TECHNICAL REPORT
NATICK/TR-09/014

AD _____

ANTHROPOMETRIC SURVEY (ANSUR) II PILOT STUDY: METHODS AND SUMMARY STATISTICS

by
Steve Paquette
Claire Gordon
and
Bruce Bradtmiller*

***Anthrotech**
Yellow Springs, OH 45387

April 2009

Final Report
June 2006 – September 2008

Prepared for
U.S. Army Natick Soldier Research, Development and Engineering Center
Natick, Massachusetts 01760-5020

DISCLAIMERS

The findings contained in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Citation of trade names in this report does not constitute an official endorsement or approval of the use of such items.

DESTRUCTION NOTICE

For Classified Documents:

Follow the procedures in DoD 5200.22-M, Industrial Security Manual, Section II-19 or DoD 5200.1-R, Information Security Program Regulation, Chapter IX.

For Unclassified/Limited Distribution Documents:

Destroy by any method that prevents disclosure of contents or reconstruction of the document.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
21-04-2009	Final	June 13, 2006 – September 4, 2008

4. TITLE AND SUBTITLE

ANTHROPOMETRIC SURVEY (ANSUR) II PILOT STUDY: METHODS AND SUMMARY STATISTICS

5a. CONTRACT NUMBER
W911QY-06-C-0061

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
622786

6. AUTHOR(S)

Steve Paquette, Claire Gordon, and Bruce Bradtmiller*

5d. PROJECT NUMBER
AH98

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Anthrotech
503 Xenia Avenue
Yellow Springs, OH 45387

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Natick Soldier Research, Development and Engineering Center
ATTN: RDNS-WSH-E (S. Paquette)
Kansas Street, Natick, MA 01760-5020

10. SPONSOR/MONITOR'S ACRONYM(S)
NSRDEC

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
NATICK/TR-09/014

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

* Anthrotech

14. ABSTRACT

Virtually every Army materiel system in use was designed and/or sized using a database of anthropometric information that is 20 years old. It was based on the Army Anthropometric Survey (ANSUR), which was conducted in 1988 on only Active Duty Soldiers. However, more than one-half of today's fighting forces are National Guard and Reserve component troops. A pilot study (ANSUR II) was recently undertaken to (1) assess anthropometric change since 1988 within the Active Army; (2) to assess anthropometric differences among Army Active, Reserve, and National Guard components; and (3) to provide guidance on whether a further, more comprehensive survey and an update of the current ANSUR database are needed. This report provides measurement methods and summary statistics for 25 body measurements made on 2811 male and 651 female soldiers in the pilot study. The anthropometric change since 1988 and tests of component differences are presented in a separate technical report. The subjects were weighted by component, sex, age, and racial/ethnic group to match Total Army demographics as of March 2007 in order to provide interim design guidance on Total Army body size distributions as of March 2007.

15. SUBJECT TERMS

SURVEYS	BODY SCANS	ANTHROPOMETRY	THREE DIMENSIONAL
SCANNING	ACTIVE DUTY	ARMY PERSONNEL	COMPUTER PROGRAMS
BODY SIZE	HUMAN BODY	SIZES(DIMENSIONS)	ARMY NATIONAL GUARD
COMPARISON	MEASUREMENTS	WHOLE BODY SCAN	ANTHROPOMETRIC MEASUREMENT TOOL
INFORMATION RETRIEVAL		MEASURING INSTRUMENTS	

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Steven Paquette
U	U	U	SAR	96	19b. TELEPHONE NUMBER *(include area code)* 508-233-5430

This page intentionally left blank.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This publication is one of two technical reports issued in connection with the U.S. Army Anthropometric Survey (ANSUR) II pilot study of U.S. Army Soldier anthropometry. The pilot study was performed during the period June 13, 2006 – September 4, 2008 under a contract (number W911QY-06-C-0061) awarded by the U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC) to Anthrotech. The NSRDEC program element number was 622786, and the project number was AH98. This report presents the measurement methods and summary statistics for 25 measurements made on a sample of both male and female soldiers. The companion report presents anthropometric change since 1988 and differences among today's Active Army, the Reserves, and the National Guard.

The pilot study arose as a result of sizing and tariffing problems reported during initial deployments to Operation Iraqi Freedom, and because an ANSUR II update of the Army's 1988 ANSUR database, first proposed in 1998, remained unfunded. The ANSUR II pilot study was undertaken to: 1) assess anthropometric differences among Army Active, Reserve, and National Guard Components; 2) assess anthropometric change since 1988 within the Active Duty Component; and 3) to provide interim Total Army design guidance if the results of the first two comparisons indicated that a new anthropometric survey was needed. This report contains measurement methods and Total Army summary statistics for 25 body measurements obtained in the ANSUR II pilot study. The data collected during the study are considered interim guidance only because funding limitations prohibited a comprehensive set of engineering measurements, limited the study to two measurement sites, and prevented the execution of a stratified random multi-stage sampling strategy of the kind used in ANSUR in 1988. A relevant survey of the contemporary Army is required to systematically address Army anthropometric variation distributed over three components, two genders, five racial/ethnic groups, and multiple age groups.

This study would not have been possible without the support and cooperation of TACOM's Integrated Logistics Support Center (ILSC) and Mr. Joseph Cooper, who allowed us to leverage sizing and fit-testing fieldwork in their Uniform System for Improved Tariffs (USFIT) project. Dr. Kenneth Parham and Mr. Chris King of the NSRDEC, Battle Lab Integration Team were instrumental in coordinating access to troops at Ft. Hood, Texas. Anthrotech provided a highly trained and motivated measuring team supervised by Ann Lisa Piercy. Body scans were obtained using a VITUS/Smart 3D body scanner supervised by Human Solutions employees Michael VanGenabith and Roy Wang. Scan quality reviews, post-processing, and scan archiving were conducted by Mr. Jeremy Carson and Drs. Brian Corner and Peng Li of Natick's Ergonomics Team.

Project coordination was conducted by Ms. Belva Hodge, Anthrotech. In addition, statistical support was provided by Ms. Shirley Kristensen, Anthrotech, and editorial support was provided by Ms. Ilse Tebbetts of Anthrotech. As always, studies like this cannot be conducted without the patience and support of Soldiers themselves, and for this we thank the Soldiers of Ft. McCoy, Wisconsin, and Ft. Hood for their willingness to participate in USFIT and the ANSUR II Pilot study.

The body measurement statistics in this report were summarized from data collected in accordance with 32 CFR 219.101(b) and AR 70-25, under a five year exemption entitled "A Comprehensive Exemption for Human Factors and Anthropometric Size and Fit Evaluation", dated 7 January 2004 and approved on 15 January 2004.

ANTHROPOMETRIC SURVEY (ANSUR) II PILOT STUDY: METHODS AND SUMMARY STATISTICS

CHAPTER I

INTRODUCTION

Anthropometric data describing Army body size distributions are maintained by the Army Materiel Command (AMC) at the U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC). These data are used to establish design and sizing requirements, engineering solutions, and digital models for vehicular crew stations, portable shelters and workstations, protective clothing, individual life support equipment, and military uniforms.

The current U.S. Army Anthropometric Survey (ANSUR) database, now 20 years old, predates the total-Army concept, so it has measurements on active duty Army personnel only. Recent small-scale studies of active duty soldiers at Ft. Bliss, Oklahoma, and of National Guard soldiers at Ft Polk., Louisiana, clearly indicate that both active duty and National Guard soldiers are heavier than the soldiers measured in ANSUR. In addition, height and weight distributions of today's soldiers are substantially more variable than they were in 1988, meaning that the 90% accommodation ranges derived from the ANSUR database may no longer capture 90% of today's soldiers.

This report documents the measurement methods and summary statistics from a pilot study (ANSUR II), conducted between June 13, 2006 and September 4, 2008, to (1) assess anthropometric change since 1988 within the Active Army; (2) to assess anthropometric differences among Army Active, Reserve, and National Guard components; and (3) to provide guidance on whether a further, more comprehensive survey and an update of the current ANSUR database are needed. The anthropometric change since 1988 and differences among today's Active Army, the Reserves, and the National Guard are presented in a separate report. The ANSUR II Pilot (A2P) study was performed by Anthrotech under contract to NSRDEC.

The fact that the ANSUR database may no longer represent today's heavier, more variable soldier population, even with statistical weighting to correct for changes in demographic distributions, has already been felt in the field. Deployments to Iraq resulted in critical shortages of the larger sizes in both chemical/biological (CB) protective clothing and body armor, and special-order data have suggested a need to extend routinely available size ranges.

A research design for validation and update of the ANSUR database was developed in 1998 and was briefed successfully to the Honorable Mr. Walter Hollis (DUSA (OR)). However, despite a favorable January 1999 briefing to Dr. Michael Andrews, Assistant Secretary of the Army, a full update of the database remains unfunded. Subsequent attempts to leverage anthropometric data from three-dimensional (3D) body scans obtained for combat clothing size prediction and logistics applications in 2005 and 2006 proved futile because many standardized anthropometric measurements cannot be obtained from 3D scan images. Furthermore, those that can be obtained are often not sufficiently close to standardized measurements to be considered accurate enough for reference anthropometry.

It thus became clear that a pilot field study was needed to assess anthropometric changes that may have occurred in the regular Army component since 1988, to determine whether substantial anthropometric differences exist between regular Army, Army Reserve, and Army National Guard components, and to provide interim design and procurement guidance until a full update of the Army's

anthropometric database could be planned and executed. The A2P was undertaken to address these needs.

The last anthropometric survey of active duty U.S. Army men and women (ANSUR) was conducted in 1988 (Gordon et al. 1989) some 20 years, or the equivalent of a military generation, ago. In 1988, a substantial proportion of the men (some 30%) were aged 31 or above — considerably older than the earlier 1966 sample (White and Churchill 1971). In the current active-duty Army, 35% of male soldiers are between 26 and 35, and 20% are 36 years old and above.

A slight majority of the women in the 1988 sample (53%) were 25 and above , while more than one-half the women in an earlier 1977 survey were younger than 25 (Churchill et al. 1977; Laubach et al. 1977). Some 51% of today's active-duty Army women are over 25.

In 1988, 61% of active duty male soldiers and approximately 52% of active duty Army women were white. Today, 64% of men and 43% of women are white. Black men and women comprised some 25% and 41%, respectively, of Army personnel in 1988, which reflected a considerable increase in diversity from previous demographic patterns. Currently, 19% of Army men are black, and 10% hispanic. Minority women, today, include 37% black and 11% hispanic soldiers.

Between 1970 and 1980, the percentage of women in the active Army increased nearly seven fold. In 1988 women made up almost 11% of Army personnel, and with each passing year, more jobs are filled by women. Today about 15% of active-duty soldiers are women.

The biggest change in Army anthropometry between 1988 and 2008 may be the dramatic shift in composition of the force. Twenty years ago, most of the nation's fighting force was composed of active duty troops. Today, under the total-Army concept, the Army National Guard and Army Reserves comprise more than one-half of the troops currently serving in Iraq and Afghanistan. These Army components are essentially unknown from an anthropometric point of view, although it is well known that their demographic composition is different from the active duty Army of 1988.

Finally, there is an obesity epidemic in the United States (Ogden et al. 2007). It is unknown whether, or to what extent, this epidemic has influenced body dimensions in the Army —active duty, National Guard, or Reserves.

The A2P consisted of 3462 subjects., It was conducted to determine whether the changing demographic distributions in today's Army and changing obesity patterns among U.S. civilians have carried with them enough anthropometric changes to justify measuring a larger sample for purposes of reconstituting the Army's anthropometric database. Furthermore, because large numbers of Reserves and National Guard soldiers have been sent into combat in recent years and because they have never been measured, soldiers from these two components were included, for the first time, in this pilot sample.

In order to produce a truly comparative set of measurements, the anthropometric data collection methods used in this survey were identical to those used in the 1988 ANSUR survey (Clauser et al. 1988). Scanning equipment for collecting 3D data was not readily available for anthropometric purposes in 1988, so this feature has been added to the current study. Anthrotech's subcontractor, Human Solutions North America, obtained full body scans of current subjects.

1.1 SELECTION OF SURVEY DIMENSIONS

Several months of planning preceded the survey. During that time, the principal investigator, in collaboration with Army anthropologists, selected the short list of 25 dimensions to be measured in the pilot study. Dimensions were selected to include those important for tariffing combat items, as well as for basic design of next generation protective equipment and workspaces. Most areas of the body are represented by one or two dimensions. The final list is as follows:

- Acromion-Radiale Length
- Biacromial Breadth
- Bideltoid Breadth
- Bizygomatic Breadth
- Buttock Circumference
- Buttock-Knee Length
- Cervicale Height
- Chest Circumference
- Crotch Height
- Foot Breadth
- Foot Length
- Hand Breadth
- Hand Length
- Head Breadth
- Head Length
- Hip Breadth, Sitting
- Knee Height, Sitting
- Menton-Sellion Length
- Radiale-Stylion Length
- Sitting Height
- Stature
- Waist Back Length (Omphalion)
- Waist Circumference (Omphalion)
- Waist Height (Omphalion)
- Weight

1.2 THE SAMPLE

The sample was selected to reflect the major demographic groups (with regard to age, sex, and racial/ethnic background) represented in today's Army. The sampling strategy, sample acquisition, and sample weighting are described fully in Chapter III.

1.3 HOW TO USE THIS REPORT

Chapter II lists and describes the landmarks used to define the origin and termination of the measurements made in this survey, summarizes the operational aspects of the survey (including descriptions, illustrations and sources of the instruments used), and describes the 3D body scanning process. As noted above, Chapter III deals with the sample.

The working data in this report are given in Chapter IV, which includes summary statistics and descriptions of the traditional anthropometric dimensions. Each is described and illustrated. Summary statistics are reported separately for each sex. A visual index that precedes the statistical material is designed to help readers identify and locate dimensions by their location on the body, even if the exact anthropometric term is unfamiliar.

Chapter V contains a brief discussion of differences found between the body sizes of service men and women in the 1988 Army and those obtained in the current pilot survey, and assesses the need for additional anthropometric studies.

The appendices include copies of the photographic release form; the data sheet used to document the demographic and anthropometric measurement data for each soldier; and weighted demographic distributions of the total-Army population and A2P subjects as of 2007, when the survey was completed.

CHAPTER II

THE SURVEY

2.1 SUBJECT PROCESSING AND MEASURER TRAINING

A team of four individuals was assembled for this project. The strategy was to use a team supervisor to provide continuity between the two locations, and then to hire the remaining staff— two measurers and the subcontracted scanner operator—locally. In the final implementation, one of the measurers (RS) was hired locally from the Ft. McCoy, Wisconsin, region, and he traveled to Ft. Hood, Texas, for the second location, so he was part of the team throughout the study. The second measurer and the scanner operator were local to the two locations. The two measurers were trained in measuring all the traditional dimensions selected for this pilot study. Prior to data collection at each location, training was conducted at Anthrotech's home office in Ohio. All measurers used the Measurer's Handbook (Clauser et al. 1988) that had been developed and used to train measurers in the 1988 survey, so as to ensure consistency in measuring techniques. This handbook contained detailed written and illustrated instructions for marking and measuring subjects, and explained the operation and maintenance of the computer data-entry system. The measurers were ready to begin data collection only when their inter-observer errors were within the allowable error as defined in the Measurer's Handbook. Unavoidable circumstances led to the replacement of the second measurer early in data collection at each location. The replacements were trained on location and did not collect data until their training data set comparisons were within allowable error when compared to measurer RS.

The measuring teams spent approximately four months at each of two Army posts: Ft. McCoy and Ft. Hood.

At each location, three stations were set up: (1) briefing and waiting, (2) landmarking and measuring, and (3) 3D scanning. (The subjects returned to the first station for out-processing.)

At the first station, soldiers were briefed on the general purposes of the survey, signed image release forms (see Appendix A) and filled out demographic and biographical information about themselves on questionnaires (see Appendix B). The image release forms were needed because the 3D scan images are photographic in nature. Soldiers were requested to appear in Physical Training (PT) attire. If they did not have their own PT gear, running shorts and tank tops (for females) were available. Men were measured in running shorts alone. Women were measured in running shorts and sports bras. The tank top was used for modesty when moving from station to station. Both male and female soldiers were issued Spandex™ bike shorts, which were worn for scanning. Females wore the sports bras for scanning.

At the next station measurers of both sexes landmarked and measured the men. Female measurers processed the women. The subjects then moved to the scanning station for the 3D scan. After the scan was verified for quality, the soldiers returned to the first station for out-processing, where the team supervisor reviewed their data forms and checked to make sure that they had been through both the measuring and scanning stations.

2.2 COMPUTER PROCEDURES

The subjects arrived at the measuring station carrying their data forms (see Appendix C), which had been pre-numbered and bar-coded. The bar-coded subject number was scanned to ensure that there

would be no mistyping of the numbers. The bar code on the same form was scanned in the scanner station where it became part of the scan file name, ensuring that the traditional data could be accurately matched with the soldier's scan. As each measurement was made, the recorder entered the data into the station's laptop computer. At the end of each day, data from the laptop hard drive was backed up on a thumb drive and also e-mailed back to the Anthrotech offices in Yellow Springs, Ohio.

The editing routines in the computer software were based on procedures that had been used successfully for many years by the contractor in a number of previous military surveys (Churchill et al. 1988; Kikta and Churchill 1978). The approach is essentially two-phased. A value is first checked against the highest value and the lowest value measured for that variable. If the measured value is higher than the highest value to date or lower than the lowest value, a signal, given on the computer instructs the measurer to take the measurement again. This approach is very effective in screening out wildly aberrant values resulting from mis-assembling an instrument, misreading an instrument, transposing digits, or mis-entering a value by 100 or 1000. For the second phase of the editing program, regression equations, in which the value for each dimension is predicted from the values of two other dimensions, are entered into the computer software. The measured value for a given subject for a given dimension is compared to the predicted value. If the measured and the predicted value differ by more than a preset amount, a signal instructs the measurer to remeasure that dimension. In that way, values that are not aberrant for the population as a whole but are disproportionate for that individual are identified and checked. In the case of a flagged minimum or maximum, if the value was validated by the regression test, then it became a new minimum or maximum.

When this editing program was used in the 1988 ANSUR survey, minimum and maximum values and regression equations for predicting an individual's values were, of necessity, developed during the survey itself and periodically updated. In the A2P, 2nd and 98th percentile ANSUR values were used as initial minima and maxima. Regression equations with two independent variables were based on ANSUR data and used within the software as initial regression equations. After 50 subjects (of each sex) were measured in the pilot study, the software automatically calculated the best independent variables for each dimension, and recalculated the regression equations. Subsequent to that initial re-calculation, the equations were recalculated after every subject, thus continually improving the sensitivity of the equations.

