	49.3	51.2	50.5
6. Hip Breadth, Standing	32.0	31.7	31.4	31.7	31.0	31.5	32.3	31.4	31.3	31.6	32.0	32.4	32.4	32.5	32.6
7. Cervical Height	140.6	144.8	141.0	142.3	142.9	139.6	139.7	140.2	140.5	141.3	143.0	144.6	139.5	144.7	142.4
8. Calf Height	32.6	35.1	33.0	34.1	34.9	32.6	32.9	33.0	34.2	33.6	34.6	33.9	32.7	34.3	33.8
9. Chest Depth	23.3	22.3	21.9	22.3	22.0	22.9	22.3	22.5	22.3	22.4	22.0	23.1	22.8	23.2	23.0
10. Chest Breadth	30.5	29.0	29.1	30.1	29.6	29.9	29.7	29.8	29.5	29.7	30.0	30.8	30.6	30.6	31.0
11. Functional Arm Reach (from Wall)	76.9	76.3	75.3	76.9	80.5	75.6	76.8	74.9	76.8	76.5	77.6	80.2	75.0	78.6	78.0
12. Sitting Height	87.4	87.4	86.2	87.4	84.6	86.1	85.4	85.7	85.3	86.0	87.0	86.4	86.3	87.6	86.4
13. Eye Height, Sitting	75.5	75.8	74.2	75.2	73.1	73.8	74.0	75.1	73.4	74.7	75.5	74.3	75.1	75.1	75.0
14. Shoulder-Elbow Length	35.0	35.5	34.9	35.2	36.1	34.4	34.4	34.5	35.0	35.2	35.6	36.2	34.9	36.4	35.6
15. Forearm-Hand Length	44.5	46.3	45.0	45.3	47.6	44.0	45.5	44.7	45.7	46.3	46.7	46.5	44.8	47.2	45.9
16. Buttock-Knee Length	55.7	58.1	56.4	57.0	57.3	55.5	54.9	55.9	55.9	56.0	57.1	57.2	55.4	58.6	57.1
17. Buttock-Popliteal Length	44.7	47.5	45.6	45.9	46.2	44.9	43.9	45.3	44.7	45.0	46.2	45.7	44.6	46.8	46.1
18. Knee Height, Sitting	49.9	51.8	50.8	51.1	52.2	49.4	50.7	50.2	50.8	51.5	51.8	51.7	50.6	52.3	51.7
19. Popliteal Height, Sitting	39.4	42.1	40.7	41.3	41.7	39.7	40.2	40.1	40.8	40.8	41.3	40.7	40.4	41.4	41.0
20. Shoulder Breadth	43.6	42.8	42.5	42.8	43.5	42.5	43.4	42.3	43.0	42.9	44.3	44.2	43.6	43.7	44.6
21. Hip Breadth, Sitting	32.9	32.5	32.4	32.9	32.0	32.3	33.3	32.6	32.2	32.8	33.2	34.1	33.4	33.6	33.5
22. Arm Reach, Upward	131.0	133.8	130.6	132.3	133.8	130.1	130.2	131.7	130.9	131.7	133.0	132.5	131.4	134.2	131.3
23. Mid-shoulder Height, Sitting	60.2	59.8	58.8	59.6	58.2	59.1	58.4	59.4	58.4	58.7	59.9	59.1	59.9	59.2	59.4
24. Maximum Forearm-Forearm Breadth	43.4	41.7	41.4	42.3	43.2	42.7	42.1	42.2	41.8	42.7	43.5	44.5	43.0	43.9	44.4
25. Neck Circumference	35.5	35.6	35.1	35.4	35.4	35.7	35.6	35.5	35.2	35.2	35.7	36.0	35.5	36.2	36.5
26. Shoulder Circumference	108.7	106.1	105.9	106.2	108.7	107.0	107.0	106.0	106.8	105.6	108.0	108.6	108.9	109.0	112.1
27. Chest Circumference	92.4	88.2	89.5	90.1	89.7	91.3	90.4	91.0	89.0	89.5	89.6	92.0	91.5	92.2	93.5
28. Waist Circumference	76.0	76.1	75.0	75.2	77.1	76.5	75.9	75.6	77.0	77.0	76.3	79.7	77.5	79.0	80.0
29. Hip (Buttock) Circumference	89.8	90.7	89.5	90.9	88.6	90.2	90.4	89.4	88.9	89.3	90.0	92.4	90.5	92.2	92.5
30. Wrist Circumference	16.4	16.3	15.9	16.2	16.0	16.2	15.9	16.0	16.0	16.2	16.1	16.4	16.0	16.7	16.3
31. Crotch-Thigh Circumference (Upper)	52.3	52.9	52.1	52.9	51.9	52.3	52.4	52.7	51.5	52.5	53.0	54.8	52.9	54.0	54.0
32. Lower Thigh Circumference	41.5	42.3	41.5	41.9	38.3	42.4	39.7	40.7	41.8	41.0	41.3	40.0	40.5	40.5	41.0
33. Calf Circumference	33.9	35.3	34.3	35.0	34.3	33.7	34.7	33.7	33.7	34.3	34.8	35.4	35.1	35.6	34.9
34. Ankle Circumference	21.6	22.2	21.8	22.4	21.3	21.9	22.0	21.4	21.1	21.6	21.5	22.2	22.0	22.5	21.8
35. Arm Syc Circumference	42.1	42.0	41.2	41.4	41.6	41.9	42.0	41.9	41.3	42.0	42.4	42.7	41.5	42.1	43.0