2.3 ANTHROPOMETRIC INSTRUMENTS

The standard anthropometric instruments used in this survey include the following (see Figures 1 and 2):

GPM anthropometer GPM Spreading caliper
GPM Beam caliper Lufkin Steel tape
GPM Sliding caliper Seca Scale

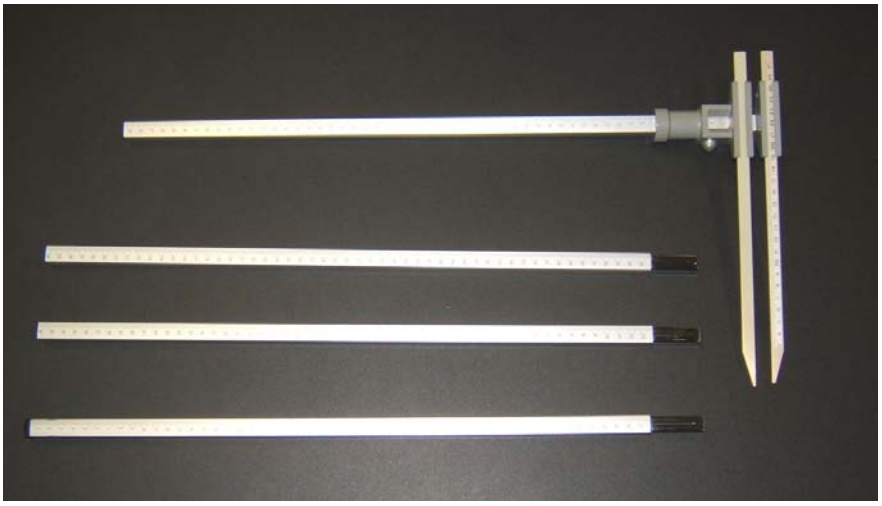


Figure 1. GPM anthropometer and beam caliper.

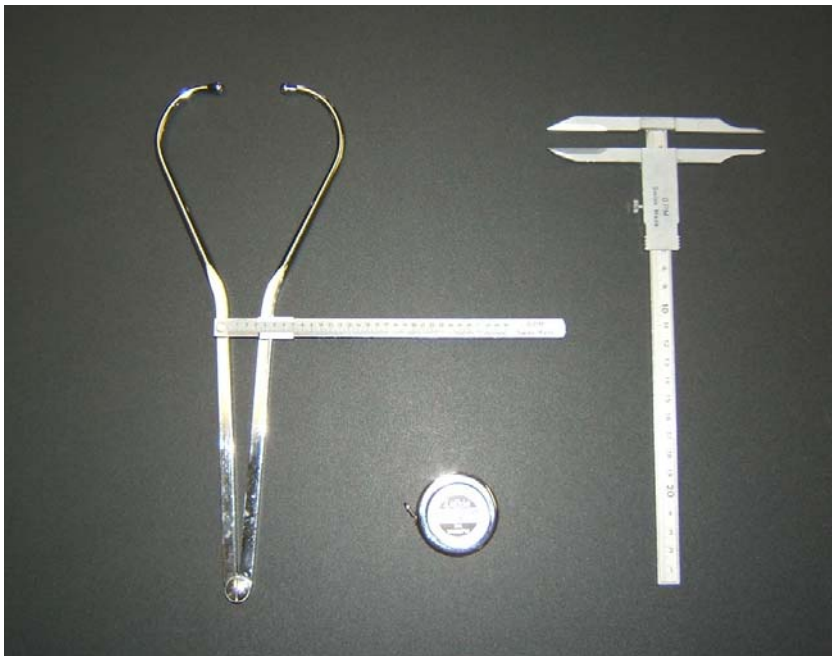


Figure 2. GPM sliding caliper, Lufkin steel tape, and GPM spreading caliper.

Additional instruments, created for the original ANSUR survey and used once more in this survey include the foot boxes, shown in Figure 3.

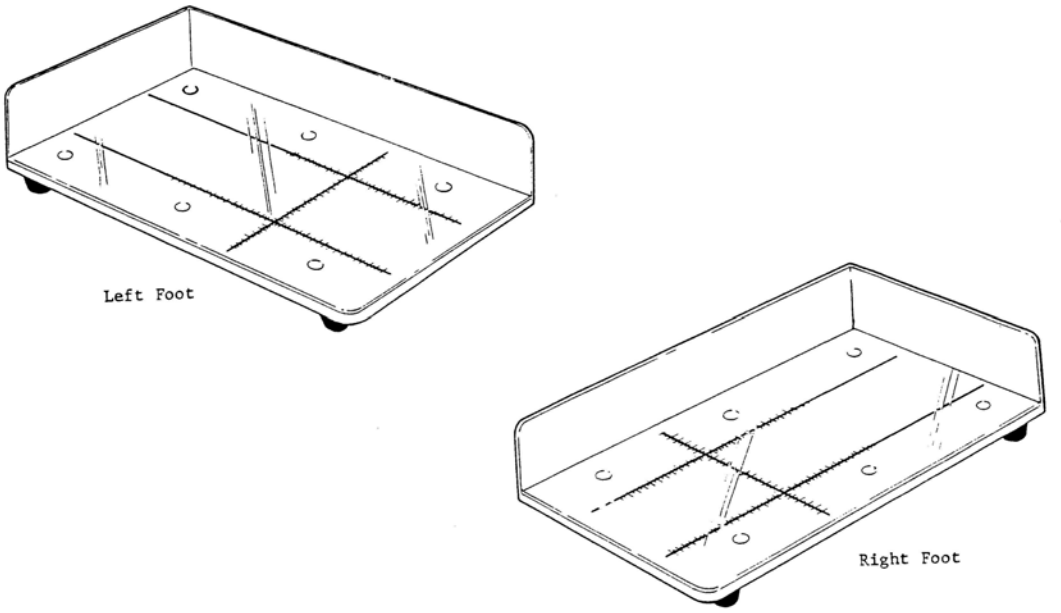


Figure 3. Right and left foot boxes.

2.4 THE LANDMARKS

Traditional dimensions are measured from one point on the body (or fixed surface such as the floor) to another. In the case of circumferences, the dimension is measured around a part of the body at a specified level. To ensure that each dimension is measured accurately and consistently from subject to subject, dimensions are defined in terms of body landmarks, which serve as the origin, termination, or level of measurement for that dimension.

Measurers in this survey were also trained to locate landmarks by palpation or by sight and to place drawn marks on the bodies of all subjects. The landmarks used to define the measurements are listed and briefly described in Figure 4. Detailed illustrated instructions for locating these landmarks can be found in the Measurer's Handbook (Clauser et al. 1988).

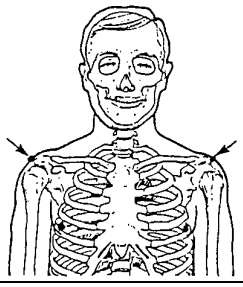
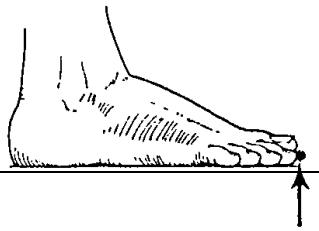
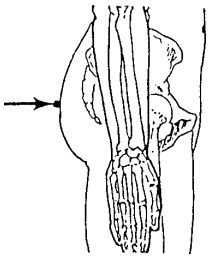
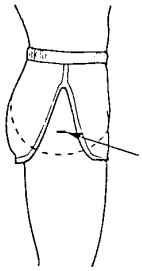
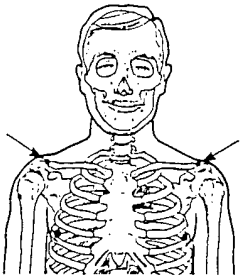
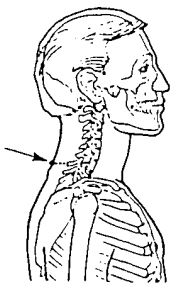
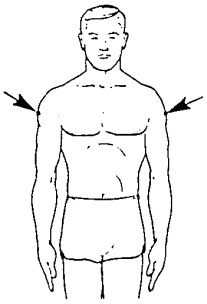
Acromion, right and left: The point of intersection of the lateral border of the acromial process and a line running down the middle of the shoulder from the neck to the tip of the shoulder. 	**Acropodion:** The tip of the first or second toe, whichever is longer. 
Buttock point, posterior: Point of maximum protrusion of the right buttock of a standing subject. 	**Buttock point, right lateral and left lateral:** Points on the thigh or hip at the level of the maximum protrusion of the right buttock. 
Clavicle point, right and left: The superior points of the lateral ends of the clavicles. 	**Cervicale:** The superior palpable point of the spine of the seventh cervical vertebra. 
Dactylion III, right: The tip of the middle finger. 	**Deltoid point, right and left:** The lateral point of the right deltoid muscle, and the margin of the left deltoid muscle at the level of the right deltoid point. 

Figure 4. Landmarks.

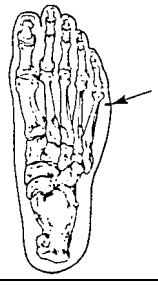
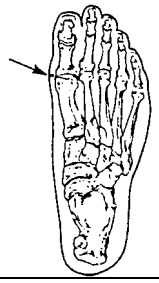
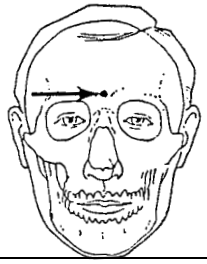
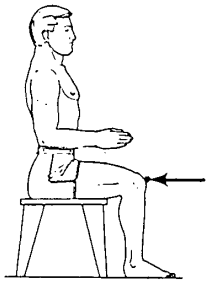
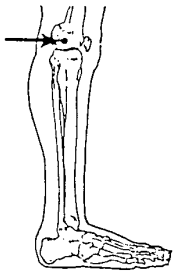
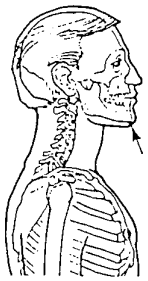
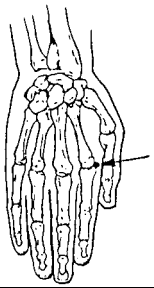
Fifth metatarsophalangeal protrusion: The lateral protrusion of the right foot in the region of the fifth metatarsophalangeal joint. 	**First metatarsophalangeal protrusion:** The medial protrusion of the right foot in the region of the first metatarsophalangeal joint. 
Glabella: The anterior point on the frontal bone midway between the bony brow ridges. 	**Infraorbitale, right:** The lowest point on the anterior border of the right bony eye socket. 
Knee point, anterior: The most protruding point of the right kneecap of a seated subject. 	**Lateral femoral epicondyle, standing:** Lateral point of the right femoral epicondyle (knee pivot point). 
Menton: The inferior point of the mandible in the midsagittal plane (bottom of the chin). 	**Metacarpale II:** The lateral point of the right metacarpophalangeal joint II (at the base of the index finger on the outer edge of the hand). 

Figure 4. Landmarks (continued).

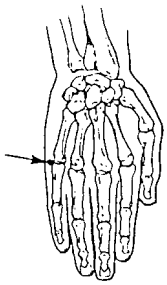
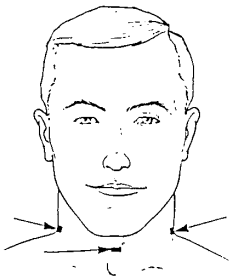
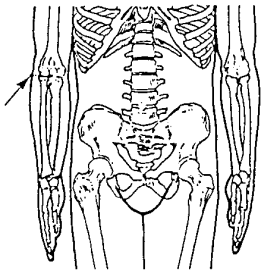
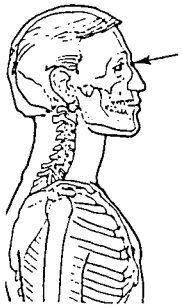
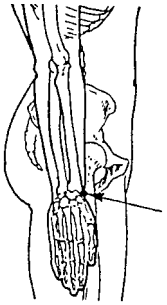
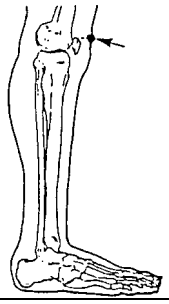
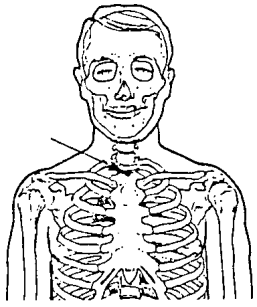
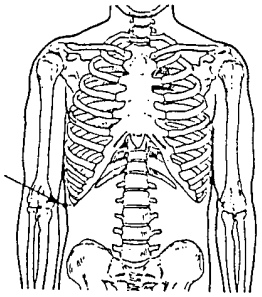
Metacarpale V: The medial point of the right metacarpophalangeal joint V (at the base of the little finger on the outer edge of the hand). 	**Neck: anterior, right lateral, and left lateral:** Anterior and lateral points at the base of the neck. 
Radiale: The highest point on the outside edge of the radius. 	**Sellion:** The point of the deepest depression of the nasal bones at the top of the nose. 
Stylion: The lowest point of the bottom of the radius. 	**Suprapatella:** The superior point of the patella (kneecap). 
Suprasternale: The inferior point of the jugular notch of the sternum (top of the breastbone). 	**Tenth rib:** The inferior point of the right tenth rib (bottom of the rib cage). 

Figure 4. Landmarks (continued).

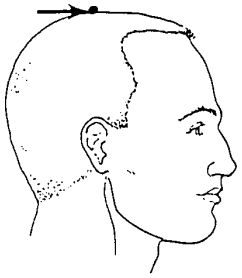
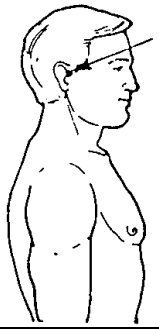
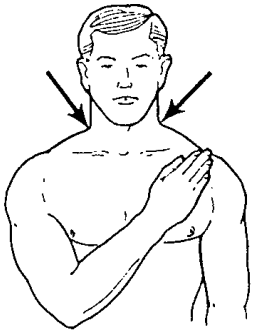
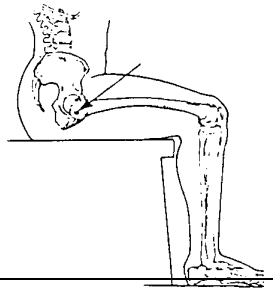
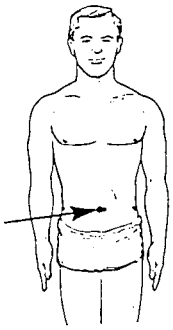
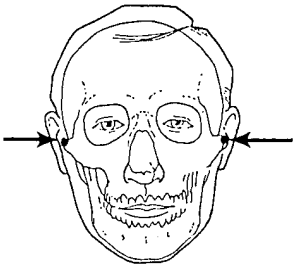
Top of head: The highest point on the head when the head is in the Frankfort plane. 	**Tragion, right:** The superior point on the juncture of the cartilaginous flap (tragus) of the ear with the head. 
Trapezius point, right and left: The point at which the anterior border of the trapezius muscle crosses the lateral neck landmark. 	**Trochanter:** A point at the center of the lateral surface of the right greater trochanter of the right femur of a sitting subject. 
Waist (omphalion): right and left; anterior and posterior: Level of the center of the navel. 	**Zygion, right and left:** The lateral point on the zygomatic arch. 

Figure 4. Landmarks (continued).

2.5 THE MEASUREMENTS

To the greatest extent possible, the measurement procedures used in AP2 were exactly the same as those used in ANSUR. The measurements are described and illustrated with photos in Chapter IV, along with the summary statistics. More detailed descriptions of the exact procedures used in taking the measurements can be found in the Measurer's Handbook (Clauser et al. 1988).

2.6 THREE-DIMENSIONAL SCANNING

One of the advances in anthropometric technology that occurred during the two decades since ANSUR was the development of reliable 3D scanners. It is not yet clear to what extent whole body scans will complement or replace traditional caliper and tape technology, but it is clear that digital images will have some role in the future of U.S. Army anthropology. By way of developing an initial database of digital images which might help guide Army decision-making about this technology in the future, soldiers who participated in this pilot study were scanned using a VITUS Smart 3D Body Scanner.

2.6.1 Three-Dimensional Body Scanner Hardware

The VITUS/Smart 3D Body Scanner (Figure 5) is designed to capture the surface of the human body in a few seconds. The scanning volume is approximately 2 m in height by 80 cm by 100 cm in depth and width. Resolution in X, Y, and Z is 6 mm (or less) in the middle of the scanning base for human subjects.

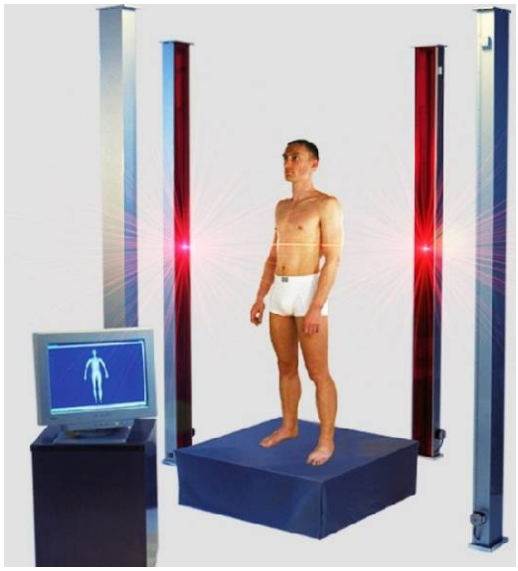


Figure 5. VITUS/Smart 3D whole body scanner

The VITUS/Smart 3D Body Scanner uses optical triangulation as the basis for measurement extraction. For this purpose, a CCD-Camera with integrated image processing hardware is combined with a laser pointing towards the object to produce images showing a laser line on the object surface. This combination of camera and laser is called a laser sensor. The laser illuminating the object is positioned at a fixed angle to the camera. In the resulting camera images, the light line position and shape correlates directly to the distance and shape of the object surface. Based on the known distance and angle between the camera and the laser, coordinates of 3D points along the laser line on the scanned object can be calculated from the position and shape of the laser line in an image. To perform the scanning of a 3D area with a laser sensor, the sensor is moved linearly along the object to be scanned, while the camera records a set of images. From each image, a set of 3D points along the laser line (i.e., x, y, and z positions of surface points on the object) is derived by triangulation. By combining the surface points derived from all the images taken during the scan process, a 3D model of the surface of the scanned object can be formed.

It is impossible for one sensor to scan an entire body, as it can only "see" those parts of the object that face towards the camera. Therefore, several sensors have to be combined to scan the object from different directions. A calibration procedure ensures that the data delivered by several sensors can be combined to form a single 3D model of the scanned object.

Even after combining the output of several laser sensors, there may be parts of the object that cannot be scanned because the cameras do not “see” them. If the lasers point horizontally towards the object and the cameras are fixed above the lasers pointing slightly downward to record images showing the object with the laser lines, then it is impossible for the cameras to “see” the area below the horizontal laser line (e.g., under the chin of a standing person).

To remedy this problem, each sensor head is equipped with two cameras. One-half of the cameras are located above the lasers pointing slightly downwards, and the other half are mounted

underneath the lasers pointing upwards, thus covering the same measuring range. This method, called double triangulation, enables body areas such as the shoulder or under the chin to be scanned.