	El														
	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
36. Biceps Circumference, Extended	26.0	26.7	26.4	26.1	26.2	26.4	26.1	26.4	26.0	26.6	26.8	26.9	26.2	26.7	27.5
37. Biceps Circumference, Flexed	29.7	30.0	29.5	29.3	29.8	29.9	30.0	29.9	29.4	30.0	30.4	30.0	29.5	30.2	30.8
38. Forearm Circumference, Flexed	26.0	26.8	26.2	26.2	27.6	26.4	26.7	26.4	26.2	26.6	27.4	27.1	26.5	27.2	27.6
39. Vertical Trunk Circumference	155.2	157.7	151.9	153.4	155.6	152.8	152.0	155.2	152.1	152.0	156.7	156.1	154.8	158.2	155.7
40. Back—Waist Length	40.2	40.1	40.4	40.1	40.2	40.5	41.0	39.5	39.6	39.5	41.3	49.9	49.3	40.5	41.0
41. Interscye Breadth, Distance	38.5	38.5	37.3	38.1	37.3	39.0	37.5	38.5	37.7	36.5	38.0	38.4	38.1	39.0	39.3
42. Sleeve Inscam	45.7	47.2	45.8	46.4	48.9	44.6	46.0	45.0	46.4	46.8	48.0	47.6	46.2	48.0	47.1
43. Sleeve Length	82.0	84.0	81.3	82.1	84.0	81.5	81.7	81.0	82.2	82.0	83.5	84.0	82.1	84.7	83.5
44. Interscye Maximum	52.2	50.9	50.8	50.9	51.0	52.6	51.1	51.2	50.9	50.0	51.3	52.3	51.0	51.3	52.3
45. Shoulder Length	13.7	15.0	14.5	14.5	14.7	14.4	14.3	14.3	13.7	14.0	14.5	13.6	14.6	14.5	14.5
46. Head Length	18.6	19.0	18.2	18.6	19.5	18.5	18.5	18.6	18.5	18.5	18.7	19.0	18.5	19.4	18.8
47. Head Height	12.3	12.2	12.3	12.3	12.2	12.1	12.4	12.3	11.9	12.3	12.4	12.4	12.3	12.3	12.3
48. Face Length	12.1	11.9	11.6	11.9	11.7	12.0	11.7	11.8	11.7	11.7	11.8	11.8	12.1	12.0	11.9
49. Head Breadth	15.0	15.1	15.2	15.1	14.8	15.1	15.2	14.9	15.1	15.2	15.2	15.5	15.4	14.9	15.3
50. Head Circumference	54.8	55.7	54.8	55.1	55.8	54.6	54.7	54.7	54.6	54.7	55.2	56.0	54.6	55.8	55.8
51. Interpupillary Distance	6.0	5.9	6.0	6.1	6.1	5.9	6.1	6.1	6.2	6.1	6.2	6.0	6.0	6.0	6.0
52. Face Breadth (Bisymphomatic)	12.7	11.9	12.1	12.4	13.1	12.2	13.5	12.2	12.7	12.8	13.0	13.5	13.5	13.1	13.3
53. Bitragion Diameter	13.5	13.4	13.2	13.4	13.2	13.4	13.5	13.3	13.5	13.5	13.5	13.6	13.7	13.4	13.6
54. Hand Length	17.9	18.5	18.0	18.1	18.6	17.7	18.3	18.1	18.3	18.3	18.4	18.5	17.9	18.6	18.4
55. Palm Length	10.3	10.4	10.1	10.3	10.7	10.0	10.4	10.3	10.3	10.3	10.5	10.5	10.2	10.6	10.5
56. Hand Breadth (Metacarpals)	8.4	8.7	8.3	8.4	8.6	8.4	8.3	8.3	8.4	8.3	8.5	8.4	8.3	8.8	8.4
57. Hand Circumference (Metacarpals)	20.6	21.1	20.6	20.9	21.1	21.0	20.7	20.9	20.6	20.7	20.9	20.8	20.2	21.5	20.9
58. Foot Length	24.6	25.3	25.3	25.5	25.7	24.5	25.1	25.1	25.2	25.5	25.6	25.6	25.2	26.1	25.7
59. Instep Length (Ball of Foot)	18.7	19.1	18.8	19.0	19.3	18.5	18.7	18.9	19.0	19.3	19.0	19.2	19.1	19.5	19.2
60. Foot Breadth (Ball of Foot)	9.7	10.0	9.7	9.7	10.0	9.5	9.7	9.5	9.6	9.7	9.8	10.3	9.8	10.0	9.7
61. Ball of Foot Circumference	24.0	24.5	23.8	24.0	24.2	23.6	23.7	23.4	23.9	23.5	23.8	24.9	23.6	24.5	23.9
62. Heel Breadth	6.6	6.6	6.6	6.6	6.8	6.6	6.7	6.6	6.7	6.7	6.7	6.9	6.7	6.7	6.8
63. Heel-Ankle Circumference	32.9	33.6	32.7	33.0	33.7	32.6	33.1	32.5	32.8	32.7	33.1	33.7	32.8	33.8	33.2
64. Instep Circumference	24.7	25.4	24.9	25.0	25.0	24.4	24.5	25.1	24.8	24.7	25.0	25.2	24.9	25.5	24.9
65. Kneeling Height	80.1	80.5	79.9	79.6	81.6	78.0	80.6	79.9	77.4	80.5	81.3	81.2	80.2	84.4	81.5
66. Kneeling Length	115.0	119.2	116.7	119.9	118.9	117.0	115.7	115.2	118.1	116.0	118.0	117.0	115.1	116.5	116.1
67. Crawling Height	75.8	74.9	74.1	73.9	76.9	72.8	75.7	73.0	72.5	74.9	76.7	78.8	74.3	79.3	76.9
68. Crawling Length	123.2	125.7	125.3	127.7	128.3	123.5	124.1	123.4	125.1	125.2	126.7	126.5	123.6	126.6	126.4
69. Prone Height	32.4	30.3	31.4	32.1	32.4	32.7	32.2	32.9	31.4	32.4	32.4	32.5	32.8	33.7	33.0
70. Prone Length	213.0	219.0	214.6	217.5	223.0	211.4	213.2	213.6	215.5	218.0	218.6	219.8	214.4	221.4	217.9
71. Left Hand Grip (kg)*	36.0	39.5	36.0	37.0	39.0	36.0	38.0	38.5	35.0	38.0	38.0	37.0	36.0	43.0	39.0
72. Right Hand Grip (kg)*	39.0	41.0	40.0	40.0	41.0	39.0	39.0	41.0	41.0	41.0	41.0	42.0	39.0	45.0	41.0
73. One-half Squat (kg)	81.8	81.8	80.7	77.3	77.3	77.3	90.9	82.0	77.3	86.4	81.8	84.1	86.4	92.5	90.9
74. Dead Lift (kg)	113.6	118.2	113.6	113.6	109.1	115.9	113.6	118.2	109.1	109.1	111.4	115.9	113.6	122.7	113.6
75. Weight (kg)	61.8	65.0	61.4	63.6	61.8	60.9	61.4	60.5	60.5	60.9	65.0	66.8	63.6	68.6	67.2

*Free-Grip Dynamometer

APPENDIX H

COMPARISON OF PHYSICAL MEASUREMENTS BY COUNTRY

(Comparison of 99th Percentile in Centimeters)

	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	El Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
1. Stature	180.3	182.1	179.3	183.0	182.7	176.8	176.5	177.4	179.2	183.1	184.1	180.8	177.6	180.7	178.4
2. Shoulder Height	148.2	151.2	148.1	151.4	151.7	149.6	145.6	160.7	149.0	152.8	152.6	150.5	147.6	151.0	148.4
3. Waist Height	111.2	113.6	109.8	114.4	116.7	107.9	108.8	108.5	113.5	114.9	115.3	111.2	108.6	112.1	111.3
4. Crotch Height	83.4	89.3	85.9	86.4	86.4	84.7	82.5	82.6	86.3	86.3	91.7	86.3	83.3	89.9	86.8
5. Kneecap Height	56.3	55.8	55.1	56.4	59.3	53.6	55.8	56.3	56.0	56.3	58.2	57.7	56.4	56.7	58.1
6. Hip Breadth, Standing	35.7	35.1	34.5	35.8	35.9	35.4	37.6	39.2	37.6	36.6	37.3	37.5	35.9	36.8	36.1
7. Cervical Height	154.5	159.3	154.2	157.2	157.4	152.5	152.1	150.9	154.0	159.3	160.2	155.3	151.8	153.9	153.1
8. Calf Height	38.2	40.7	37.4	39.2	40.4	37.4	37.5	39.5	38.4	38.4	41.0	40.5	39.7	40.5	39.4
9. Chest Depth	28.2	25.6	25.3	26.1	26.8	27.2	28.3	30.0	31.0	27.4	27.5	27.7	26.0	26.0	27.5
10. Chest Breadth	35.5	32.8	34.0	36.7	35.7	35.4	39.9	39.5	35.3	38.1	36.3	37.2	35.8	37.4	36.4
11. Functional Arm Reach (from Wall)	87.8	86.3	86.7	90.7	91.7	85.3	86.4	87.0	85.5	87.9	86.8	88.2	85.0	89.4	88.0
12. Sitting Height	95.8	96.7	92.8	94.9	92.7	92.8	91.5	93.0	92.5	95.0	93.7	94.2	92.4	93.2	92.6
13. Eye Height, Sitting	82.0	84.2	81.8	82.8	79.2	81.0	80.7	80.7	81.9	82.3	82.3	82.9	81.2	80.5	81.2
14. Shoulder-Elbow Length	38.9	40.1	38.6	40.0	40.2	38.4	37.7	38.9	38.8	40.7	39.9	39.3	38.6	40.0	39.2
15. Forearm-Hand Length	49.0	50.9	49.6	50.3	53.0	48.1	51.2	51.8	49.4	52.0	54.9	51.8	49.9	50.5	51.3
16. Buttock-Knee Length	63.0	63.3	61.1	63.2	64.6	61.8	60.3	65.0	61.7	62.3	64.5	62.3	60.7	63.2	62.5
17. Buttock-Popliteal Length	50.1	52.5	50.4	52.1	53.2	50.4	47.8	51.3	50.8	50.2	53.2	50.3	50.6	51.5	50.6
18. Knee Height, Sitting	56.1	57.5	55.6	57.4	60.1	54.7	57.5	58.0	57.0	57.6	58.8	57.5	56.2	56.9	56.7
19. Popliteal Height, Sitting	44.0	46.8	44.7	46.6	46.4	44.6	44.2	45.1	46.6	46.0	47.7	45.7	46.1	46.1	45.4
20. Shoulder Breadth	48.8	47.3	47.1	47.8	50.3	47.9	50.5	52.0	48.8	50.9	49.9	49.6	48.7	47.5	49.5
21. Hip Breadth, Sitting	38.6	37.1	36.0	38.0	38.5	37.2	40.2	40.9	39.5	39.4	39.7	38.5	37.5	39.1	38.4
22. Arm Reach, Upward	142.2	143.9	140.9	144.4	144.7	141.0	141.4	144.1	139.6	147.0	146.2	140.9	142.0	145.7	142.4
23. Mid-shoulder Height, Sitting	72.2	74.3	73.5	76.6	74.2	74.9	66.0	64.6	75.3	71.5	71.4	71.7	76.2	64.8	65.5
24. Maximum Forearm-Forearm Breadth	52.8	48.2	47.3	49.9	53.7	50.5	52.4	55.4	50.8	54.7	53.1	53.2	49.5	50.5	54.2
25. Neck Circumference	40.5	40.1	44.1	40.6	40.3	40.7	40.1	41.8	41.2	43.2	40.1	41.5	38.8	40.2	41.0
26. Shoulder Circumference	123.7	119.2	117.1	120.2	125.8	120.1	125.7	135.3	125.5	131.3	125.0	121.4	121.1	124.1	126.0
27. Chest Circumference	110.8	101.9	99.8	102.4	106.0	106.0	109.9	116.0	110.5	111.9	107.4	107.3	102.9	108.0	107.7
28. Waist Circumference	99.4	92.8	85.5	89.7	103.4	96.2	101.9	107.6	95.8	109.7	100.5	97.1	90.6	92.8	103.4
29. Hip (Buttock) Circumference	101.7	104.4	99.1	101.6	120.5	103.9	108.2	112.0	107.1	107.8	105.5	106.0	100.2	102.8	105.4
30. Wrist Circumference	18.3	17.9	18.3	18.5	18.6	18.1	19.1	19.0	18.1	19.0	19.0	21.4	17.9	19.8	19.3
31. Crotch-Thigh Circumference (Upper)	61.7	61.7	60.1	61.8	64.2	60.0	65.1	67.6	63.1	66.0	66.7	64.2	60.1	63.2	63.3
32. Lower Thigh Circumference	49.8	50.3	51.5	50.8	49.8	49.9	47.0	53.1	52.1	49.7	50.9	52.9	51.2	49.8	50.3
33. Calf Circumference	38.6	40.2	39.2	39.7	40.8	38.3	40.5	42.4	40.5	42.2	40.9	41.2	40.6	40.7	41.3
34. Ankle Circumference	25.0	26.4	24.9	26.0	25.2	32.2	29.5	27.6	33.2	25.7	27.8	29.0	25.7	32.9	25.1
35. Arm Scye Circumference	51.7	49.8	48.9	49.7	48.7	49.0	48.9	52.7	49.8	52.1	49.7	50.5	46.5	49.4	50.2