The mechanical set-up for a complete 360° scan consists of four columns (each containing a double triangulation sensor) placed at approximately 90° angles to one other. Each column consists of a double triangulation sensor (diode laser with a cylindrical lens in front and two CCD matrix video cameras). The sensors are initially arranged at the same horizontal level in each column and move from top to bottom in the columns to scan the entire body.

The lasers are switched on (pulsed) when the measurement begins. During the measurement, the slides travel vertically at a defined speed. The camera signals are acquired during the measuring procedure in real-time as described above. The measuring time and section density (system resolution in the vertical direction) are dependent upon traveling speed. In this case, the data acquisition took approximately 15 seconds, with a resolution of 6 mm in the vertical direction. The scanned data are stored on the hard drive.

2.6.2 Three-Dimensional Body Scanner Software

ScanWorX is Human Solutions' system of software components developed for the processing of the 3D scan data. ScanWorX consists of different modules, which can be combined for different applications. In addition to the measurement data, socio-demographic information was collected and stored to enlarge the possibilities of statistical analysis.

2.6.3 Scanning Process

The prerequisite for reliable body measurements is the correct position and posture of the subject during the scanning process. Soldiers were briefed on the correct posture, both verbally and by means of an illustrated poster. The correct scanning posture was defined as follows and was checked by the scan operator prior to taking the scan:

- The soldier stands on the scanner platform with his or her feet on "footprints" painted on the platform. The footprints are positioned 20 cm. apart. The soldier stands erect with the weight distributed equally on both feet.
- The soldier forms fists, slightly bends the arms at the elbows, and positions the hands approximately one hand width away from the hips. The backs of the hands are turned towards the front.
- The subject looks straight ahead with the head held in a position that approximates the Frankfurt plane.
- The soldier breathes normally and stands relaxed without flexing his or her muscles.

2.6.4 Scan Wear

Special tight fitting scan-wear was used in order to guarantee a wrinkle-free body shape and therefore a wrinkle-free scan surface (Figure 6). This is important for the measurement extraction, as well as for further processing of the scan. Nylon skull caps were used to produce smooth head shapes that would yield correct head dimensions. It was found that even for bald soldiers scans were improved if the skull caps were worn.

Figure 6. Scan wear.

2.6.5 Scan

The scan was filed in a directory named by the subject number of the recruit and was put into the system via the bar code reader. The scan was stored in a highly compressed format (0.6MB to 1MB, depending on the size and shape of the scanned subject). Figure 7 shows a sample scan.

In the implementation for this pilot study, the scanner was set up in a separate room, adjacent to the participant waiting room. Soldiers donned the scan wear in a nearby restroom, and then put on their PT shorts and tank tops (females) over the scan wear for modesty as they walked through the waiting room. Soldiers then went into the scanning room, and with the door closed, removed their PT shorts and tank tops (females). The scanner operator placed non-reflective hemispheres (called "buttons") about 1 cm in diameter on 11 of the landmarks that had been previously marked by the measurers. Immediately after scanning, the operator visually checked the scan for completeness and correct subject posture. If the scan was deficient in any way, it was repeated. The scans were electronically delivered to NSRDEC on a daily basis. There were a few soldiers who, for various reasons, were not scanned. Thus the scanned participants form a subset of the total pilot study sample. The demographic distribution of the scanned subset is shown in Table 1.

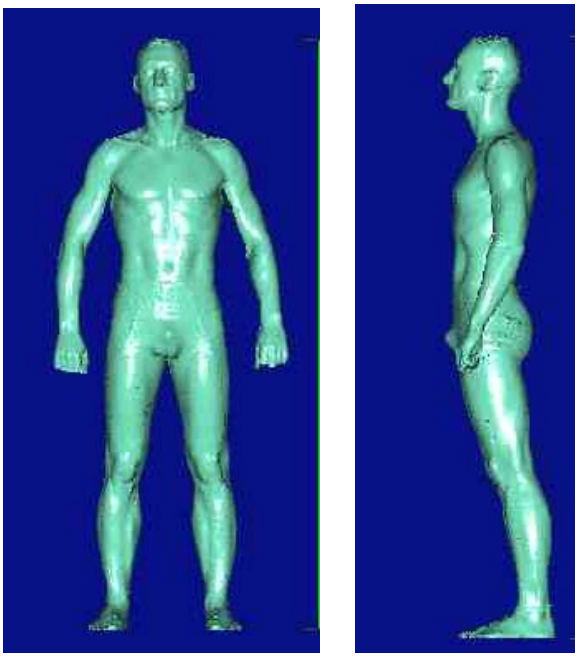


Figure 7. Sample of a 3D body scan.

TABLE 1. Demographic Distribution of Scanned Participants.

SCANNED SOLDIERS	Number Scanned			Percent Scanned		
	Female	Male	Total	Female	Male	Total
Population Group						
White not of Hispanic Origin	306	1759	2065	50.83%	64.81%	62.27%
Black not of Hispanic Origin	160	419	579	26.58%	15.44%	17.46%
Native American/Alaskan	2	10	12	0.33%	0.37%	0.36%
Asian	16	64	80	2.66%	2.36%	2.41%
Hispanic	59	308	367	9.80%	11.35%	11.07%
Pacific Islander	8	15	23	1.33%	0.55%	0.69%
Mixed	26	53	79	4.32%	1.95%	2.38%
Other	25	85	110	4.15%	3.13%	3.32%
Not available	0	1	1	0.00%	0.04%	0.03%
Military Component						
Army Active Duty	269	1425	1694	44.68%	52.51%	51.09%
Army Reserve	217	766	983	36.05%	28.22%	29.64%
Army National Guard	114	520	634	18.94%	19.16%	19.12%
U.S. Coast Guard	1	0	1	0.17%	0.00%	0.03%
Not available	1	3	4	0.17%	0.11%	0.12%
Total	**602**	**2714**	**3316**	**18.15%**	**81.85%**	**100.00%**

CHAPTER III

THE SAMPLE

3.1 SAMPLE ACQUISITION

Funding limitations for A2P prohibited the kind of 3-stage (post/unit/soldier demographics) stratified random sampling technique utilized in 1987 and 1988 for the ANSUR survey. Instead two posts were chosen for the study—one for sampling active duty soldiers (Ft. Hood) and the other for National Guard subjects (Ft. McCoy). Site selection was heavily influenced by combat commitments, troop rotations, and willingness of military leaders on post to support the study.

Unit acquisition at Ft. McCoy was directly related to the schedule of units processing in for pre-deployment training there, and initial projections indicated that most of the units would be National Guard. This worked well as preliminary studies suggested that the body size distributions of Army Reserve soldiers were intermediate between active duty and National Guard, and reducing the study to two components could maximize statistical power while still meeting the needs of the pilot study. Unit acquisition at Ft. Hood was conducted through the III Corps G3 (Operations and Training) office. Units that were already deployed or about to be deployed in the immediate future were not included in the study. Other units providing a broad range of combat, combat support, and combat service support soldiers were tasked by the G3 for participation in the study.

3.2 SAMPLING TARGETS

Power analyses were done in advance to establish minimum sample sizes needed to meet three pilot study objectives: 1) to test for significant differences between the means of 2007 active duty soldiers and 1988 active duty soldiers; 2) to test for significant differences between the means of active duty and National Guard soldiers; and 3) to estimate mean and 5^{th} /95^{th} percentile ranges needed for interim sizing and design guidance until the ANSUR database can be fully updated. In the case of mean comparisons between Army components and between the 1988 and 2007 active duty populations, 90% detection of differences twice the size of observer error is desirable, using two sided α=.05 tests. In the case of mean and percentile estimates for establishing anthropometric accommodation ranges in requirements documents, 1% precision and 95% confidence is desirable.

Generally, waist and chest circumference measurements are the most variable body dimensions in anthropometric surveys, thus providing "worst case" scenarios for power estimates. The A2P power analyses used (1) means and variances from waist and chest circumferences of active duty male soldiers[1] measured during a recent JSLIST fit test conducted by the JPMO in order to provide the most realistic estimates possible (Bradtmiller, 2005) and (2) standard power equations such as those published in Sokal & Rohlf (1994) and Zar (1998). The A2P power analyses were executed in Stata Version 9 *sampsi* routines (StataCorp, 2005). Observer error estimates for waist circumference (6 mm) and chest circumference (7 mm) were taken from the larger of male and female observer errors reported from the ANSUR survey (Gordon et al., 1989), where inter-observer error was measured daily. The resulting minimum sample sizes based on male waist and chest circumference are listed in Table 2.

[1] National Guard subjects in the JSLIST study had slightly lower variances than those of Active Duty subjects, so Active Duty statistics were used in power equations to establish sample size requirements.

TABLE 2. Minimum Sample Sizes Based on Male Waist and Chest Circumference

Application	Power	Sample Sizes	
		Waist Circ	Chest Circ
Mean Estimates	95% confidence & 1% precision	505	296
5th/95th Percentile Estimates	95% confidence & 1% precision	1187	696
Comparison of Means	90% detection of differences $\geq$ 2*observer error in a Two-sided, α = .05 test	1577	851

As can be seen in Table 2, the most demanding application in terms of sample size required is the test for mean differences between Army components. However, knowing whether active duty anthropometric distributions are significantly different from those of the National Guard is crucial to valid decision making when establishing total Army design criteria, and for planning and executing another large-scale survey, should that prove necessary. Note also that the minimum sample sizes based on waist circumference variability are much higher than those for chest circumference. It is tempting to choose a lower sample size requirement based on chest circumference; doing so, however, would reduce the power of tests between components from 90% to 66.4%, which is an unacceptably low power for such an important hypothesis test. Thus a minimum sample size of approximately 1,577 soldiers is needed in each component group in order to detect 12-mm (twice observer error) differences in waist circumference at the .05 level with 90% confidence. As can also be seen in Table 2, this sample size is more than sufficient for estimating mean and percentile values, and because waist circumference is the most variable of all the dimensions selected for the current study, sample sizes based on waist circumference will provide more than enough power for similar comparisons based on other body dimensions.

Power analyses such as those described above are usually applied separately for males and females because most statistical analyses and engineering applications of anthropometric data treat males and females separately. However females represent only about 15.5% of Army soldiers, and without sampling multiple posts and specifically targeting units with high percentages of females (as was done in ANSUR using TRADOC posts), one cannot possibly expect to capture 1,577 females in a pilot study. In general, with convenience sampling of whole units at two sites, the best that could be hoped for were unbiased samples of active duty and National Guard components with demographic distributions representative of the current Army population. Thus female sampling targets were established because they represent 15.5% of today's Army soldiers.

In the end, available funding supported an estimated 1800 subjects per site, which was quite close to the ideal numbers based on power analyses. Representative samples were desired, so active duty and National Guard demographic frequencies from the Defense Manpower Data Center (DMDC, 2006) were used to distribute the targeted 1800 subjects into demographic sampling units (see Table 3). Although slightly below the ideal of 1,577 subjects per site, the estimated samples of 1547 males at Ft. Hood and 1564 at Ft. McCoy rendered a Stata 9.0 power estimate of 89.63% for a test of mean differences, which was considered close enough to 90% to be acceptable.

TABLE 3. Sampling Targets by Demographic Breakdown.
(N=1800 each post)

	White	Black	Hispanic	Asian, NH/PI, AI/AN, Other	Total
FT. HOOD					
Males	997	294	156	100	1547
Females	109	95	28	21	253
FT. McCOY					
Males	1191	189	113	71	1564
Females	149	55	18	14	236

With only two measuring sites and a relatively small total number of soldiers in each component and sex subgroup, it was considered impractical to set age-specific targets within each subgroup's racial/ethnic sampling strata. Instead, DMDC 2006 representative age distributions for each component and sex subgroup were used as a guide while in the field, to ensure that any gross biases in age distribution were caught and corrected if necessary while subjects were still being accessed. The desired age distributions based on DMDC 2006 data are shown in Table 4.

TABLE 4. Age Distribution for Active Army and National Guard Troops.

	Males		Females	
Age	Active	Guard	Active	Guard
17-20	12%	13%	15%	22%
21-25	33%	23%	34%	29%
26-35	35%	28%	33%	25%
36+	20%	36%	18%	23%

In short, sampling targets for the A2P study were established with the intention of measuring demographically representative samples of active duty and National Guard soldiers, and with sufficient sample sizes for 90% or better confidence in hypothesis tests and design parameters based on male subjects. The measuring team was instructed to measure every female available at each site in order to boost the sample sizes for female soldiers. However, since only 14-15% of U.S. Army soldiers are female and since the subjects were measured at only two measuring sites, it was known in advance that this pilot study could not possibly access sufficient numbers of female soldiers to provide parameter estimates and hypothesis tests of the same quality and validity as possible for the male sample.

3.3 STUDY SAMPLE RESULTS

Although the team originally planned on acquiring a two-component study sample composed of active duty and National Guard soldiers—each providing relatively robust sample sizes— matters in the field turned out differently. As can be seen in Table 5, the A2P sample comprises a robust sample of active duty subjects, but only modest samples of Army Reserve and National Guard subjects. This happened because unit rotation and associated training schedules changed between the time the study was planned and the time that the measuring team arrived at Ft. McCoy and because there was insufficient funding to add a third measuring site. This sample distribution reduced power in comparisons among the three Army components (which are reported in a separate technical report) and reduced the precision of

Reserve- and Guard-specific parameter estimates. However, once comparisons among Army components determined that total-Army statistical distributions should be used for interim design and acquisition guidance, the presence of Army Reserves in the study became an advantage instead of a disadvantage.

TABLE 5. A2P Subjects Measured at Both Sites.

Sample	Male	Female	Total
Regular Army	1,475	287	1,762
Army Reserve	771	246	1,017
National Guard	565	118	683
Total	2,811	651	3,462

The distribution of study subjects by sex and racial/ethnic group is presented in Table 6. Sampling goals were met or exceeded in five of eight sampling cells at Ft. Hood, and met or exceeded in seven of eight sampling cells at Ft. McCoy (see Table 3 for make-up of sampling cells).

TABLE 6. Racial/Ethnic Distribution of the Study Sample.

	Active				Reserve				National Guard			
Race/Ethnicity	Male	Ethnicity	Female	Ethnicity	Male	Ethnicity	Female	Ethnicity	Male	Ethnicity	Female	Ethnicity
White	870		115		469		131		369		70	
Black	224		76		129		72		74		16	
Hispanic	156		33		91		21		84		18	
Mexican		80		20		29		5		14		3
Puerto Rican		46		3		40		11		65		8
Other Hispanic		30		10		22		5		5		7
Asian/PI	42		15		28*		4		9		5	
Filipino		14		4		10		1		2		4
Samoan		3		5		2		0		0		0
Korean		6		1		3		0		2		1
Vietnamese		1		1		6		2		0		0
OtherAsian		5		1		5		1		4		0
Other PI		13		3		1		0		1		0
AmerInd	12		1		3		0		0		0	
Mixed Other	171		47		51		18		29		9	
Totals	1,4		287		771		246		565		118	

* 1 Asian/PI Reservist had missing data for ethnicity

3.4 SAMPLE WEIGHTING

In order to obtain statistics for a demographically representative sample of the total-Army population, subjects in the A2P study sample need to be weighted to match total-Army demographic distributions. For the purpose of weighting, sample cells were created based on age/race/sex, calculating age from the DMDC 2006 age distribution chart (Table 4). Sample weights are calculated for each age/race/sex sampling cell as the ratio of target population proportion over sample population proportion, or $W = pT/pS$. Subject weights are greater than 1 when the sample proportion of the A2P cell is smaller

than the comparable population proportion of the total Army; weights are smaller than 1 when the sample proportion of the A2P cell is larger than the comparable population proportion of the total Army.

Table 7 shows the resulting A2P total-Army subject weights used in calculating the statistics presented in this report. Appendix D presents demographic data for the A2P sample and total-Army demographics as of 2007, when the A2P study was completed.

Table 7. Total Army Weights.

Males					Females				
Age Range	White	Black	Hispanic	Other	Age Range	White	Black	Hispanic	Other
ACTIVE									
≤20	0.4741	0.4194	0.5597	0.1194	≤20	0.6040	0.7874	0.6206	0.1653
21-25	0.7988	0.8132	0.6946	0.3050	21-25	0.8311	0.8733	0.7768	0.3610
26-35	1.0380	1.2136	0.8207	0.3733	26-35	1.2580	1.2179	1.0496	0.3648
≥36	1.8522	1.1312	1.8937	0.8467	≥36	1.1336	1.9699	2.8699	0.4184
RESERVE									
≤20	0.4097	0.4123	0.3988	0.1320	≤20	0.6246	0.4321	2.9249	0.2409
21-25	0.7159	0.7091	0.6290	0.3843	21-25	0.7197	1.2069	1.0627	0.8668
26-35	1.3351	0.7708	0.7105	1.1570	26-35	1.1474	2.0951	1.5263	1.8973
≥36	1.9636	1.9356	2.2523	1.1529	≥36	1.1996	1.0756	0.9389	0.6778
GUARD									
≤20	2.5026	2.2553	1.4453	1.5634	≤20	2.1739	4.0972	3.4329	0.9647
21-25	1.4878	1.2224	0.9607	0.6066	21-25	1.2413	4.9674	0.6317	0.4812
26-35	1.6938	1.4624	0.5744	1.1808	26-35	1.4406	1.1458	0.4997	0.8617
≥36	1.6687	1.1178	0.6986	1.1749	≥36	1.4026	3.4455	0.6823	0.6111

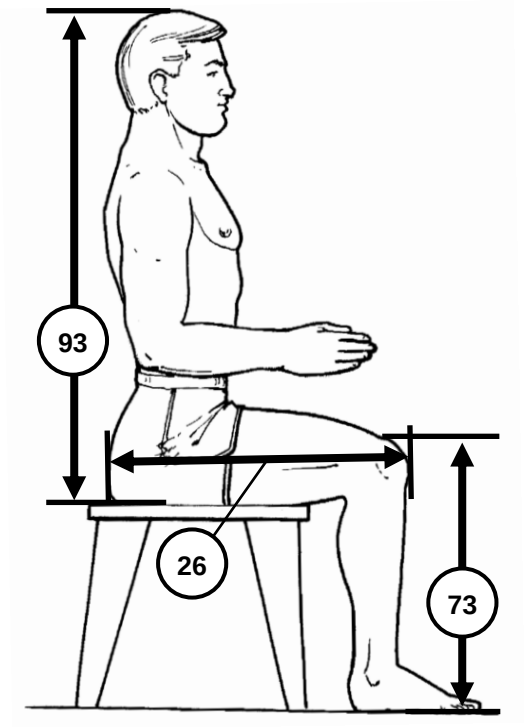
CHAPTER IV

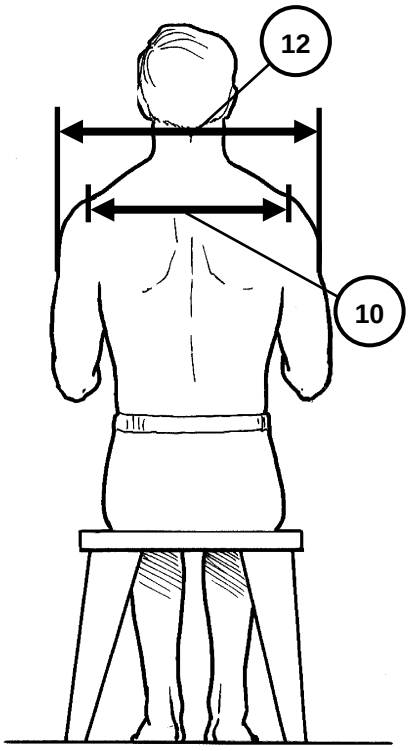
THE TRADITIONAL MEASUREMENTS

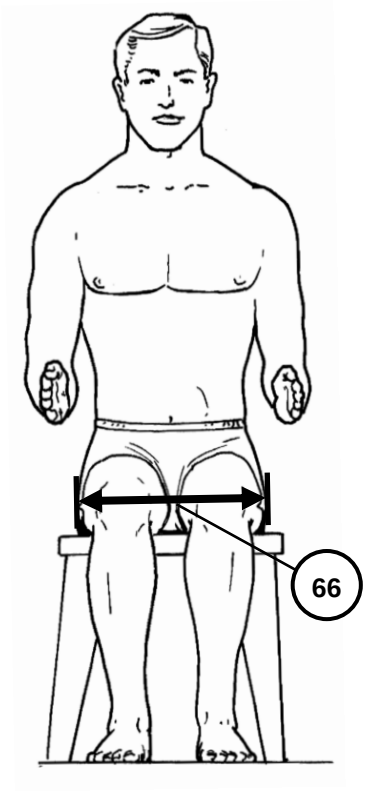
Twenty-five measured dimensions were obtained in this survey using traditional measuring instruments and methods. Where there was a choice of right or left, all measurements were taken on the right side except in rare cases where an injury or anatomical abnormality made it necessary to measure on the left side. All measurements were made to the nearest millimeter. Weight was taken to the nearest 0.1 kilogram. Detailed, illustrated instructions for making these measurements can be found in the Measurer's Handbook (Clauser et al. 1988).