	Bolivia	Brazil	Colombia	Chile	Dominican Republic	Ecuador	El Salvador	Guatemala	Honduras	Nicaragua	Panama	Paraguay	Peru	Uruguay	Venezuela
36. Biceps Circumference, Extended	31.3	31.9	34.0	31.0	33.8	31.2	34.1	33.1	32.7	36.1	33.5	32.7	30.8	34.7	33.1
37. Biceps Circumference, Flexed	35.3	35.6	34.0	35.6	37.0	34.7	37.4	37.4	35.4	38.8	37.6	35.1	34.2	34.1	36.2
38. Forearm Circumference, Flexed	29.7	32.7	29.8	30.2	33.2	30.9	32.0	31.5	33.4	32.3	33.7	30.3	30.4	31.1	32.8
39. Vertical Trunk Circumference	173.2	174.0	167.7	172.0	175.2	168.1	172.9	178.3	168.0	175.6	174.9	171.2	168.1	174.5	174.2
40. Back-Waist Length	48.9	47.7	49.1	48.9	47.2	48.5	48.0	46.2	47.8	46.5	49.6	50.4	45.4	46.6	46.7
41. Interscye Breadth, Distance	45.3	49.3	43.9	45.3	44.6	44.2	44.4	45.0	43.4	45.8	46.1	45.3	44.0	45.3	45.7
42. Sleeve Inseam	52.4	54.0	52.0	54.0	55.6	50.5	51.6	50.8	52.8	54.8	54.0	53.9	51.0	52.3	53.5
43. Sleeve Length	91.3	95.6	90.6	91.2	96.1	89.7	90.0	95.0	90.5	92.5	91.9	92.8	90.0	92.4	91.4
44. Interscye Maximum	59.1	59.2	57.0	58.0	59.4	57.8	59.9	60.4	58.1	56.9	59.7	57.5	59.9	58.2	59.8
45. Shoulder Length	16.8	18.0	17.4	17.5	18.5	17.7	17.2	18.0	16.9	18.5	17.7	16.6	17.8	18.1	17.5
46. Head Length	20.1	20.2	20.0	20.0	20.8	20.0	19.8	20.2	19.6	20.1	20.5	20.1	19.6	20.4	20.4
47. Head Height	13.9	13.5	14.3	14.0	13.3	13.9	13.7	14.2	14.0	13.5	14.1	13.8	13.9	13.9	14.0
48. Face Length	13.9	14.3	13.0	13.4	13.4	14.0	13.0	13.7	13.5	13.1	13.3	13.2	12.3	13.2	13.4
49. Head Breadth	16.2	16.6	16.7	16.5	16.5	16.2	17.7	16.0	16.4	16.6	16.7	16.7	16.9	16.0	16.5
50. Head Circumference	57.8	59.0	58.4	58.4	59.8	57.7	58.0	58.9	58.0	58.4	59.0	59.3	57.4	58.5	58.8
51. Interpupillary Distance	6.6	6.8	6.9	7.0	6.8	6.8	6.6	6.7	6.6	6.8	6.9	6.7	6.7	6.6	6.8
52. Face Breadth (Bisymphomatic)	15.4	13.7	14.5	14.7	15.2	14.4	15.3	15.1	15.0	15.4	14.8	15.0	15.2	14.5	15.2
53. Bitragon Diameter	15.1	14.6	14.5	14.6	14.7	14.6	14.9	14.7	15.1	14.7	14.9	15.2	14.7	14.5	14.9
54. Hand Length	20.2	20.0	20.1	20.3	20.6	19.5	20.9	20.9	20.0	20.6	20.7	20.3	20.3	20.7	20.4
55. Palm Length	11.4	11.7	11.5	11.6	12.0	11.2	12.0	11.6	11.4	11.9	12.0	11.7	11.4	11.8	11.5
56. Hand Breadth (Metacarpals)	9.5	9.7	9.3	9.5	9.7	9.3	9.4	9.4	9.3	9.6	9.5	9.4	9.3	9.6	9.3
57. Hand Circumference (Metacarpals)	24.4	23.7	23.8	24.1	24.2	24.2	23.4	23.6	23.2	23.6	23.9	24.3	22.5	24.6	23.6
58. Foot Length	27.2	27.9	27.6	28.3	28.5	27.0	27.7	28.6	27.4	28.2	29.2	28.8	27.8	28.7	28.1
59. Instep Length (Ball of Foot)	20.4	21.0	20.6	21.5	21.5	20.5	20.4	21.1	20.5	22.1	24.2	21.2	20.9	21.8	20.9
60. Foot Breadth (Ball of Foot)	10.9	11.1	10.8	11.2	11.7	10.8	10.9	11.0	10.7	11.2	11.2	11.7	11.3	10.9	11.4
61. Ball of Foot Circumference	27.2	27.4	27.1	27.2	27.1	27.4	26.4	26.5	26.1	29.4	27.4	27.5	27.1	27.0	26.8
62. Heel Breadth	7.5	7.7	7.5	7.8	7.9	7.6	7.5	7.9	7.5	7.5	7.7	7.8	7.7	7.6	7.7
63. Heel-Ankle Circumference	37.2	36.3	36.2	36.5	37.1	36.3	41.1	37.5	36.4	36.7	36.8	36.3	36.7	36.4	36.4
64. Instep Circumference	28.4	29.0	29.7	29.8	29.3	28.4	27.5	28.1	29.5	27.8	29.0	28.5	28.3	27.9	27.9
65. Kneeling Height	89.4	89.0	88.6	91.2	91.0	89.1	90.2	92.1	88.6	89.8	89.1	90.4	86.7	94.9	90.5
66. Kneeling Length	134.0	133.2	139.0	140.0	131.6	133.6	122.6	130.7	137.2	164.5	140.1	138.8	128.1	128.9	131.5
67. Crawling Height	83.9	84.9	84.3	84.9	87.7	82.7	105.6	84.8	82.4	83.6	85.3	88.1	82.9	90.9	83.9
68. Crawling Length	139.2	144.5	138.4	146.4	141.3	140.2	137.3	139.8	143.2	145.2	148.1	146.7	135.4	139.2	142.6
69. Prone Height	37.8	36.0	37.2	38.6	37.8	39.2	38.9	39.2	38.5	37.5	37.2	38.1	37.8	37.9	39.5
70. Prone Length	232.0	240.0	228.8	241.1	244.3	228.4	235.6	234.3	237.3	242.2	240.1	240.2	232.3	237.1	235.7
71. Left Hand Grip (kg)*	48.6	60.2	48.9	52.9	54.0	53.9	50.0	52.3	50.1	56.1	56.4	53.4	53.8	60.1	56.2
72. Right Hand Grip (kg)*	54.0	62.1	55.8	57.9	58.0	54.9	51.6	54.7	59.1	56.4	58.8	55.8	57.8	61.5	61.2
73. One-half Squat (kg)	153.1	130.5	128.8	123.0	128.1	131.7	157.6	155.6	143.6	145.5	139.6	148.9	152.0	141.7	150.0
74. Dead Lift (kg)	163.6	136.4	155.2	159.1	164.5	150.0	154.5	156.4	145.9	164.5	167.0	140.9	161.1	157.2	171.4
75. Weight (kg)	86.2	87.3	75.4	81.7	95.9	81.6	91.7	103.5	84.6	96.7	90.0	87.9	80.5	88.1	90.6

*Free-Grip Dynamometer

APPENDIX I

PERCENTILES AND RANGES FOR STANDING, SITTING, BODY CIRCUMFERENCE, SURFACE, HEAD, HAND, FOOT, SPATIAL, STRENGTH, AND WEIGHT MEASUREMENTS OF 1985 LATIN-AMERICAN MILITARY PERSONNEL (Centimeters Unless Otherwise Noted)

	Percentiles											Range	
	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th	Min	Max
STANDING MEASUREMENTS													
1. Stature	154.2	155.3	157.4	159.1	162.1	166.1	170.0	174.1	176.8	180.1	181.6	148.5	186.9
2. Shoulder Height	125.9	127.0	128.6	130.4	133.2	136.8	140.5	144.1	146.8	149.5	151.3	121.5	179.8
3. Waist Height	90.4	91.3	93.0	94.6	97.2	100.3	103.5	106.7	108.6	111.2	113.5	87.0	199.9
4. Crotch Height	67.1	68.0	69.8	71.3	73.3	76.0	78.9	81.5	83.4	85.8	86.9	58.2	93.0
5. Kneecap Height	43.9	44.4	45.5	46.4	47.9	49.7	51.4	53.3	54.4	56.0	57.2	41.2	82.3
6. Hip Breadth, Standing	28.4	28.8	29.3	29.8	30.7	31.8	32.9	33.9	34.8	35.9	36.6	23.2	39.3
7. Cervical Height	130.5	131.4	133.4	135.2	138.1	141.5	145.1	148.8	151.6	154.9	157.0	125.3	165.6
8. Calf Height	29.2	29.8	30.3	31.0	32.2	33.6	35.1	36.6	37.6	38.7	39.6	26.1	67.3
9. Chest Depth	19.0	19.4	20.0	20.5	21.4	22.5	23.6	24.7	25.5	26.7	27.5	12.5	34.6
10. Chest Breadth	25.6	26.1	27.0	27.6	28.7	30.0	31.5	33.0	34.2	35.8	36.7	21.3	42.4
11. Functional Arm Reach	66.8	67.8	69.4	70.9	73.6	76.8	79.8	83.0	85.1	87.7	89.1	58.7	92.4
SITTING MEASUREMENTS													
12. Sitting Height	79.0	80.2	81.4	82.7	84.6	86.6	88.6	90.6	91.8	93.2	94.6	71.5	99.7
13. Eye Height, Sitting	60.2	64.6	68.7	70.4	72.5	74.8	76.9	78.9	80.1	81.5	82.2	42.2	85.3
14. Shoulder-Elbow Length	31.3	31.7	32.3	32.8	34.0	35.2	36.4	37.6	38.3	39.0	39.7	26.8	45.6
15. Forearm-Hand Length	41.0	41.5	42.2	42.9	44.1	45.5	47.0	48.3	49.4	50.8	51.7	34.0	76.7
16. Buttock-Knee Length	50.9	51.7	52.3	53.2	54.7	56.5	58.3	60.0	61.2	62.5	63.5	45.1	70.1
17. Buttock-Popliteal Length	40.5	41.0	41.8	42.6	44.0	45.6	47.2	48.7	49.8	51.0	51.6	39.0	56.0
18. Knee Height, Sitting	45.6	46.2	46.9	47.8	49.4	50.9	52.6	54.3	55.4	56.8	57.5	41.2	60.8
19. Popliteal Height, Sitting	35.9	36.7	37.4	38.2	39.4	40.8	42.2	43.7	44.7	45.8	46.3	33.3	49.2
20. Shoulder Breadth	38.2	38.8	39.7	40.4	41.6	43.2	44.8	46.4	47.4	48.8	49.7	34.0	52.5
21. Hip Breadth, Sitting	29.1	29.5	30.0	30.6	31.7	32.8	34.2	35.5	36.6	38.1	38.8	23.1	42.9