Summary statistics, including means, standard deviations, and percentile values for male and female subjects, are tabulated on the following pages. Frequency tables for each dimension are also given. Users of these data will note .00 standard error (SE) values for some means and standard deviations. This occurs because values in these tables are not listed beyond two decimal places.

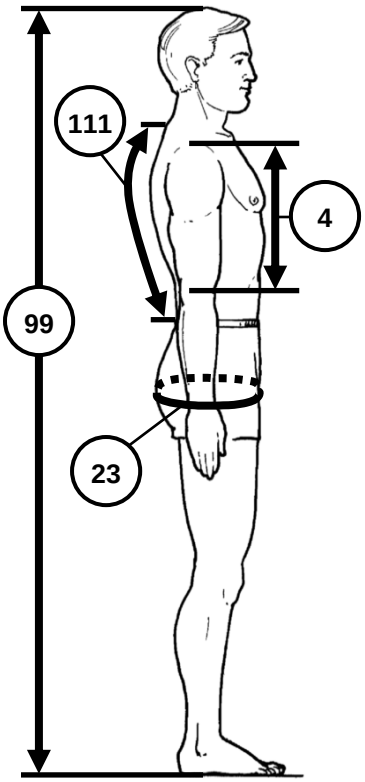
A visual index, designed to assist the reader in locating particular dimensions whose names may be unfamiliar, appears on the following pages. The bulk of this section contains the data pages, which include brief measurement descriptions, percentile tables, summary statistics and frequency tables, as well as illustrations of the measured dimensions.

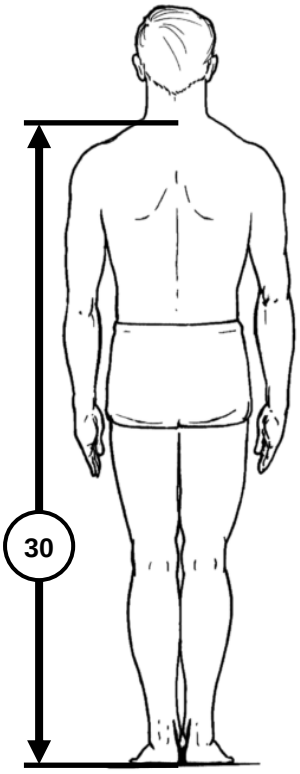


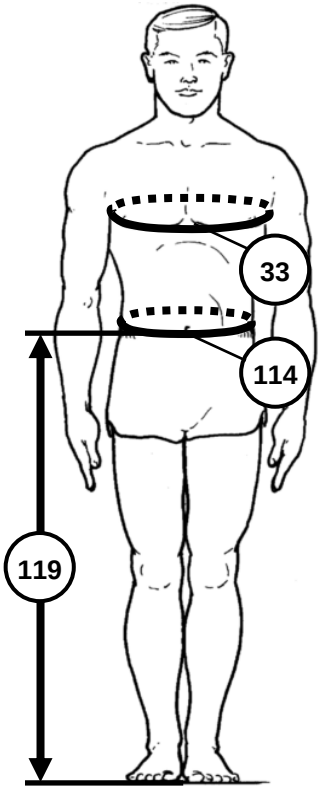




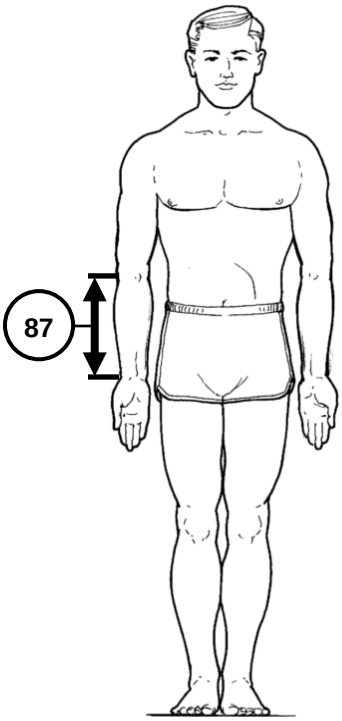
(10) BIACROMIAL BREADTH
(12) BIDELTOID BREADTH
(26) BUTTOCK-KNEE LENGTH
(66) HIP BREADTH, SITTING
(73) KNEE HEIGHT, SITTING
(93) SITTING HEIGHT

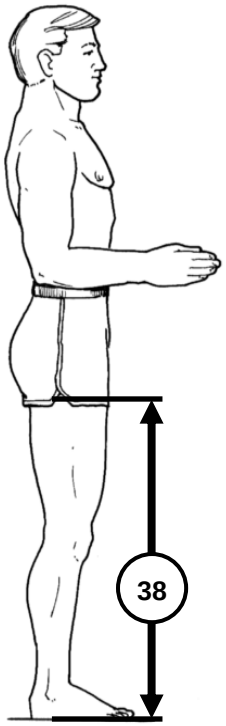


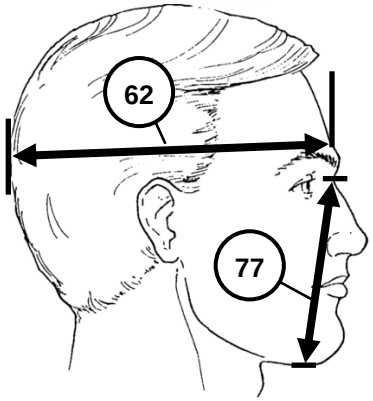




(4) ACROMION-RADIALE LENGTH
(23) BUTTOCK CIRCUMFERENCE
(30) CERVICALE HEIGHT
(33) CHEST CIRCUMFERENCE
(99) STATURE
(111) WAIST BACK LENGTH (OMPHALION)
(114) WAIST CIRCUMFERENCE (OMPHALION)
(119) WAIST HEIGHT OMPHALION





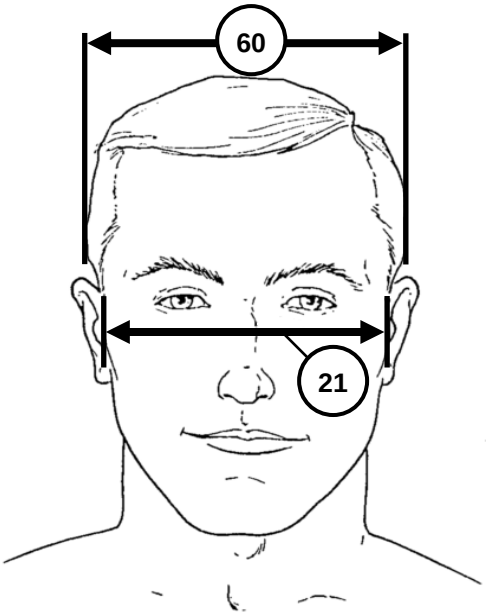


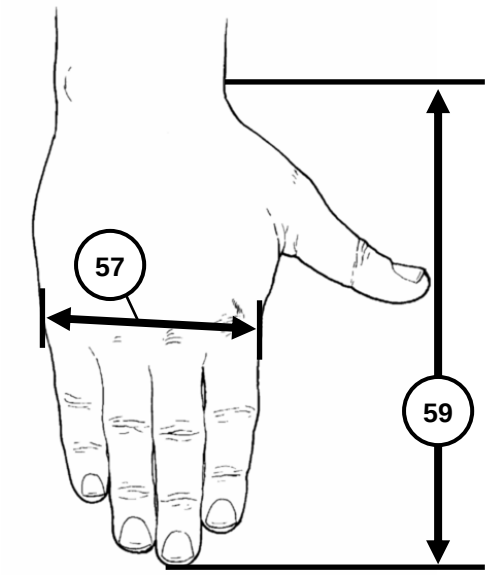
(38) CROTCH HEIGHT

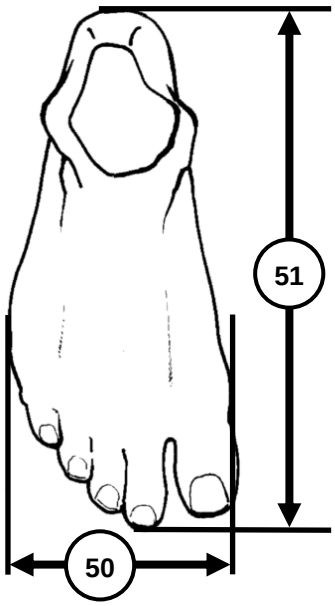
(62) HEAD LENGTH

(77) MENTON-SELLION LENGTH

(87) RADIALE-STYLION LENGTH



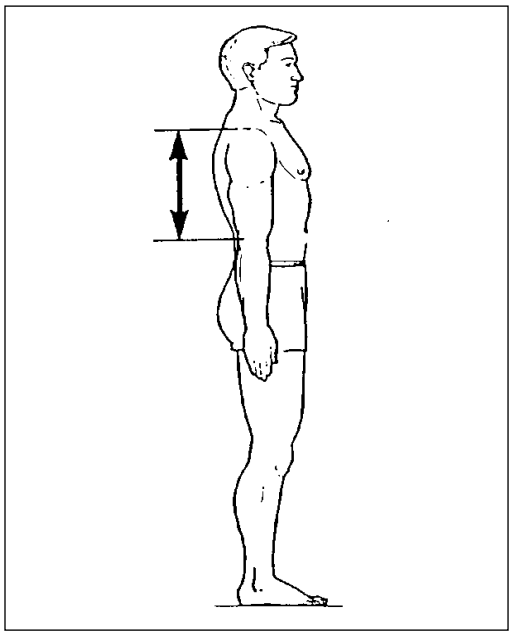




(21) BIZYGOMATIC BREADTH
(50) FOOT BREADTH, HORIZONTAL
(51) FOOT LENGTH
(57) HAND BREADTH
(59) HAND LENGTH
(60) HEAD BREADTH

(4) ACROMION-RADIALE LENGTH

The distance between the acromion landmark on the tip of the right shoulder and the radiale landmark on the right elbow is measured with a beam caliper held parallel to the long axis of the arm. The subject stands erect. The shoulders and upper extremities are relaxed with the palms facing the thighs.



PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
26.85	10.57	1ST	29.20	11.50
27.40	10.79	2ND	29.70	11.69
27.70	10.91	3RD	30.00	11.81
28.00	11.02	5TH	30.30	11.93
28.70	11.30	10TH	30.90	12.17
29.00	11.42	15TH	31.30	12.32
29.30	11.54	20TH	31.60	12.44
29.70	11.69	25TH	32.00	12.60
29.90	11.77	30TH	32.20	12.68
30.20	11.89	35TH	32.40	12.76
30.30	11.93	40TH	32.70	12.87
30.60	12.05	45TH	33.00	12.99
30.90	12.17	50TH	33.20	13.07
31.20	12.28	55TH	33.40	13.15
31.40	12.36	60TH	33.60	13.23
31.60	12.44	65TH	33.90	13.35
31.90	12.56	70TH	34.10	13.43
32.30	12.72	75TH	34.30	13.50
32.50	12.80	80TH	34.60	13.62
32.70	12.87	85TH	35.00	13.78
33.00	12.99	90TH	35.40	13.94
33.80	13.31	95TH	36.10	14.21
34.10	13.43	97TH	36.50	14.37
34.37	13.53	98TH	37.00	14.57
34.73	13.67	99TH	37.30	14.69

ACROMION-RADIALE LENGTH

FEMALES		
CM		INCHES
30.90	MEAN	12.16
0.07	SE (MEAN)	0.03
1.74	STD. DEVIATION	0.69
0.05	SE (STD.DEV)	0.02
25.80	MINIMUM	10.16
36.20	MAXIMUM	14.25
	SKEWNESS	0.00
	KURTOSIS	2.67
	COEF VAR	5.6%
	N	651

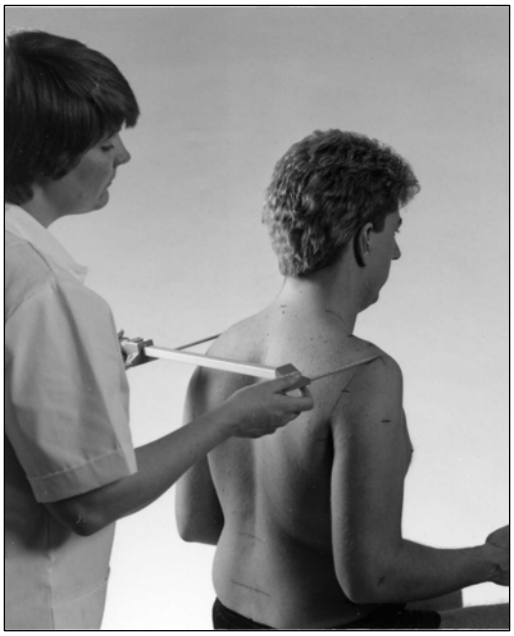
MALES		
CM		INCHES
33.16	MEAN	13.06
0.03	SE (MEAN)	0.01
1.76	STD DEVIATION	0.69
0.02	SE (STD DEV)	0.01
27.4	MINIMUM	10.79
40.3	MAXIMUM	15.87
	SKEWNESS	0.11
	KURTOSIS	3.01
	COEF VAR	5.3%
	N	2811

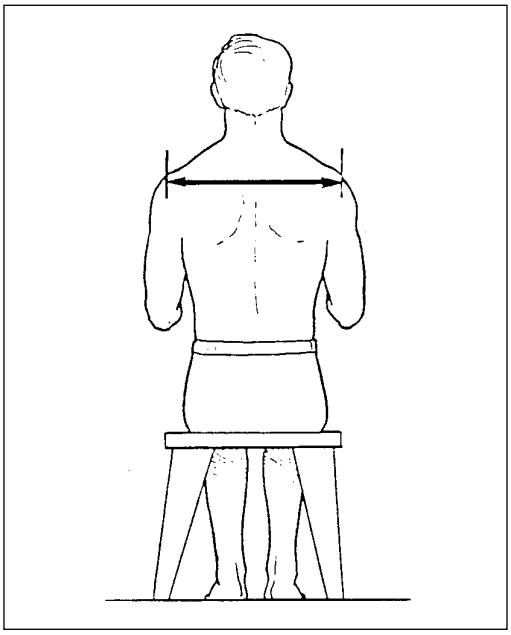
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.14	1	0.14	25.75	-	26.25				
2	0.29	3	0.44	26.25	-	26.75				
6	0.89	9	1.33	26.75	-	27.25				
14	2.21	23	3.54	27.25	-	27.75	2	0.08	2	0.08
17	2.66	40	6.19	27.75	-	28.25	2	0.08	4	0.16
30	4.66	70	10.85	28.25	-	28.75	2	0.08	6	0.24
54	8.24	124	19.09	28.75	-	29.25	23	0.83	29	1.07
57	8.72	181	27.81	29.25	-	29.75	38	1.33	67	2.41
60	9.20	241	37.00	29.75	-	30.25	64	2.29	131	4.70
65	10.02	306	47.03	30.25	-	30.75	113	4.01	244	8.70
65	10.00	371	57.02	30.75	-	31.25	156	5.54	400	14.24
69	10.60	440	67.62	31.25	-	31.75	231	8.22	631	22.46
44	6.71	484	74.33	31.75	-	32.25	239	8.48	870	30.94
84	12.82	568	87.15	32.25	-	32.75	311	11.04	1181	41.99
32	4.87	600	92.03	32.75	-	33.25	282	10.05	1463	52.03
17	2.63	617	94.65	33.25	-	33.75	300	10.68	1763	62.72
20	3.03	637	97.68	33.75	-	34.25	314	11.15	2077	73.87
9	1.43	646	99.11	34.25	-	34.75	248	8.81	2325	82.68
3	0.53	649	99.64	34.75	-	35.25	167	5.95	2492	88.63
1	0.17	650	99.81	35.25	-	35.75	116	4.12	2608	92.75
1	0.19	651	100.00	35.75	-	36.25	95	3.36	2703	96.11
				36.25	-	36.75	46	1.65	2749	97.76
				36.75	-	37.25	30	1.08	2779	98.84
				37.25	-	37.75	14	0.50	2793	99.34
				37.75	-	38.25	7	0.26	2800	99.61
				38.25	-	38.75	7	0.23	2807	99.84
				38.75	-	39.25	2	0.09	2809	99.92
				39.25	-	39.75	0	0.00	2809	99.92
				39.75	-	40.25	2	0.06	2811	99.99
				40.25	-	40.75	0	0.01	2811	100.00

(10) BIACROMIAL BREADTH

The distance between the right and left acromion landmarks at the tips of the shoulders is measured with a beam caliper. The subject sits erect. The shoulders and upper arms are relaxed and the forearms and hands are extended forward horizontally with the palms facing each other. The measurement is taken at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
32.26	12.71	1ST	36.20	14.25
32.70	12.87	2ND	36.90	14.53
32.90	12.95	3RD	37.21	14.65
33.27	13.10	5TH	37.70	14.84
34.06	13.41	10TH	38.40	15.12
34.60	13.62	15TH	38.80	15.28
35.00	13.78	20TH	39.20	15.43
35.38	13.93	25TH	39.50	15.55
35.60	14.02	30TH	39.80	15.67
35.90	14.13	35TH	40.10	15.79
36.10	14.21	40TH	40.30	15.87
36.40	14.33	45TH	40.60	15.98
36.60	14.41	50TH	40.90	16.10
36.90	14.53	55TH	41.10	16.18
37.10	14.61	60TH	41.40	16.30
37.40	14.72	65TH	41.60	16.38
37.70	14.84	70TH	42.00	16.54
38.00	14.96	75TH	42.20	16.61
38.30	15.08	80TH	42.50	16.73
38.60	15.20	85TH	42.90	16.89
39.00	15.35	90TH	43.40	17.09
39.50	15.55	95TH	44.10	17.36
40.00	15.75	97TH	44.53	17.53
40.40	15.91	98TH	44.87	17.67
41.10	16.18	99TH	45.44	17.89