	Percentiles										Range		
	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th	Min	Max
22. Arm Reach, Upward	120.4	122.1	123.7	125.5	128.4	131.8	135.1	138.4	140.4	142.9	144.4	116.6	152.4
23. Mid-shoulder Height, Sitting	52.5	53.5	54.8	55.9	57.4	59.4	61.3	63.4	64.7	70.4	74.6	50.4	80.5
24. Maximum Forearm— Forearm Breadth	36.0	36.9	38.1	39.1	40.5	42.7	45.0	47.3	49.1	50.9	52.8	28.8	60.8
BODY CIRCUMFERENCES													
25. Neck Circumference	31.4	32.1	32.7	33.3	34.3	35.5	36.7	38.0	39.0	40.2	41.1	27.3	48.2
26. Shoulder Circumference	96.2	97.2	99.2	100.8	104.0	107.5	111.7	115.9	118.9	122.3	125.1	90.2	140.5
27. Chest Circumference	79.8	81.1	83.0	84.8	87.4	90.6	94.5	99.0	101.0	105.8	108.6	68.8	123.2
28. Waist Circumference	66.2	67.3	68.6	70.1	73.0	76.2	80.5	86.0	90.5	95.5	98.3	60.9	118.0
29. Hip (Buttock) Circumference	80.3	81.3	83.0	84.7	87.4	90.4	93.8	97.2	99.8	102.8	105.3	72.5	185.2
30. Wrist Circumference	14.2	14.5	14.9	15.1	15.6	16.2	16.9	17.4	17.9	18.4	18.7	10.8	27.7
31. Crotch—Thigh Circum- ference (Upper Thigh)	43.8	45.6	46.9	48.1	50.2	52.8	55.2	58.0	59.7	62.0	64.0	33.1	73.5
32. Lower Thigh Circum- ference	32.5	33.2	34.4	35.5	38.1	41.4	44.9	47.3	48.7	50.0	51.3	20.9	56.3
33. Calf Circumference	28.8	30.0	30.9	31.7	33.1	34.5	36.1	37.6	38.6	40.0	41.0	16.6	45.2
34. Ankle Circumference	19.2	19.5	20.0	20.3	21.0	21.9	22.7	23.7	24.4	25.2	26.7	17.7	37.0
35. Arm Scye* Circum- ference	35.6	36.3	37.6	38.5	40.0	41.8	43.8	46.0	47.3	49.0	49.8	24.2	58.0
36. Biceps Circumference, Extended	21.8	22.5	23.3	24.0	25.1	26.5	28.0	29.6	30.6	32.3	33.5	13.1	43.0
37. Biceps Circumference, Flexed	24.9	25.5	26.3	27.0	28.3	29.8	31.2	32.9	34.0	35.5	36.7	20.3	44.0
38. Forearm Circumference, Flexed	22.0	22.8	23.9	24.4	25.5	26.6	27.9	29.1	30.0	31.1	32.5	16.0	36.7
39. Vertical Trunk Circumference	115.4	133.3	143.2	146.0	149.9	154.1	159.4	164.0	166.5	171.2	174.0	104.3	193.0
40. Back—Waist Length	33.9	34.5	35.7	36.8	38.6	40.4	42.2	44.0	45.4	47.2	49.1	22.0	55.7

*Armhole

41. Interscye Breadth, Distance	30.8	31.5	33.1	34.5	36.2	38.2	40.1	42.0	43.0	44.5	45.5	28.0	49.5
42. Sleeve Inseam	40.3	41.1	42.2	43.0	44.6	46.4	48.3	50.0	51.0	52.5	54.0	32.9	78.5
43. Sleeve Length	71.6	74.0	76.0	77.4	80.0	82.3	85.0	87.5	89.3	91.0	93.0	55.0	106.7
44. Interscye Maximum	42.4	44.0	45.7	47.1	49.3	51.5	53.5	55.6	56.6	58.1	59.1	20.0	62.0
45. Shoulder Length	11.2	11.5	12.1	12.6	13.5	14.4	15.4	16.3	16.9	17.5	17.8	10.0	22.3

HEAD MEASUREMENTS

46. Head Length	16.9	17.2	17.5	17.8	18.2	18.6	19.1	19.6	19.8	20.1	20.3	11.3	21.0
47. Head Height	10.4	10.7	10.9	11.2	11.7	12.3	12.8	13.2	13.5	13.8	14.0	9.8	15.0
48. Face Length	10.5	10.6	10.9	11.1	11.4	11.9	12.3	12.7	13.0	13.3	13.7	10.0	17.0
49. Head Breadth	13.7	13.9	14.1	14.4	14.7	15.2	15.6	16.0	16.2	16.5	16.7	13.1	19.4
50. Head Circumference	51.3	52.0	52.6	53.1	54.0	55.0	56.0	57.0	57.6	58.2	58.7	14.2	60.0
51. Interpupillary Distance	5.2	5.4	5.5	5.6	5.8	6.1	6.3	6.5	6.6	6.8	6.8	4.4	7.4
52. Face Breadth	10.3	10.5	11.0	11.3	11.9	12.5	13.5	14.2	14.5	14.9	15.1	9.3	19.0
53. Bitrignon Diameter	12.1	12.4	12.5	12.8	13.1	13.4	13.8	14.2	14.4	14.6	14.9	11.7	19.0

HAND MEASUREMENTS

54. Hand Length	16.2	16.4	16.8	17.1	17.6	18.1	18.7	19.3	19.8	20.1	20.4	11.0	23.0
55. Palm Length	9.1	9.2	9.4	9.6	10.0	10.3	10.7	11.1	11.3	11.6	11.8	8.5	19.5
56. Hand Breadth (Metacarpals)	7.5	7.6	7.8	7.9	8.1	8.4	8.7	9.0	9.2	9.4	9.5	6.3	9.9
57. Hand Circumference (Metacarpals)	18.4	18.6	19.0	19.4	20.0	20.8	21.5	22.4	22.9	23.6	24.1	11.0	40.9

FOOT MEASUREMENTS

58. Foot Length	22.9	23.2	23.5	23.9	24.5	25.3	26.2	27.0	27.5	28.1	28.3	16.2	29.9
59. Instep Length (Ball of Foot)	14.8	16.6	17.3	17.8	18.3	19.0	19.6	20.2	20.5	21.0	21.4	10.7	29.8
60. Foot Breadth (Ball of Foot)	8.4	8.6	8.8	9.0	9.3	9.7	10.1	10.5	10.7	11.1	11.3	8.1	12.0
61. Ball of Foot Circumference	20.9	21.4	22.0	22.4	23.1	23.9	24.7	25.6	26.1	27.0	27.4	19.7	44.8
62. Heel Breadth	5.8	5.9	6.0	6.2	6.4	6.7	7.0	7.2	7.4	7.6	7.8	5.4	8.4

	Percentiles										Range		
	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th	Min	Max
63. Heel-Ankle Circumference	29.3	30.0	30.6	31.1	32.0	33.0	34.0	35.0	35.7	36.3	36.7	20.5	44.5
64. Instep Circumference	22.0	22.4	22.9	23.3	24.0	24.9	25.9	26.8	27.4	28.1	28.9	20.0	36.7
SPATIAL MEASUREMENTS													
65. Kneeling Height	69.9	70.7	72.7	74.3	76.9	80.0	83.0	85.7	87.5	89.6	90.7	64.4	96.0
66. Kneeling Length	101.4	102.9	105.0	108.0	112.3	117.0	122.4	127.7	131.1	135.6	139.1	88.8	205.4
67. Crawling Height	64.7	66.0	67.5	69.0	71.7	74.7	77.8	80.6	82.5	84.1	85.9	59.6	122.6
68. Crawling Length	107.9	111.0	113.9	116.7	121.0	125.5	130.5	134.5	137.7	142.0	144.3	71.2	163.0
69. Prone Height	25.3	26.3	27.3	28.2	30.1	32.2	34.2	35.4	36.3	37.7	38.6	11.8	53.0
70. Prone Length	196.6	199.6	202.0	205.7	210.8	216.3	221.9	227.5	231.8	236.9	240.0	115.3	277.3
STRENGTH MEASUREMENTS													
71. Left Hand Grip (kg)*	23.0	25.0	28.0	30.0	33.0	37.0	42.0	46.0	49.0	53.0	55.0	16.0	64.0
72. Right Hand Grip (kg)*	26.6	28.0	30.0	32.0	36.0	40.0	45.0	50.0	53.0	56.0	59.0	19.0	74.0
73. One-half Squat (kg)	40.9	45.5	50.0	54.5	68.2	81.8	95.5	113.6	127.3	136.4	145.5	20.5	172.7
74. Dead Lift (kg)	67.8	72.7	81.8	90.9	100.0	113.6	127.3	140.9	145.5	154.5	163.6	50.0	186.4
75. Weight (kg)	49.1	50.5	52.3	54.5	58.6	63.2	68.2	74.8	79.5	85.0	89.1	45.5	114.1

*Free-Grip Dynamometer

APPENDIX J

DISTRIBUTION LIST

Agency	Final Report
Commander US Army Test and Evaluation Command ATTN: AMSTE-ME Aberdeen Proving Ground, MD 21005	10
Commander US Army Materiel Command ATTN: AMCRD-T AMCRD (Dr. Kaufman) AMCRD-U AMCIL Washington, DC 20315	1 1 1 1
Chief of Naval Research Washington, DC 20390	1
Director Smithsonian Institution ATTN: Assistant Secretary (Science) Washington, DC 20560	2
HQDA (DAAG-ASL) Washington, DC 20310	1
Institute for Applied Technology National Bureau of Standards Washington, DC 20234	1
Associate for Documentation and Accession Psychological Abstracts American Psychological Association 1200 Seventeenth Street, NW Washington, DC 20036	1
HQDA (DACE-ZA) (DALO-ILZ) (DAMO-IAM) (DARD-ARB) (DARD-ARE) (DARD-ARL) Washington, DC 20310	1 1 2 1 1 1

Agency	Final Report
Director Department of Defense, Research and Engineering ATTN: Advanced Research Projects Agency (ODR) The Pentagon, Washington, DC 20315	1
Assistant Secretary of the Army (R&D) The Pentagon, Washington, DC 20315	1
Defense Intelligence Agency Washington, DC 20301	1
Commander US Army Test and Evaluation Command ATTN: USACDC Liaison Officer Aberdeen Proving Ground, MD 21005	1
Commander US Army Human Engineering Laboratories ATTN: Technical Director Aberdeen Proving Ground, MD 21005	2
Commander US Army Land Warfare Laboratory Aberdeen Proving Ground, MD 21005	1
President US Army Aviation Test Board Fort Rucker, AL 36362	1
Arctic, Desert, Tropic Information Center Maxwell Air Force Base, AL 36112	1
Commander US Army Combat Developments Experimentation Command ATTN: CDEC-AG Fort Ord, CA 93941	1
President US Army Infantry Board Fort Benning, GA 31905	1

Agency	Final Reports
US Army Armor Human Research Unit Building 2423 Fort Knox, KY 40121	1
President US Army Armor and Engineer Board Fort Knox, KY 40121	1
Commander US Army Natick Laboratories ATTN: Mr. Robert White Natick, MA 01762	10
Commander US Army Research Institute for Environmental Medicine Natick, MA 01769	1
President US Army Airborne, Communications and Electronics Board Fort Bragg, NC 28307	1
President US Army Field Artillery Board Fort Sill, OK 73504	1
Tactical Technology Center Battelle Memorial Institute 505 King Avenue Columbus, OH 43201	1
President US Army Air Defense Board Fort Bliss, TX 79906	1
Director Behavior and Systems Research Laboratory, USAMANRRDC 1320 Wilson Boulevard Arlington, VA 22209	1