BIACROMIAL BREADTH

FEMALES		
CM		INCHES
36.60	MEAN	14.41
0.07	SE (MEAN)	0.03
1.90	STD DEVIATION	0.75
0.05	SE (STD DEV)	0.02
31.10	MINIMUM	12.24
42.00	MAXIMUM	16.54
	SKEWNESS	-0.11
	KURTOSIS	2.78
	COEF VAR	5.2%
	N	651

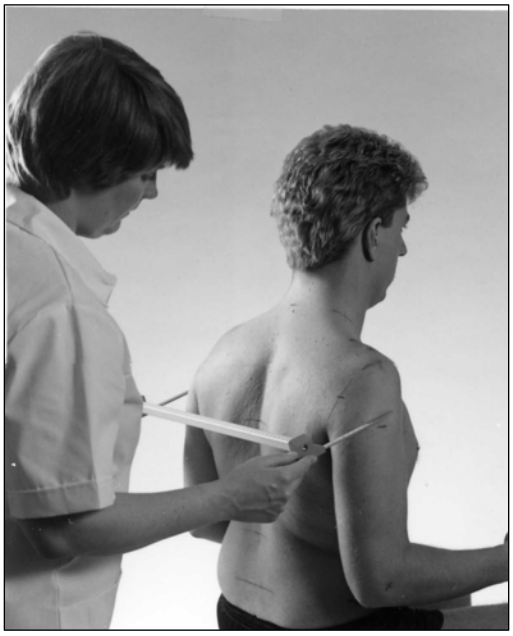
MALES		
CM		INCHES
40.87	MEAN	16.09
0.04	SE (MEAN)	0.01
1.96	STD DEVIATION	0.77
0.03	SE (STD DEV)	0.01
33.30	MINIMUM	13.11
47.50	MAXIMUM	18.70
	SKEWNESS	-0.02
	KURTOSIS	2.95
	COEF VAR	4.8%
	N	2809

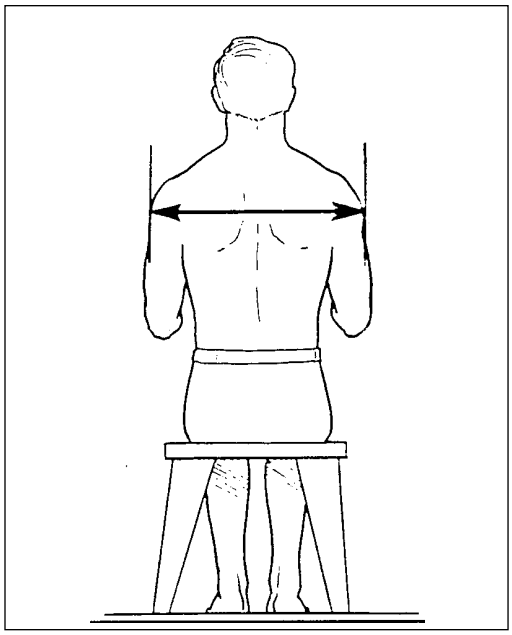
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
2	0.36	2	0.36	30.75	-	31.25				
0	0.00	2	0.36	31.25	-	31.75				
3	0.52	5	0.88	31.75	-	32.25				
9	1.36	14	2.24	32.25	-	32.75				
17	2.66	31	4.91	32.75	-	33.25				
23	3.52	54	8.42	33.25	-	33.75	0	0.02	0	0.02
20	3.12	74	11.54	33.75	-	34.25	2	0.05	2	0.07
37	5.69	111	17.23	34.25	-	34.75	1	0.05	3	0.12
38	5.86	149	23.09	34.75	-	35.25	5	0.17	8	0.29
61	9.41	210	32.51	35.25	-	35.75	9	0.33	17	0.62
59	9.01	269	41.51	35.75	-	36.25	11	0.40	28	1.02
70	10.81	339	52.32	36.25	-	36.75	15	0.52	43	1.53
66	10.12	405	62.44	36.75	-	37.25	41	1.46	84	3.00
53	8.11	458	70.55	37.25	-	37.75	59	2.08	143	5.08
59	9.04	517	79.59	37.75	-	38.25	105	3.72	248	8.81
52	8.04	569	87.63	38.25	-	38.75	128	4.55	376	13.35
39	5.92	608	93.55	38.75	-	39.25	221	7.86	597	21.21
17	2.57	625	96.11	39.25	-	39.75	236	8.40	833	29.61
10	1.50	635	97.62	39.75	-	40.25	233	8.28	1066	37.90
7	1.09	642	98.71	40.25	-	40.75	272	9.70	1338	47.60
6	0.84	648	99.54	40.75	-	41.25	270	9.63	1608	57.22
1	0.17	649	99.71	41.25	-	41.75	263	9.35	1871	66.57
2	0.29	651	100.00	41.75	-	42.25	245	8.73	2116	75.30
				42.25	-	42.75	229	8.15	2345	83.46
				42.75	-	43.25	151	5.36	2496	88.82
				43.25	-	43.75	116	4.14	2612	92.96
				43.75	-	44.25	79	2.82	2691	95.77
				44.25	-	44.75	51	1.82	2742	97.59
				44.75	-	45.25	31	1.10	2773	98.69
				45.25	-	45.75	24	0.87	2797	99.56
				45.75	-	46.25	7	0.26	2804	99.82
				46.25	-	46.75	2	0.08	2806	99.90
				46.75	-	47.25	1	0.04	2807	99.94
				47.25	-	47.75	2	0.06	2809	100.00

(12) BIDELTOID BREADTH

The maximum horizontal distance between the lateral margins of the upper arms on the deltoid muscles is measured with a beam caliper. The subject sits erect looking straight ahead. The shoulders and upper arms are relaxed, and the forearms and hands are extended forward horizontally with the palms facing each other. The measurement is made at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
38.94	15.32	1ST	43.30	17.05
39.10	15.39	2ND	44.00	17.32
39.50	15.55	3RD	44.40	17.48
40.10	15.79	5TH	45.10	17.76
40.90	16.10	10TH	46.16	18.17
41.40	16.30	15TH	46.90	18.46
41.80	16.46	20TH	47.40	18.66
42.34	16.67	25TH	47.86	18.84
42.80	16.85	30TH	48.30	19.02
43.30	17.05	35TH	48.70	19.17
43.63	17.18	40TH	49.20	19.37
44.10	17.36	45TH	49.60	19.53
44.40	17.48	50TH	50.10	19.72
44.90	17.68	55TH	50.40	19.84
45.20	17.80	60TH	50.90	20.04
45.60	17.95	65TH	51.30	20.20
46.10	18.15	70TH	51.80	20.39
46.58	18.34	75TH	52.40	20.63
47.20	18.58	80TH	52.90	20.83
47.90	18.86	85TH	53.70	21.14
48.80	19.21	90TH	54.40	21.42
50.20	19.76	95TH	55.70	21.93
50.85	20.02	97TH	56.70	22.32
51.38	20.23	98TH	57.30	22.56
53.00	20.87	99TH	59.05	23.25

BIDELTOID BREADTH

FEMALES		
CM		INCHES
44.65	MEAN	17.58
0.12	SE (MEAN)	0.05
3.08	STD DEVIATION	1.21
0.09	SE (STD DEV)	0.03
37.80	MINIMUM	14.88
55.00	MAXIMUM	21.65
	SKEWNESS	0.44
	KURTOSIS	2.95
	COEF VAR	6.9%
	N	651

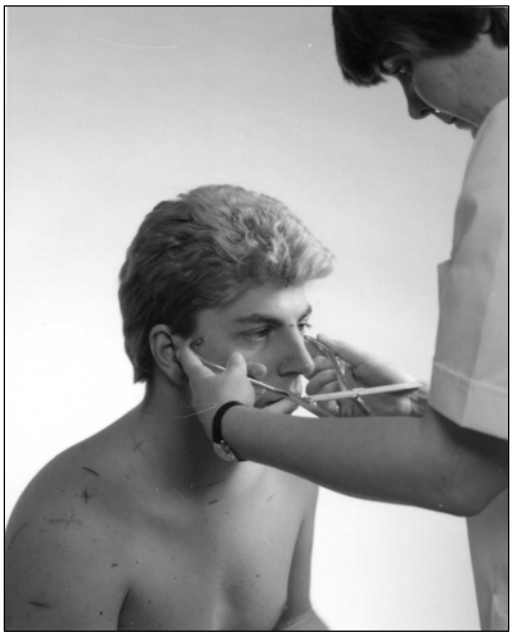
MALES		
CM		INCHES
50.18	MEAN	19.76
0.06	SE (MEAN)	0.02
3.26	STD DEVIATION	1.28
0.04	SE (STD DEV)	0.02
40.50	MINIMUM	15.94
62.00	MAXIMUM	24.41
	SKEWNESS	0.29
	KURTOSIS	3.10
	COEF VAR	6.5%
	N	2810

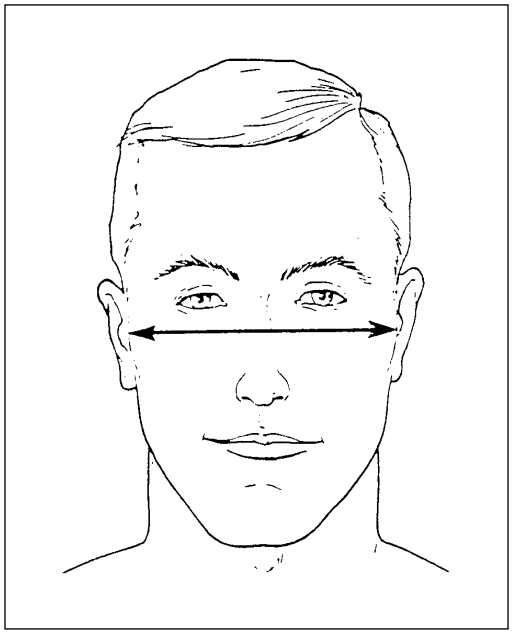
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.11	1	0.11	37.75	-	38.25				
3	0.51	4	0.62	38.25	-	38.75				
11	1.64	15	2.25	38.75	-	39.25				
10	1.52	25	3.77	39.25	-	39.75				
14	2.12	39	5.90	39.75	-	40.25				
18	2.74	57	8.64	40.25	-	40.75	2	0.06	2	0.06
34	5.27	91	13.91	40.75	-	41.25	2	0.08	4	0.14
37	5.62	128	19.53	41.25	-	41.75	2	0.09	6	0.23
33	5.08	161	24.61	41.75	-	42.25	3	0.11	9	0.34
32	4.94	193	29.55	42.25	-	42.75	2	0.08	11	0.42
31	4.72	224	34.27	42.75	-	43.25	15	0.55	26	0.96
43	6.60	267	40.87	43.25	-	43.75	17	0.59	43	1.55
39	6.03	306	46.91	43.75	-	44.25	27	0.96	70	2.51
49	7.54	355	54.44	44.25	-	44.75	35	1.24	105	3.75
38	5.82	393	60.26	44.75	-	45.25	42	1.50	147	5.25
40	6.14	433	66.40	45.25	-	45.75	70	2.48	217	7.73
33	5.11	466	71.51	45.75	-	46.25	73	2.58	290	10.32
34	5.27	500	76.78	46.25	-	46.75	110	3.90	400	14.22
22	3.46	522	80.24	46.75	-	47.25	122	4.35	522	18.57
19	2.84	541	83.08	47.25	-	47.75	141	5.03	663	23.60
24	3.73	565	86.81	47.75	-	48.25	175	6.24	838	29.84
18	2.77	583	89.58	48.25	-	48.75	150	5.33	988	35.17
14	2.11	597	91.69	48.75	-	49.25	164	5.83	1152	41.00
16	2.45	613	94.14	49.25	-	49.75	155	5.50	1307	46.50
9	1.32	622	95.46	49.75	-	50.25	160	5.68	1467	52.18
10	1.50	632	96.96	50.25	-	50.75	174	6.19	1641	58.37
7	1.02	639	97.97	50.75	-	51.25	157	5.58	1798	63.95
3	0.40	642	98.38	51.25	-	51.75	154	5.50	1952	69.45
1	0.22	643	98.60	51.75	-	52.25	132	4.71	2084	74.16
2	0.36	645	98.96	52.25	-	52.75	118	4.21	2202	78.37
3	0.49	648	99.45	52.75	-	53.25	101	3.61	2303	81.98
0	0.00	648	99.45	53.25	-	53.75	109	3.87	2412	85.84
1	0.19	649	99.64	53.75	-	54.25	86	3.05	2498	88.89
0	0.00	649	99.64	54.25	-	54.75	85	3.02	2583	91.91
2	0.36	651	100.00	54.75	-	55.25	53	1.88	2636	93.80
				55.25	-	55.75	40	1.44	2676	95.24
				55.75	-	56.25	31	1.09	2707	96.33
				56.25	-	56.75	20	0.71	2727	97.04
				56.75	-	57.25	25	0.89	2752	97.93
				57.25	-	57.75	14	0.51	2766	98.43
				57.75	-	58.25	10	0.35	2776	98.78
				58.25	-	58.75	2	0.08	2778	98.87
				58.75	-	59.25	7	0.24	2785	99.10
				59.25	-	59.75	8	0.28	2793	99.39
				59.75	-	60.25	4	0.16	2797	99.55
				60.25	-	60.75	8	0.30	2805	99.84
				60.75	-	61.25	2	0.07	2807	99.91
				61.25	-	61.75	1	0.03	2808	99.94
				61.75	-	62.25	2	0.06	2810	100.00

(21) BIZYGOMATIC BREADTH

The maximum horizontal breadth of the face (between the zygomatic arches) is measured with a spreading caliper.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
12.10	4.76	1ST	13.00	5.12
12.30	4.84	2ND	13.20	5.20
12.40	4.88	3RD	13.30	5.24
12.55	4.94	5TH	13.40	5.28
12.70	5.00	10TH	13.60	5.35
12.90	5.08	15TH	13.70	5.39
13.00	5.12	20TH	13.80	5.43
13.10	5.16	25TH	14.00	5.51
13.12	5.17	30TH	14.10	5.55
13.27	5.23	35TH	14.20	5.59
13.30	5.24	40TH	14.20	5.59
13.40	5.28	45TH	14.30	5.63
13.50	5.31	50TH	14.40	5.67
13.50	5.31	55TH	14.50	5.71
13.60	5.35	60TH	14.50	5.71
13.70	5.39	65TH	14.60	5.75
13.70	5.39	70TH	14.70	5.79
13.80	5.43	75TH	14.80	5.83
14.00	5.51	80TH	14.90	5.87
14.00	5.51	85TH	15.10	5.94
14.20	5.59	90TH	15.30	6.02
14.40	5.67	95TH	15.50	6.10
14.50	5.71	97TH	15.70	6.18
14.60	5.75	98TH	15.80	6.22
14.80	5.83	99TH	16.10	6.34

BIZYGOMATIC BREADTH

FEMALES		
CM		INCHES
13.47	MEAN	5.30
0.02	SE (MEAN)	0.01
0.57	STD DEVIATION	0.23
0.02	SE (STD DEV)	0.01
11.70	MINIMUM	4.61
16.10	MAXIMUM	6.34
	SKEWNESS	0.06
	KURTOSIS	3.26
	COEF VAR	4.3%
	N	651

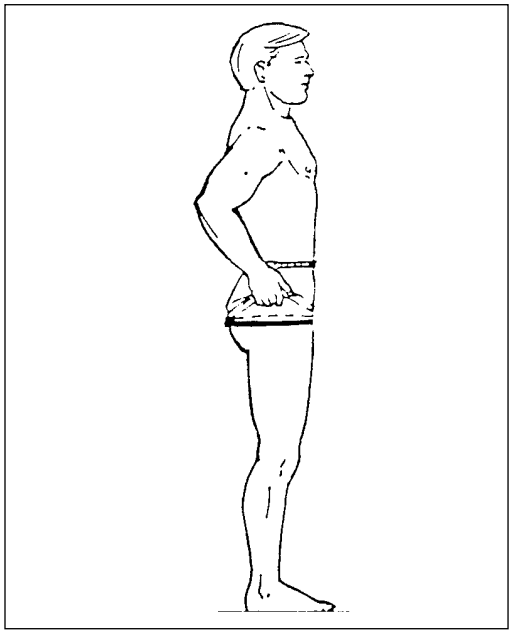
MALES		
CM		INCHES
14.41	MEAN	5.67
0.01	SE (MEAN)	0.00
0.65	STD DEVIATION	0.26
0.01	SE (STD DEV)	0.00
12.60	MINIMUM	4.96
17.00	MAXIMUM	6.69
	SKEWNESS	0.28
	KURTOSIS	3.08
	COEF VAR	4.5%
	N	2811

FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
3	0.44	3	0.44	11.65	-	11.75				
0	0.00	3	0.44	11.75	-	11.85				
0	0.00	3	0.44	11.85	-	11.95				
1	0.19	4	0.64	11.95	-	12.05				
6	0.90	10	1.53	12.05	-	12.15				
1	0.13	11	1.66	12.15	-	12.25				
5	0.82	16	2.48	12.25	-	12.35				
7	1.02	23	3.50	12.35	-	12.45				
9	1.43	32	4.94	12.45	-	12.55				
13	2.04	45	6.97	12.55	-	12.65	1	0.03	1	0.03
21	3.17	66	10.15	12.65	-	12.75	7	0.24	8	0.27
20	3.13	86	13.28	12.75	-	12.85	3	0.10	11	0.37
22	3.39	108	16.67	12.85	-	12.95	6	0.22	17	0.59
39	6.03	147	22.70	12.95	-	13.05	12	0.44	29	1.03
48	7.31	195	30.01	13.05	-	13.15	23	0.82	52	1.85
32	4.94	227	34.95	13.15	-	13.25	28	0.99	80	2.84
48	7.33	275	42.28	13.25	-	13.35	44	1.55	124	4.39
44	6.69	319	48.97	13.35	-	13.45	38	1.34	162	5.73
53	8.06	372	57.03	13.45	-	13.55	79	2.80	241	8.53
50	7.74	422	64.77	13.55	-	13.65	85	3.02	326	11.56
39	5.92	461	70.69	13.65	-	13.75	120	4.28	446	15.84
29	4.42	490	75.11	13.75	-	13.85	125	4.46	571	20.30
20	3.07	510	78.18	13.85	-	13.95	110	3.92	681	24.22
46	7.00	556	85.19	13.95	-	14.05	135	4.78	816	29.00
15	2.24	571	87.43	14.05	-	14.15	151	5.35	967	34.36
20	3.05	591	90.48	14.15	-	14.25	166	5.91	1133	40.27
19	2.99	610	93.47	14.25	-	14.35	236	8.40	1369	48.67
12	1.88	622	95.35	14.35	-	14.45	154	5.47	1523	54.14
14	2.12	636	97.47	14.45	-	14.55	178	6.33	1701	60.47
4	0.67	640	98.15	14.55	-	14.65	180	6.40	1881	66.87
4	0.60	644	98.75	14.65	-	14.75	165	5.88	2046	72.75
3	0.50	647	99.25	14.75	-	14.85	111	3.93	2157	76.68
2	0.25	649	99.50	14.85	-	14.95	96	3.40	2253	80.08
0	0.00	649	99.50	14.95	-	15.05	96	3.42	2349	83.50
2	0.34	651	99.83	15.05	-	15.15	75	2.68	2424	86.17
0	0.00	651	99.83	15.15	-	15.25	80	2.86	2504	89.03
0	0.06	651	99.89	15.25	-	15.35	92	3.28	2596	92.31
0	0.06	651	99.94	15.35	-	15.45	33	1.19	2629	93.50
0	0.00	651	99.94	15.45	-	15.55	48	1.70	2677	95.20
0	0.00	651	99.94	15.55	-	15.65	31	1.10	2708	96.30
0	0.00	651	99.94	15.65	-	15.75	35	1.25	2743	97.55
0	0.00	651	99.94	15.75	-	15.85	14	0.50	2757	98.05
0	0.00	651	99.94	15.85	-	15.95	10	0.37	2767	98.41
0	0.00	651	99.94	15.95	-	16.05	8	0.27	2775	98.68
0	0.06	651	100.00	16.05	-	16.15	16	0.58	2791	99.26
				16.15	-	16.25	10	0.37	2801	99.63
				16.25	-	16.35	2	0.08	2803	99.71
				16.35	-	16.45	4	0.14	2807	99.85
				16.45	-	16.55	2	0.05	2809	99.91
				16.55	-	16.65	0	0.01	2809	99.92
				16.65	-	16.75	0	0.00	2809	99.92
				16.75	-	16.85	0	0.00	2809	99.92
				16.85	-	16.95	2	0.07	2811	99.99
				16.95	-	17.05	0	0.01	2811	100.00

(23) BUTTOCK CIRCUMFERENCE

The horizontal circumference of the trunk at the level of the maximum protrusion of the right buttock is measured with a tape. The subject stands erect with the heels together and the weight equally distributed on both feet.



PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
86.14	33.92	1ST	87.16	34.31
87.92	34.62	2ND	88.40	34.80
88.45	34.82	3RD	89.23	35.13
89.90	35.39	5TH	91.20	35.91
91.70	36.10	10TH	93.50	36.81
93.20	36.69	15TH	95.00	37.40
94.40	37.17	20TH	96.30	37.91
95.75	37.70	25TH	97.70	38.46
96.86	38.13	30TH	99.00	38.98
97.60	38.43	35TH	100.00	39.37
99.00	38.98	40TH	100.80	39.69
99.97	39.36	45TH	101.60	40.00
101.10	39.80	50TH	102.50	40.35
102.15	40.22	55TH	103.50	40.75
103.21	40.63	60TH	104.50	41.14
105.00	41.34	65TH	105.50	41.54
106.10	41.77	70TH	106.40	41.89
107.33	42.25	75TH	107.80	42.44
108.59	42.76	80TH	108.90	42.87
110.40	43.46	85TH	110.30	43.43
113.00	44.49	90TH	112.60	44.33
118.00	46.46	95TH	116.03	45.68
120.17	47.31	97TH	117.70	46.34
121.72	47.92	98TH	119.40	47.01
124.70	49.09	99TH	121.70	47.91

BUTTOCK CIRCUMFERENCE

FEMALES		
CM		INCHES
101.91	MEAN	40.12
0.33	SE (MEAN)	0.13
8.35	STD DEVIATION	3.29
0.23	SE (STD DEV)	0.09
83.00	MINIMUM	32.68
131.80	MAXIMUM	51.89
	SKEWNESS	0.50
	KURTOSIS	3.00
	COEF VAR	8.2%
	N	651

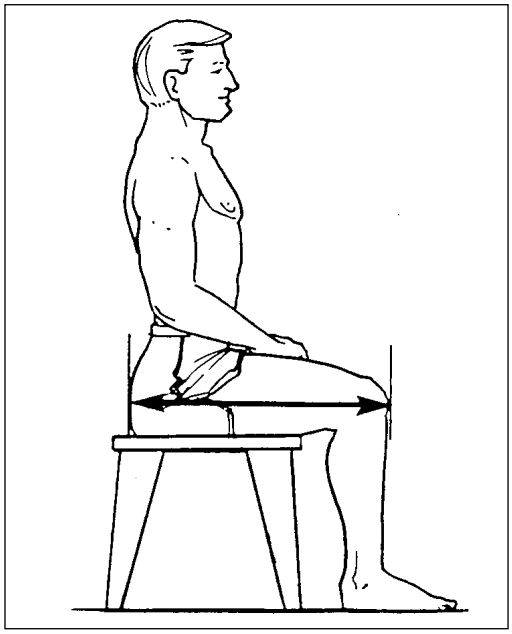
MALES		
CM		INCHES
102.87	MEAN	40.50
0.14	SE (MEAN)	0.06
7.48	STD DEVIATION	2.94
0.10	SE (STD DEV)	0.04
82.30	MINIMUM	32.40
131.10	MAXIMUM	51.61
	SKEWNESS	0.27
	KURTOSIS	3.09
	COEF VAR	7.3%
	N	2811

FREQUENCY TABLE

FEMALES							MALES			
F	FPct	CumF	CumFPct	CENTIMETERS			F	FPct	CumF	CumFPct
				81.55	-	82.55	1	0.03	1	0.03
1	0.11	1	0.11	82.55	-	83.55	2	0.06	3	0.09
2	0.37	3	0.48	83.55	-	84.55	4	0.13	7	0.22
3	0.40	6	0.88	84.55	-	85.55	5	0.17	12	0.38
2	0.31	8	1.19	85.55	-	86.55	8	0.29	20	0.67
4	0.53	12	1.72	86.55	-	87.55	16	0.56	36	1.23
9	1.39	21	3.11	87.55	-	88.55	28	0.99	64	2.22
9	1.45	30	4.56	88.55	-	89.55	30	1.06	94	3.28
10	1.48	40	6.04	89.55	-	90.55	27	0.97	121	4.25
20	3.03	60	9.07	90.55	-	91.55	47	1.68	168	5.92
20	3.10	80	12.17	91.55	-	92.55	63	2.26	231	8.18
29	4.39	109	16.57	92.55	-	93.55	60	2.15	291	10.33
27	4.15	136	20.71	93.55	-	94.55	90	3.20	381	13.53
26	3.93	162	24.64	94.55	-	95.55	83	2.96	464	16.48
30	4.66	192	29.30	95.55	-	96.55	128	4.55	592	21.03
34	5.24	226	34.54	96.55	-	97.55	96	3.40	688	24.44
28	4.35	254	38.90	97.55	-	98.55	109	3.87	797	28.31
30	4.66	284	43.56	98.55	-	99.55	122	4.33	919	32.63
27	4.11	311	47.66	99.55	-	100.55	170	6.06	1089	38.69
29	4.38	340	52.04	100.55	-	101.55	167	5.95	1256	44.64
33	5.12	373	57.16	101.55	-	102.55	162	5.77	1418	50.41
27	4.07	400	61.23	102.55	-	103.55	135	4.81	1553	55.22
18	2.73	418	63.97	103.55	-	104.55	147	5.22	1700	60.44
26	3.94	444	67.90	104.55	-	105.55	135	4.79	1835	65.23
25	3.79	469	71.70	105.55	-	106.55	143	5.08	1978	70.31
30	4.57	499	76.27	106.55	-	107.55	104	3.71	2082	74.02
24	3.71	523	79.98	107.55	-	108.55	128	4.57	2210	78.59
12	1.91	535	81.88	108.55	-	109.55	107	3.79	2317	82.38
24	3.64	559	85.53	109.55	-	110.55	83	2.96	2400	85.34
16	2.48	575	88.01	110.55	-	111.55	64	2.26	2464	87.60
7	1.11	582	89.12	111.55	-	112.55	67	2.39	2531	89.99
11	1.68	593	90.80	112.55	-	113.55	53	1.88	2584	91.87
8	1.29	601	92.09	113.55	-	114.55	43	1.53	2627	93.40
8	1.30	609	93.39	114.55	-	115.55	34	1.21	2661	94.61
5	0.77	614	94.16	115.55	-	116.55	36	1.28	2697	95.90
5	0.77	619	94.94	116.55	-	117.55	28	0.98	2725	96.88
7	1.14	626	96.08	117.55	-	118.55	23	0.81	2748	97.69
4	0.60	630	96.68	118.55	-	119.55	12	0.44	2760	98.13
7	1.12	637	97.80	119.55	-	120.55	14	0.50	2774	98.63
2	0.29	639	98.08	120.55	-	121.55	9	0.32	2783	98.95
5	0.71	644	98.79	121.55	-	122.55	7	0.26	2790	99.21
1	0.18	645	98.97	122.55	-	123.55	2	0.06	2792	99.27
0	0.00	645	98.97	123.55	-	124.55	5	0.17	2797	99.44
4	0.59	649	99.57	124.55	-	125.55	3	0.12	2800	99.56
1	0.19	650	99.75	125.55	-	126.55	5	0.20	2805	99.75
0	0.06	650	99.81	126.55	-	127.55	3	0.10	2808	99.85
0	0.00	650	99.81	127.55	-	128.55	1	0.05	2809	99.91
0	0.00	650	99.81	128.55	-	129.55	0	0.00	2809	99.91
0	0.00	650	99.81	129.55	-	130.55	2	0.08	2811	99.99
0	0.00	650	99.81	130.55	-	131.55	0	0.01	2811	100.00
1	0.19	651	100.00	131.55	-	132.55				

(26) BUTTOCK-KNEE LENGTH

The horizontal distance between a buttock plate placed at the most posterior point on either buttock and the anterior point of the right knee is measured with an anthropometer. The subject sits erect. The thighs are parallel and the knees flexed 90 degrees with the feet in line with the thighs.



PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
51.40	20.24	1ST	54.80	21.57
51.90	20.43	2ND	55.50	21.85
52.62	20.72	3RD	55.90	22.01
53.60	21.10	5TH	56.60	22.28
54.80	21.57	10TH	57.70	22.72
55.56	21.87	15TH	58.40	22.99
56.30	22.17	20TH	59.00	23.23
56.70	22.32	25TH	59.50	23.43
57.00	22.44	30TH	60.00	23.62
57.60	22.68	35TH	60.40	23.78
58.10	22.87	40TH	60.80	23.94
58.55	23.05	45TH	61.30	24.13
59.00	23.23	50TH	61.60	24.25
59.50	23.43	55TH	62.00	24.41
60.00	23.62	60TH	62.40	24.57
60.20	23.70	65TH	62.90	24.76
60.70	23.90	70TH	63.20	24.88
61.10	24.06	75TH	63.80	25.12
61.50	24.21	80TH	64.30	25.31
62.20	24.49	85TH	65.00	25.59
63.10	24.84	90TH	65.90	25.94
64.20	25.28	95TH	66.80	26.30
64.70	25.47	97TH	67.50	26.57
65.40	25.75	98TH	68.10	26.81
66.40	26.14	99TH	68.99	27.17

BUTTOCK-KNEE LENGTH

FEMALES		
CM		INCHES
58.93	MEAN	23.20
0.13	SE (MEAN)	0.05
3.22	STD DEVIATION	1.27
0.09	SE (STD DEV)	0.04
50.40	MINIMUM	19.84
69.10	MAXIMUM	27.20
	SKEWNESS	-0.05
	KURTOSIS	2.84
	COEF VAR	5.5%
	N	650

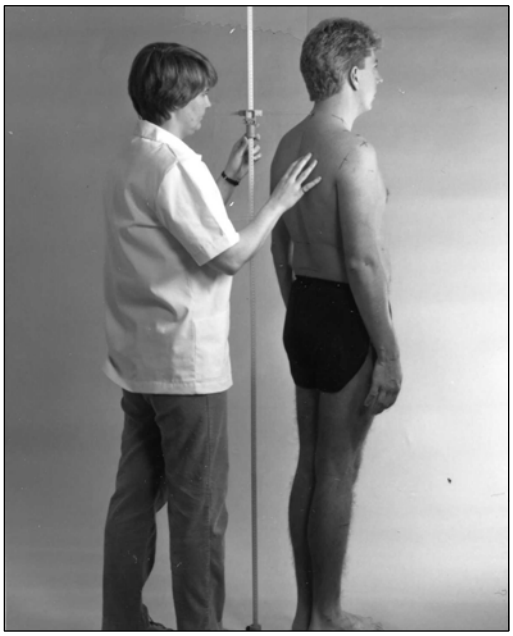
MALES		
CM		INCHES
61.68	MEAN	24.28
0.06	SE (MEAN)	0.02
3.11	STD DEVIATION	1.23
0.04	SE (STD DEV)	0.02
51.80	MINIMUM	20.39
73.50	MAXIMUM	28.94
	SKEWNESS	0.10
	KURTOSIS	2.92
	COEF VAR	5.0%
	N	2811

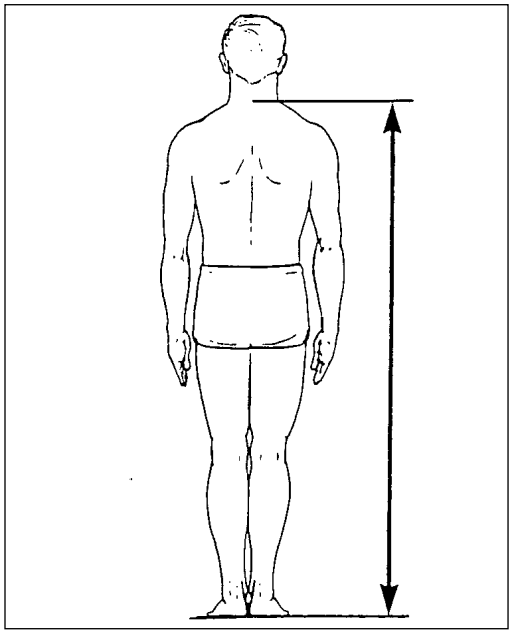
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
4	0.63	4	0.63	50.25	-	50.75				
0	0.06	4	0.68	50.75	-	51.25				
6	0.98	10	1.66	51.25	-	51.75				
6	0.94	16	2.61	51.75	-	52.25	2	0.07	2	0.07
3	0.44	19	3.05	52.25	-	52.75	1	0.04	3	0.11
6	0.93	25	3.98	52.75	-	53.25	1	0.02	4	0.13
10	1.50	35	5.47	53.25	-	53.75	3	0.11	7	0.24
9	1.37	44	6.85	53.75	-	54.25	9	0.34	16	0.58
18	2.82	62	9.66	54.25	-	54.75	9	0.34	25	0.91
25	3.83	87	13.49	54.75	-	55.25	17	0.61	42	1.53
15	2.23	102	15.72	55.25	-	55.75	32	1.13	74	2.66
26	3.98	128	19.70	55.75	-	56.25	31	1.11	105	3.77
39	6.06	167	25.76	56.25	-	56.75	52	1.84	157	5.61
40	6.13	207	31.90	56.75	-	57.25	63	2.25	220	7.85
32	4.84	239	36.74	57.25	-	57.75	78	2.78	298	10.64
29	4.48	268	41.22	57.75	-	58.25	95	3.38	393	14.02
37	5.66	305	46.88	58.25	-	58.75	97	3.44	490	17.46
38	5.89	343	52.78	58.75	-	59.25	117	4.15	607	21.61
31	4.70	374	57.48	59.25	-	59.75	158	5.61	765	27.22
51	7.79	425	65.27	59.75	-	60.25	159	5.64	924	32.86
33	5.12	458	70.39	60.25	-	60.75	174	6.20	1098	39.06
39	6.05	497	76.45	60.75	-	61.25	162	5.77	1260	44.83
33	5.08	530	81.53	61.25	-	61.75	187	6.66	1447	51.49
24	3.70	554	85.23	61.75	-	62.25	165	5.88	1612	57.37
18	2.78	572	88.01	62.25	-	62.75	172	6.14	1784	63.50
17	2.57	589	90.58	62.75	-	63.25	190	6.76	1974	70.27
19	2.94	608	93.52	63.25	-	63.75	129	4.59	2103	74.85
12	1.82	620	95.34	63.75	-	64.25	126	4.47	2229	79.32
12	1.80	632	97.14	64.25	-	64.75	111	3.95	2340	83.27
5	0.75	637	97.90	64.75	-	65.25	87	3.09	2427	86.36
5	0.82	642	98.71	65.25	-	65.75	82	2.91	2509	89.27
1	0.17	643	98.89	65.75	-	66.25	93	3.32	2602	92.59
4	0.55	647	99.44	66.25	-	66.75	61	2.16	2663	94.76
2	0.37	649	99.81	66.75	-	67.25	49	1.73	2712	96.49
0	0.00	649	99.81	67.25	-	67.75	33	1.17	2745	97.66
0	0.00	649	99.81	67.75	-	68.25	16	0.55	2761	98.22
0	0.00	649	99.81	68.25	-	68.75	19	0.68	2780	98.90
1	0.19	650	100.00	68.75	-	69.25	8	0.30	2788	99.20
				69.25	-	69.75	3	0.10	2791	99.30
				69.75	-	70.25	11	0.39	2802	99.69
				70.25	-	70.75	1	0.05	2803	99.73
				70.75	-	71.25	2	0.08	2805	99.82
				71.25	-	71.75	2	0.07	2807	99.89
				71.75	-	72.25	1	0.03	2808	99.91
				72.25	-	72.75	1	0.03	2809	99.94
				72.75	-	73.25	0	0.00	2809	99.94
				73.25	-	73.75	2	0.06	2811	100.00

(30) CERVICALE HEIGHT

The vertical distance between a standing surface and the cervicale landmark on the spine at the base of the neck is measured with an anthropometer. The subject stands erect with the head in the Frankfort plane. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.