Agency	Final Report
Commander Defense Documentation Center for Scientific and Technical Information ATTN: Document Service Center Cameron Station Alexandria, VA 22313	2
Institute for Defense Analysis 400 Army-Navy Drive Arlington, VA 22202	1
Human Resources Research Organization 300 North Washington Street Alexandria, VA 22314	1
Commander United States Southern Command ATTN: J-5 Quarry Heights, CZ	2
Commander US Army Forces Southern Command ATTN: SCARCE Fort Amador, CZ	2
Commander Detachment 2, CCTWG, DA US Air Force Tropic Survival Training School Albrook Air Force Base, CZ	1
Commandant USAF Inter-American Air Force Academy Albrook Air Force Base, CZ	2
Commander US Army Tropic Test Center ATTN: STETC-XO-A (Tech Lib)	2
STETC-OO-P	2
STETC-AD	20
Fort Clayton, CZ	

APPENDIX K

SELECTED BIBLIOGRAPHY

1. Baker, P. T. *The Biological and Cultural Structure of a High Altitude Peruvian Population*, Contr DA-49-143-MD-2260, US Army Med R&D Commander, Pennsylvania State College, July 1965.
2. Beyhaut, G. *Raices Contemporaneas de America Latina*. Editorial Universitaria de Buenos Aires, 1964.
3. Ferguson, J. H. *El Equilibrio Racial en America Latina*, Editorial Universitaria de Buenos Aires, 1963.
4. Fleishman, E. A., E. J. Kremer, and G. W. Shoup. *The Dimensions of Physical Fitness—A Factor Analysis of Strength Tests*. Tech Rep 2, Contr Nonr 609(32) Office of Naval Research, Yale University, August 1961.
5. Fox, Katherine. *The Effect of Clothing on Certain Measures of Strength of Upper Extremities*. Tech Rep Ep-47, QM R&D Center, Contr DA44-109-qm-1760, State University of Iowa, June 1957.
6. Hertzberg, H. T. E., G. S. Daniels, and E. Churchill. *Anthropometry of Flying Personnel*, WADC Tech Rep 52-321, Wright Air Development Center, September 1954.
7. Morgan, C. T. et al. (Eds) *Human Engineering Guide to Equipment Designs*, New York: Mc Graw-Hill, 1963.
8. Randal, E. and M. J. Baer. *Survey of Body Size of Army Personnel, Male and Female*. Tech Rep 122 (Rev), R&D Division, Office of QM General, October 1952.
9. Randall, E. *Applications of Anthropometry to the Determination of Size in Clothing*. Tech Rep 133, R&D Branch, Office of QM General, June 1948.
10. Stewart, T. D. *A Bibliography of Physical Anthropology in Latin America: 1937-1948*. Wenner-Gren Foundation Rep, 1952.
11. Churchill, E. et al. *Anthropometry of US Army Aviators*, 1970 Tech Rep 72-52-CE US Army Natick Laboratories, December 1971.
12. White, R. M. *Anthropometric Survey of the Royal Thai Armed Forces*, Sponsored by Advanced Research Projects Agency, US Army Natick Laboratories, June 1964.
13. Williams, M. W. *The People and Politics of Latin America*, Ginn and Co: 1938.
14. Mourant, A. E. *The Distribution of the Human Blood Groups*, Oxford: Blackwell, 1954.
15. Dobbins, D. A., and C. M. Kindick. *Anthropometry of the Latin-American Armed Forces*. USATTC Interim Research Report Number 10, May 1967.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Commander US Army Tropic Test Center Fort Clayton, Canal Zone	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
	2b. GROUP

3. REPORT TITLE
ANTHROPOMETRY OF THE LATIN-AMERICAN ARMED FORCES

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final Report

5. AUTHOR(S) (First name, middle initial, last name)
Delaney A. Dobbins
Charles M. Kindick

6. REPORT DATE August 1972	7a. TOTAL NO. OF PAGES 60	7b. NO. OF REFS 15
-------------------------------	------------------------------	-----------------------

8a. CONTRACT OR GRANT NO. DAHBO1-71-C-B358 b. PROJECT NO. DA Project No 1T061101A91A c. TECOM Project No 9 CO 049 000 001 d.	9a. ORIGINATOR'S REPORT NUMBER(S) USATTC Report No 7209002
	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES Data collection only by contract; this is in-house research.	12. SPONSORING MILITARY ACTIVITY US Army Tropic Test Center Fort Clayton, Canal Zone
---	--

13. ABSTRACT

The United States Army Tropic Test Center made anthropometric measurements of a sample of Latin-American enlisted military personnel in the Canal Zone from September 1965 to February 1970.

A total of 1985 trainees were measured—1852 airmen at the USAF Inter-American Air Forces Academy and 133 army personnel at the US Army School of the Americas. Fifteen Latin-American countries are represented in the sample. The average age for the sample was 23 years, average height was 5 feet, 5 ½ inches, and average weight was 141 pounds.

Percentiles and ranges for 75 physical measurements are presented, including isometric strength and hand-grip measures. Country-by-country comparisons are also presented. In addition, 1790 ABO blood group types are presented by country.

These data represent the only known source of detailed anthropometric information on Latin-American military personnel.

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Latin-American military personnel						
Anthropometry						
Hand strength						
Isometric strength						
Clothing size						
Equipment size						
Body size						
ABO Blood Groups						
Tropic Test Center						
Sampling error						
Dead-lift						
One-half squat						
Standing measurements						
Sitting measurements						
Body circumferences						
Surface measurements						
Head measurements						
Hand measurements						
Foot measurements						
Spatial measurements						
Strength measurements						