PERCENTILES

FEMALES			MALES	
CM	INCHES		CM	INCHES
126.40	49.76	1ST	136.38	53.69
127.95	50.37	2ND	138.00	54.33
129.50	50.98	3RD	139.40	54.88
130.50	51.38	5TH	140.82	55.44
132.40	52.13	10TH	143.20	56.38
134.37	52.90	15TH	145.00	57.09
135.90	53.50	20TH	146.26	57.58
136.80	53.86	25TH	147.30	57.99
137.70	54.21	30TH	148.30	58.39
138.60	54.57	35TH	149.10	58.70
139.40	54.88	40TH	149.90	59.02
139.90	55.08	45TH	150.80	59.37
140.50	55.31	50TH	151.60	59.69
141.40	55.67	55TH	152.40	60.00
142.40	56.06	60TH	153.30	60.35
143.10	56.34	65TH	154.10	60.67
143.90	56.65	70TH	154.90	60.98
144.60	56.93	75TH	155.80	61.34
145.51	57.28	80TH	157.10	61.85
146.80	57.80	85TH	158.30	62.32
147.90	58.23	90TH	160.00	62.99
150.04	59.07	95TH	162.38	63.93
151.74	59.74	97TH	164.15	64.63
152.20	59.92	98TH	165.11	65.01
153.52	60.44	99TH	167.10	65.79

CERVICALE HEIGHT

FEMALES		
CM		INCHES
140.61	MEAN	55.36
0.23	SE (MEAN)	0.09
5.90	STD DEVIATION	2.32
0.16	SE (STD DEV)	0.06
122.40	MINIMUM	48.19
158.00	MAXIMUM	62.20
	SKEWNESS	-0.10
	KURTOSIS	2.86
	COEF VAR	4.2%
	N	651

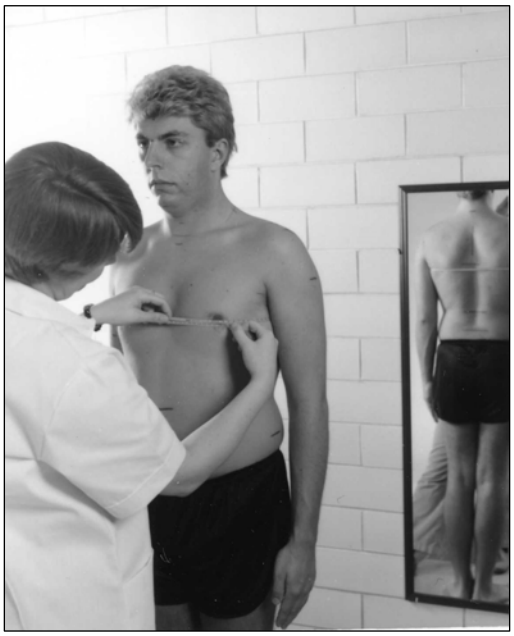
MALES		
CM		INCHES
151.62	MEAN	59.69
0.12	SE (MEAN)	0.05
6.54	STD DEVIATION	2.58
0.09	SE (STD DEV)	0.03
131.10	MINIMUM	51.61
179.90	MAXIMUM	70.83
	SKEWNESS	0.06
	KURTOSIS	3.14
	COEF VAR	4.3%
	N	2811

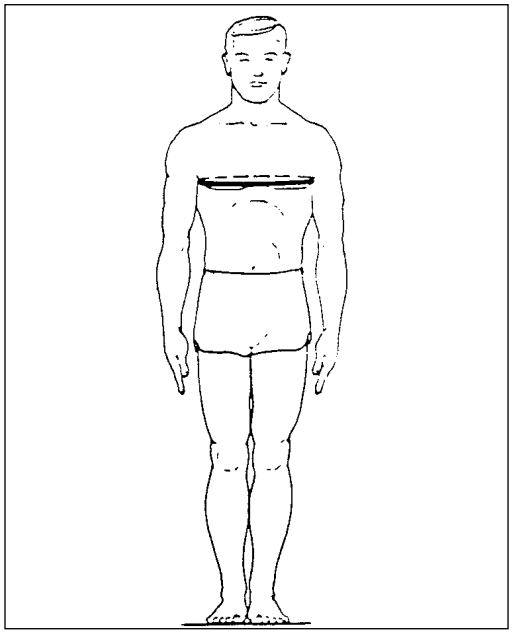
FREQUENCY TABLE

FEMALES							MALES			
F	FPct	CumF	CumFPct	CENTIMETERS			F	FPct	CumF	CumFPct
1	0.14	1	0.14	122.25	-	123.75				
0	0.00	1	0.14	123.75	-	125.25				
8	1.20	9	1.35	125.25	-	126.75				
4	0.69	13	2.04	126.75	-	128.25				
11	1.73	24	3.76	128.25	-	129.75				
19	2.89	43	6.65	129.75	-	131.25	0	0.01	0	0.01
29	4.49	72	11.14	131.25	-	132.75	2	0.06	2	0.07
24	3.65	96	14.79	132.75	-	134.25	8	0.29	10	0.36
27	4.21	123	19.01	134.25	-	135.75	9	0.32	19	0.69
51	7.87	174	26.88	135.75	-	137.25	16	0.59	35	1.27
59	9.12	233	36.00	137.25	-	138.75	37	1.33	72	2.60
80	12.29	313	48.29	138.75	-	140.25	41	1.45	113	4.05
56	8.58	369	56.88	140.25	-	141.75	78	2.78	191	6.83
61	9.41	430	66.29	141.75	-	143.25	91	3.25	282	10.08
64	9.79	494	76.08	143.25	-	144.75	117	4.14	399	14.23
43	6.58	537	82.66	144.75	-	146.25	162	5.76	561	19.99
43	6.54	580	89.21	146.25	-	147.75	195	6.94	756	26.93
24	3.61	604	92.82	147.75	-	149.25	246	8.74	1002	35.67
20	3.05	624	95.87	149.25	-	150.75	258	9.18	1260	44.85
16	2.42	640	98.30	150.75	-	152.25	263	9.37	1523	54.22
6	0.85	646	99.15	152.25	-	153.75	232	8.24	1755	62.46
1	0.16	647	99.31	153.75	-	155.25	269	9.56	2024	72.02
3	0.51	650	99.81	155.25	-	156.75	186	6.61	2210	78.63
1	0.19	651	100.00	156.75	-	158.25	172	6.10	2382	84.73
				158.25	-	159.75	129	4.59	2511	89.32
				159.75	-	161.25	101	3.59	2612	92.91
				161.25	-	162.75	78	2.78	2690	95.69
				162.75	-	164.25	38	1.33	2728	97.03
				164.25	-	165.75	39	1.40	2767	98.43
				165.75	-	167.25	17	0.62	2784	99.05
				167.25	-	168.75	8	0.28	2792	99.32
				168.75	-	170.25	7	0.26	2799	99.59
				170.25	-	171.75	7	0.23	2806	99.82
				171.75	-	173.25	1	0.03	2807	99.85
				173.25	-	174.75	3	0.12	2810	99.97
				174.75	-	176.25	0	0.00	2810	99.97
				176.25	-	177.75	0	0.00	2810	99.97
				177.75	-	179.25	0	0.00	2810	99.97
				179.25	-	180.75	1	0.03	2811	100.00

(33) CHEST CIRCUMFERENCE

The maximum horizontal circumference of the chest at the fullest part of the breast is measured with a tape. The subject stands erect looking straight ahead. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
79.48	31.29	1ST	85.39	33.62
80.86	31.83	2ND	86.89	34.21
81.53	32.10	3RD	88.70	34.92
82.20	32.36	5TH	90.30	35.55
84.77	33.38	10TH	93.07	36.64
86.50	34.06	15TH	95.20	37.48
87.90	34.61	20TH	97.00	38.19
88.71	34.92	25TH	98.40	38.74
90.20	35.51	30TH	99.50	39.17
91.30	35.94	35TH	100.60	39.61
92.30	36.34	40TH	102.10	40.20
93.50	36.81	45TH	103.30	40.67
94.64	37.25	50TH	104.50	41.14
95.50	37.60	55TH	105.60	41.57
96.80	38.11	60TH	106.70	42.01
98.20	38.66	65TH	107.90	42.48
99.87	39.32	70TH	109.30	43.03
101.40	39.92	75TH	110.90	43.66
103.00	40.55	80TH	112.40	44.25
104.75	41.24	85TH	114.70	45.16
107.40	42.28	90TH	117.10	46.10
111.36	43.84	95TH	121.20	47.72
114.04	44.90	97TH	123.30	48.54
117.40	46.22	98TH	125.30	49.33
120.20	47.32	99TH	127.50	50.20

CHEST CIRCUMFERENCE

FEMALES		
CM		INCHES
95.49	MEAN	37.59
0.35	SE (MEAN)	0.14
8.85	STD DEVIATION	3.48
0.25	SE (STD DEV)	0.10
75.80	MINIMUM	29.84
122.60	MAXIMUM	48.27
	SKEWNESS	0.53
	KURTOSIS	2.98
	COEF VAR	9.3%
	N	651

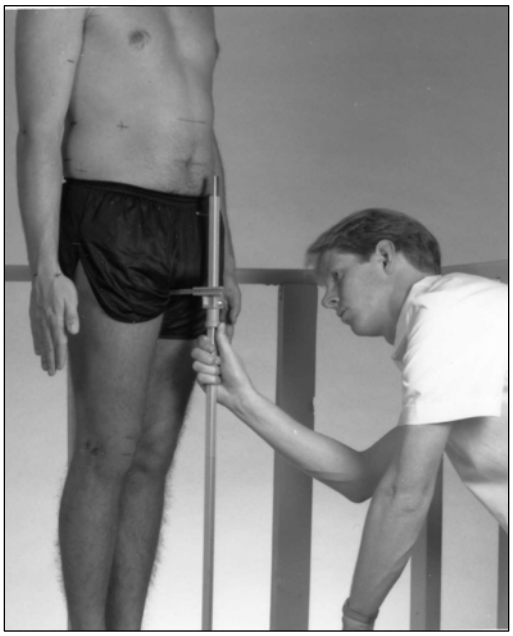
MALES		
CM		INCHES
104.80	MEAN	41.26
0.17	SE (MEAN)	0.07
9.27	STD DEVIATION	3.65
0.12	SE (STD DEV)	0.05
79.80	MINIMUM	31.42
144.50	MAXIMUM	56.89
	SKEWNESS	0.28
	KURTOSIS	2.99
	COEF VAR	8.8%
	N	2811

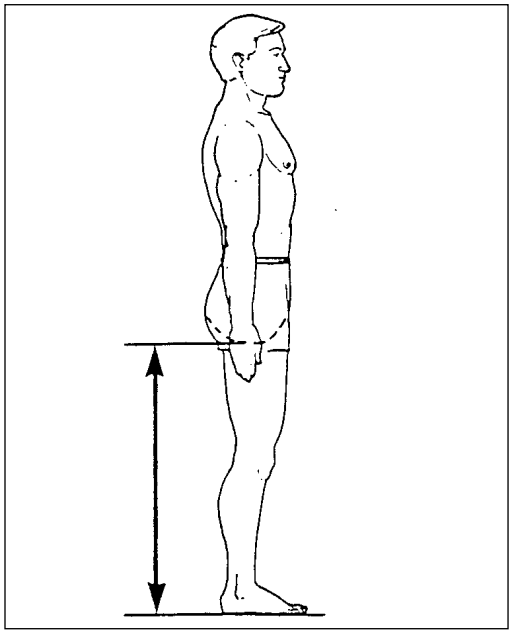
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.12	1	0.12	75.25	-	76.75				
1	0.21	2	0.33	76.75	-	78.25				
5	0.68	7	1.01	78.25	-	79.75				
9	1.41	16	2.42	79.75	-	81.25	0	0.00	0	0.00
22	3.44	38	5.85	81.25	-	82.75	5	0.18	5	0.19
22	3.37	60	9.22	82.75	-	84.25	11	0.40	16	0.59
20	3.13	80	12.35	84.25	-	85.75	21	0.76	37	1.35
32	4.91	112	17.27	85.75	-	87.25	21	0.75	58	2.10
51	7.76	163	25.03	87.25	-	88.75	27	0.95	85	3.06
33	5.11	196	30.13	88.75	-	90.25	47	1.69	132	4.74
46	7.01	242	37.14	90.25	-	91.75	83	2.97	215	7.71
47	7.21	289	44.35	91.75	-	93.25	75	2.67	290	10.38
41	6.30	330	50.65	93.25	-	94.75	106	3.77	396	14.15
52	8.01	382	58.66	94.75	-	96.25	102	3.64	498	17.79
34	5.17	416	63.83	96.25	-	97.75	129	4.60	627	22.40
32	4.89	448	68.72	97.75	-	99.25	170	6.05	797	28.45
27	4.19	475	72.91	99.25	-	100.75	200	7.11	997	35.56
36	5.58	511	78.49	100.75	-	102.25	150	5.35	1147	40.90
23	3.53	534	82.02	102.25	-	103.75	170	6.04	1317	46.95
27	4.08	561	86.10	103.75	-	105.25	162	5.75	1479	52.70
19	2.95	580	89.05	105.25	-	106.75	220	7.82	1699	60.52
12	1.85	592	90.90	106.75	-	108.25	161	5.74	1860	66.26
13	1.92	605	92.82	108.25	-	109.75	154	5.48	2014	71.73
14	2.20	619	95.02	109.75	-	111.25	119	4.25	2133	75.98
9	1.36	628	96.39	111.25	-	112.75	142	5.05	2275	81.03
6	0.90	634	97.28	112.75	-	114.25	86	3.05	2361	84.08
2	0.36	636	97.65	114.25	-	115.75	98	3.50	2459	87.59
1	0.19	637	97.84	115.75	-	117.25	85	3.02	2544	90.61
5	0.73	642	98.56	117.25	-	118.75	66	2.34	2610	92.94
4	0.65	646	99.21	118.75	-	120.25	43	1.53	2653	94.47
2	0.36	648	99.57	120.25	-	121.75	37	1.30	2690	95.77
3	0.43	651	100.00	121.75	-	123.25	34	1.20	2724	96.98
				123.25	-	124.75	24	0.85	2748	97.83
				124.75	-	126.25	18	0.65	2766	98.48
				126.25	-	127.75	16	0.57	2782	99.05
				127.75	-	129.25	5	0.17	2787	99.22
				129.25	-	130.75	9	0.31	2796	99.52
				130.75	-	132.25	6	0.21	2802	99.73
				132.25	-	133.75	3	0.10	2805	99.83
				133.75	-	135.25	2	0.05	2807	99.88
				135.25	-	136.75	0	0.00	2807	99.88
				136.75	-	138.25	3	0.09	2810	99.97
				138.25	-	139.75	0	0.00	2810	99.97
				139.75	-	141.25	0	0.00	2810	99.97
				141.25	-	142.75	0	0.00	2810	99.97
				142.75	-	144.25	0	0.00	2810	99.97
				144.25	-	145.75	1	0.03	2811	100.00

(38) CROTCH HEIGHT

The vertical distance between the standing surface and the crotch is measured with an anthropometer. The subject stands erect looking straight ahead. The heels are together and the weight is distributed equally on both feet.





PERCENTILES

FEMALES			MALES	
CM	INCHES		CM	INCHES
68.42	26.94	1ST	71.32	28.08
69.48	27.35	2ND	72.60	28.58
70.09	27.59	3RD	73.40	28.90
70.90	27.91	5TH	74.80	29.45
72.31	28.47	10TH	76.40	30.08
73.10	28.78	15TH	77.50	30.51
74.10	29.17	20TH	78.50	30.91
74.74	29.43	25TH	79.30	31.22
75.47	29.71	30TH	80.10	31.54
76.00	29.92	35TH	80.70	31.77
76.60	30.16	40TH	81.30	32.01
77.10	30.35	45TH	82.00	32.28
77.80	30.63	50TH	82.60	32.52
78.20	30.79	55TH	83.20	32.76
78.70	30.98	60TH	83.90	33.03
79.43	31.27	65TH	84.59	33.31
80.00	31.50	70TH	85.40	33.62
80.62	31.74	75TH	86.20	33.94
81.20	31.97	80TH	87.10	34.29
82.40	32.44	85TH	88.00	34.65
83.50	32.87	90TH	89.20	35.12
85.10	33.50	95TH	91.20	35.91
86.40	34.02	97TH	92.30	36.34
86.99	34.25	98TH	93.80	36.93
89.14	35.10	99TH	94.80	37.32

CROTCH HEIGHT

FEMALES		
CM		INCHES
77.77	MEAN	30.62
0.17	SE (MEAN)	0.07
4.30	STD DEVIATION	1.69
0.12	SE (STD DEV)	0.05
64.90	MINIMUM	25.55
89.80	MAXIMUM	35.35
	SKEWNESS	0.14
	KURTOSIS	2.89
	COEF VAR	5.5%
	N	651

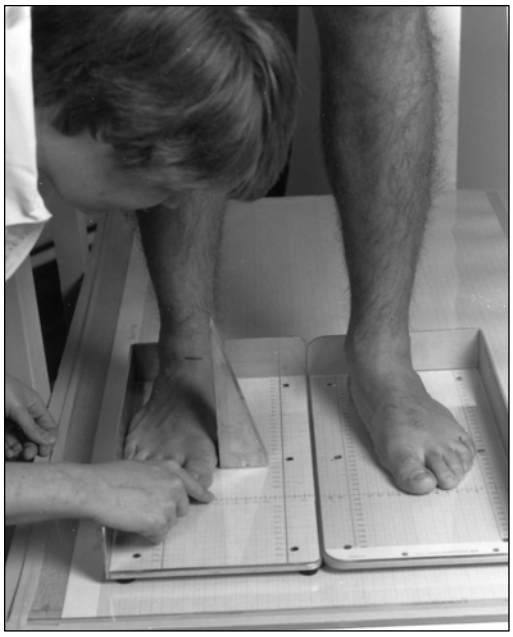
MALES		
CM		INCHES
82.75	MEAN	32.58
0.09	SE (MEAN)	0.04
5.00	STD DEVIATION	1.97
0.07	SE (STD DEV)	0.03
66.40	MINIMUM	26.14
98.30	MAXIMUM	38.70
	SKEWNESS	0.11
	KURTOSIS	2.89
	COEF VAR	6.1%
	N	2809

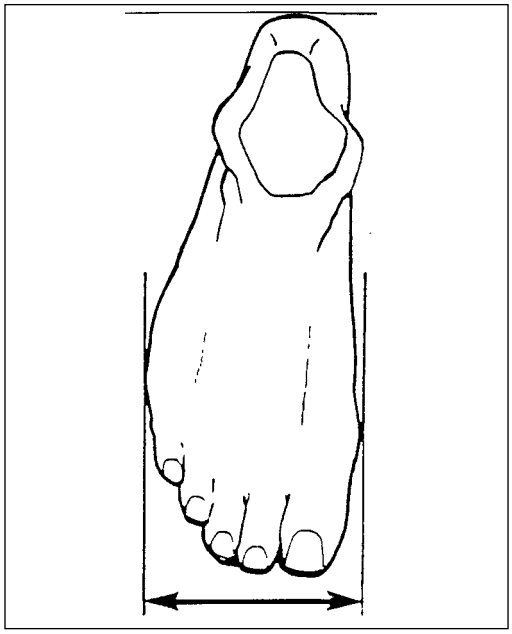
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
2	0.24	2	0.24	64.55	-	65.55				
0	0.00	2	0.24	65.55	-	66.55	1	0.04	1	0.04
3	0.46	5	0.70	66.55	-	67.55	0	0.00	1	0.04
2	0.33	7	1.03	67.55	-	68.55	2	0.08	3	0.12
6	1.00	13	2.03	68.55	-	69.55	5	0.16	8	0.28
14	2.13	27	4.16	69.55	-	70.55	9	0.33	17	0.61
17	2.55	44	6.70	70.55	-	71.55	15	0.55	32	1.16
34	5.15	78	11.85	71.55	-	72.55	20	0.71	52	1.87
33	5.02	111	16.87	72.55	-	73.55	34	1.20	86	3.07
42	6.52	153	23.39	73.55	-	74.55	35	1.24	121	4.31
55	8.46	208	31.86	74.55	-	75.55	67	2.40	188	6.71
52	8.03	260	39.88	75.55	-	76.55	110	3.90	298	10.61
51	7.83	311	47.71	76.55	-	77.55	127	4.54	425	15.15
73	11.18	384	58.89	77.55	-	78.55	144	5.12	569	20.27
51	7.82	435	66.71	78.55	-	79.55	172	6.12	741	26.39
48	7.44	483	74.15	79.55	-	80.55	217	7.71	958	34.10
49	7.49	532	81.64	80.55	-	81.55	225	8.01	1183	42.11
27	4.13	559	85.77	81.55	-	82.55	212	7.56	1395	49.67
30	4.57	589	90.33	82.55	-	83.55	232	8.25	1627	57.92
28	4.33	617	94.67	83.55	-	84.55	199	7.07	1826	64.99
9	1.34	626	96.00	84.55	-	85.55	175	6.24	2001	71.23
9	1.43	635	97.44	85.55	-	86.55	165	5.87	2166	77.10
6	0.88	641	98.31	86.55	-	87.55	167	5.94	2333	83.04
4	0.68	645	98.99	87.55	-	88.55	133	4.74	2466	87.79
6	0.95	651	99.93	88.55	-	89.55	91	3.24	2557	91.03
0	0.07	651	100.00	89.55	-	90.55	74	2.63	2631	93.66
				90.55	-	91.55	67	2.40	2698	96.05
				91.55	-	92.55	32	1.15	2730	97.21
				92.55	-	93.55	17	0.61	2747	97.82
				93.55	-	94.55	26	0.92	2773	98.74
				94.55	-	95.55	19	0.66	2792	99.40
				95.55	-	96.55	10	0.34	2802	99.74
				96.55	-	97.55	4	0.15	2806	99.90
				97.55	-	98.55	3	0.10	2809	100.00

(50) FOOT BREADTH, HORIZONTAL

The maximum breadth of the right foot is measured on a footbox scale. The subject stands with each foot in a footbox and the weight distributed equally on both feet. The heel of the right foot lightly touches the back of the box, and the side of the foot at the fifth-metatarsophalangeal-protrusion landmark lightly touches the side of the box. The medial side of the foot is parallel to the long axis of the box. A block is placed against the landmark at the first metatarsophalangeal protrusion to establish the measurement on the scale.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
7.90	3.11	1ST	8.80	3.46
8.00	3.15	2ND	8.90	3.50
8.10	3.19	3RD	9.00	3.54
8.17	3.22	5TH	9.10	3.58
8.40	3.31	10TH	9.30	3.66
8.50	3.35	15TH	9.40	3.70
8.50	3.35	20TH	9.50	3.74
8.60	3.39	25TH	9.60	3.78
8.70	3.43	30TH	9.70	3.82
8.80	3.46	35TH	9.80	3.86
8.90	3.50	40TH	9.80	3.86
9.00	3.54	45TH	9.97	3.93
9.00	3.54	50TH	10.00	3.94
9.18	3.61	55TH	10.00	3.94
9.20	3.62	60TH	10.10	3.98
9.30	3.66	65TH	10.20	4.02
9.40	3.70	70TH	10.30	4.06
9.50	3.74	75TH	10.40	4.09
9.50	3.74	80TH	10.50	4.13
9.50	3.74	85TH	10.60	4.17
9.70	3.82	90TH	10.80	4.25
9.90	3.90	95TH	11.00	4.33
10.00	3.94	97TH	11.00	4.33
10.00	3.94	98TH	11.20	4.41
10.18	4.01	99TH	11.50	4.53

FOOT BREADTH, HORIZONTAL

FEMALES		
CM		INCHES
9.04	MEAN	3.56
0.02	SE (MEAN)	0.01
0.53	STD DEVIATION	0.21
0.01	SE (STD DEV)	0.01
7.50	MINIMUM	2.95
10.90	MAXIMUM	4.29
	SKEWNESS	-0.04
	KURTOSIS	2.53
	COEF VAR	5.8%
	N	651

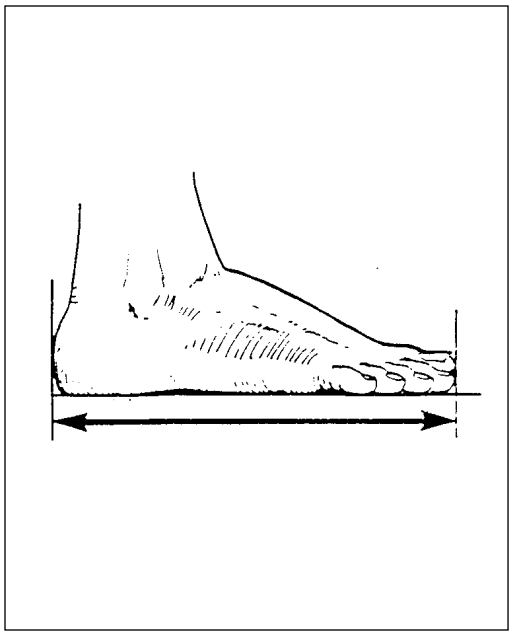
MALES		
CM		INCHES
10.01	MEAN	3.94
0.01	SE (MEAN)	0.00
0.57	STD DEVIATION	0.22
0.01	SE (STD DEV)	0.00
8.20	MINIMUM	3.23
12.20	MAXIMUM	4.80
	SKEWNESS	0.20
	KURTOSIS	3.00
	COEF VAR	5.7%
	N	2810

FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.13	1	0.13	7.45	-	7.55				
1	0.11	2	0.24	7.55	-	7.65				
0	0.00	2	0.24	7.65	-	7.75				
3	0.42	5	0.66	7.75	-	7.85				
4	0.61	9	1.27	7.85	-	7.95				
9	1.37	18	2.64	7.95	-	8.05				
15	2.26	33	4.90	8.05	-	8.15				
12	1.82	45	6.73	8.15	-	8.25	2	0.08	2	0.08
12	1.92	57	8.65	8.25	-	8.35	0	0.00	2	0.08
26	4.06	83	12.71	8.35	-	8.45	1	0.02	3	0.09
67	10.30	150	23.00	8.45	-	8.55	4	0.15	7	0.25
32	4.87	182	27.87	8.55	-	8.65	4	0.16	11	0.40
21	3.26	203	31.13	8.65	-	8.75	11	0.39	22	0.80
30	4.66	233	35.79	8.75	-	8.85	24	0.85	46	1.64
28	4.30	261	40.09	8.85	-	8.95	21	0.75	67	2.40
73	11.25	334	51.35	8.95	-	9.05	68	2.43	135	4.82
24	3.62	358	54.97	9.05	-	9.15	39	1.40	174	6.22
56	8.58	414	63.55	9.15	-	9.25	64	2.28	238	8.49
23	3.51	437	67.06	9.25	-	9.35	88	3.14	326	11.63
47	7.29	484	74.35	9.35	-	9.45	102	3.62	428	15.25
72	11.07	556	85.41	9.45	-	9.55	237	8.44	665	23.70
19	2.86	575	88.27	9.55	-	9.65	115	4.07	780	27.77
22	3.33	597	91.61	9.65	-	9.75	147	5.23	927	33.00
11	1.77	608	93.37	9.75	-	9.85	227	8.08	1154	41.08
15	2.26	623	95.63	9.85	-	9.95	110	3.91	1264	44.99
18	2.78	641	98.41	9.95	-	10.05	344	12.23	1608	57.23
4	0.62	645	99.03	10.05	-	10.15	123	4.38	1731	61.60
3	0.43	648	99.46	10.15	-	10.25	147	5.24	1878	66.84
2	0.24	650	99.70	10.25	-	10.35	165	5.87	2043	72.71
0	0.06	650	99.77	10.35	-	10.45	139	4.94	2182	77.66
1	0.11	651	99.88	10.45	-	10.55	184	6.53	2366	84.18
0	0.06	651	99.94	10.55	-	10.65	70	2.49	2436	86.67
0	0.00	651	99.94	10.65	-	10.75	88	3.14	2524	89.81
0	0.00	651	99.94	10.75	-	10.85	65	2.32	2589	92.13
0	0.06	651	100.00	10.85	-	10.95	55	1.94	2644	94.06
				10.95	-	11.05	84	2.98	2728	97.05
				11.05	-	11.15	14	0.50	2742	97.54
				11.15	-	11.25	17	0.61	2759	98.15
				11.25	-	11.35	12	0.43	2771	98.58
				11.35	-	11.45	9	0.33	2780	98.91
				11.45	-	11.55	14	0.48	2794	99.39
				11.55	-	11.65	3	0.10	2797	99.49
				11.65	-	11.75	7	0.26	2804	99.75
				11.75	-	11.85	5	0.19	2809	99.94
				11.85	-	11.95	0	0.01	2809	99.95
				11.95	-	12.05	1	0.05	2810	100.00
				12.05	-	12.15	0	0.00	2810	100.00
				12.15	-	12.25	0	0.00	2810	100.00

(51) FOOT LENGTH

The maximum length of the right foot is measured on a footbox scale. The subject stands with each foot in a footbox and the weight distributed equally on both feet. The heel of the right foot lightly touches the back of the box, and the side of the foot at the fifth-metatarsophalangeal-protrusion landmark lightly touches the side of the box. The medial side of the foot is parallel to the long axis of the box. A block is placed against the tip of the longest toe to establish the measurement on the scale.



PERCENTILES

FEMALES			MALES	
CM	INCHES		CM	INCHES
21.50	8.46	1ST	23.60	9.29
21.70	8.54	2ND	24.10	9.49
22.00	8.66	3RD	24.30	9.57
22.20	8.74	5TH	24.50	9.65
22.70	8.94	10TH	25.10	9.88
23.00	9.06	15TH	25.40	10.00
23.30	9.17	20TH	25.70	10.12
23.40	9.21	25TH	25.90	10.20
23.60	9.29	30TH	26.10	10.28
23.80	9.37	35TH	26.30	10.35
24.00	9.45	40TH	26.40	10.39
24.10	9.49	45TH	26.60	10.47
24.30	9.57	50TH	26.80	10.55
24.40	9.61	55TH	26.90	10.59
24.50	9.65	60TH	27.10	10.67
24.60	9.69	65TH	27.30	10.75
24.90	9.80	70TH	27.50	10.83
25.00	9.84	75TH	27.70	10.91
25.22	9.93	80TH	28.00	11.02
25.50	10.04	85TH	28.26	11.12
26.00	10.24	90TH	28.60	11.26
26.31	10.35	95TH	29.10	11.46
26.75	10.53	97TH	29.40	11.57
26.90	10.59	98TH	29.66	11.67
27.13	10.68	99TH	30.19	11.89

FOOT LENGTH

FEMALES		
CM		INCHES
24.25	MEAN	9.55
0.05	SE (MEAN)	0.02
1.22	STD DEVIATION	0.48
0.03	SE (STD DEV)	0.01
21.00	MINIMUM	8.27
27.50	MAXIMUM	10.83
	SKEWNESS	0.06
	KURTOSIS	2.86
	COEF VAR	5.0%
	N	651

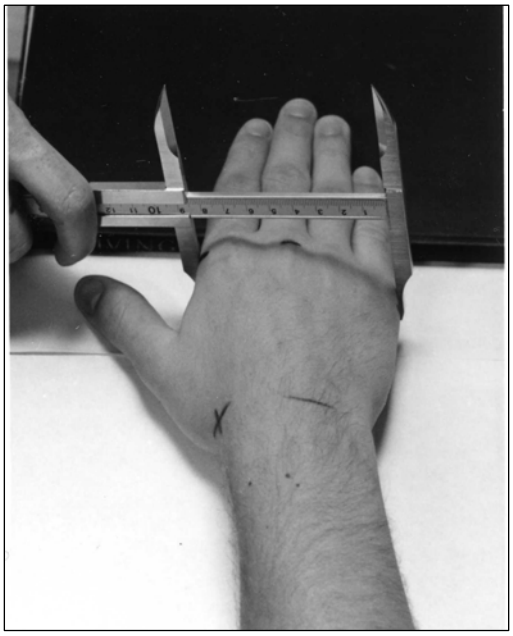
MALES		
CM		INCHES
26.80	MEAN	10.55
0.03	SE (MEAN)	0.01
1.37	STD DEVIATION	0.54
0.02	SE (STD DEV)	0.01
21.70	MINIMUM	8.54
32.80	MAXIMUM	12.91
	SKEWNESS	0.07
	KURTOSIS	3.23
	COEF VAR	5.1%
	N	2810

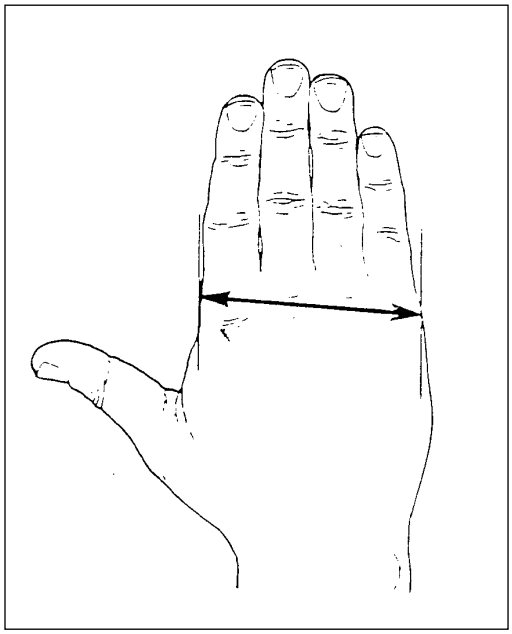
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
3	0.43	3	0.43	20.95	-	21.15				
2	0.25	5	0.68	21.15	-	21.35				
3	0.50	8	1.18	21.35	-	21.55				
6	0.85	14	2.03	21.55	-	21.75	2	0.07	2	0.07
3	0.52	17	2.55	21.75	-	21.95	0	0.00	2	0.07
15	2.29	32	4.84	21.95	-	22.15	0	0.00	2	0.07
8	1.17	40	6.01	22.15	-	22.35	3	0.10	5	0.17
20	3.07	60	9.08	22.35	-	22.55	0	0.00	5	0.17
15	2.36	75	11.44	22.55	-	22.75	3	0.10	8	0.27
14	2.14	89	13.58	22.75	-	22.95	3	0.12	11	0.39
26	4.04	115	17.62	22.95	-	23.15	1	0.03	12	0.42
25	3.84	140	21.46	23.15	-	23.35	5	0.19	17	0.61
55	8.40	195	29.86	23.35	-	23.55	10	0.35	27	0.95
26	4.00	221	33.86	23.55	-	23.75	8	0.28	35	1.24
32	4.85	253	38.71	23.75	-	23.95	7	0.25	42	1.49
50	7.70	303	46.41	23.95	-	24.15	19	0.66	61	2.15
42	6.45	345	52.85	24.15	-	24.35	28	1.01	89	3.16
66	10.17	411	63.02	24.35	-	24.55	53	1.89	142	5.05
28	4.27	439	67.29	24.55	-	24.75	38	1.36	180	6.41
28	4.24	467	71.53	24.75	-	24.95	54	1.91	234	8.32
37	5.75	504	77.27	24.95	-	25.15	67	2.39	301	10.71
28	4.26	532	81.53	25.15	-	25.35	91	3.24	392	13.95
35	5.44	567	86.97	25.35	-	25.55	131	4.65	523	18.60
9	1.43	576	88.40	25.55	-	25.75	103	3.68	626	22.28
9	1.46	585	89.86	25.75	-	25.95	97	3.45	723	25.72
19	2.98	604	92.84	25.95	-	26.15	143	5.09	866	30.81
15	2.30	619	95.13	26.15	-	26.35	193	6.86	1059	37.68
10	1.55	629	96.68	26.35	-	26.55	175	6.24	1234	43.92
2	0.35	631	97.03	26.55	-	26.75	148	5.29	1382	49.21
9	1.33	640	98.36	26.75	-	26.95	180	6.43	1562	55.63
5	0.74	645	99.10	26.95	-	27.15	154	5.49	1716	61.13
3	0.48	648	99.58	27.15	-	27.35	160	5.69	1876	66.81
3	0.42	651	100.00	27.35	-	27.55	152	5.42	2028	72.23
				27.55	-	27.75	95	3.40	2123	75.63
				27.75	-	27.95	89	3.17	2212	78.80
				27.95	-	28.15	136	4.83	2348	83.62
				28.15	-	28.35	92	3.27	2440	86.89
				28.35	-	28.55	85	3.02	2525	89.91
				28.55	-	28.75	50	1.77	2575	91.68
				28.75	-	28.95	58	2.05	2633	93.73
				28.95	-	29.15	45	1.62	2678	95.35
				29.15	-	29.35	41	1.45	2719	96.80
				29.35	-	29.55	31	1.10	2750	97.90
				29.55	-	29.75	9	0.31	2759	98.21
				29.75	-	29.95	15	0.55	2774	98.76
				29.95	-	30.15	7	0.24	2781	99.00
				30.15	-	30.35	14	0.49	2795	99.49
				30.35	-	30.55	5	0.17	2800	99.66
				30.55	-	30.75	2	0.08	2802	99.74
				30.75	-	30.95	0	0.00	2802	99.74
				30.95	-	31.15	4	0.14	2806	99.88
				31.15	-	31.35	2	0.06	2808	99.94
				31.35	-	31.55	0	0.00	2808	99.94
				31.55	-	31.75	0	0.00	2808	99.94
				31.75	-	31.95	0	0.00	2808	99.94
				31.95	-	32.15	0	0.00	2808	99.94
				32.15	-	32.35	0	0.00	2808	99.94
				32.35	-	32.55	0	0.00	2808	99.94
				32.55	-	32.75	1	0.03	2809	99.97
				32.75	-	32.95	1	0.03	2810	100.00

(57) HAND BREADTH

The breadth of the right hand between the landmarks at metacarpale II and metacarpale V is measured with a sliding caliper. The subject places the palm on a table, the fingers together, and the thumb abducted. The middle finger is parallel to the long axis of the forearm. The two distal phalanges of the fingers lie on a flat surface 8 mm higher than the table.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
6.90	2.72	1ST	8.00	3.15
7.00	2.76	2ND	8.10	3.19
7.10	2.80	3RD	8.10	3.19
7.10	2.80	5TH	8.20	3.23
7.20	2.83	10TH	8.40	3.31
7.40	2.91	15TH	8.50	3.35
7.50	2.95	20TH	8.60	3.39
7.50	2.95	25TH	8.70	3.43
7.60	2.99	30TH	8.70	3.43
7.70	3.03	35TH	8.80	3.46
7.70	3.03	40TH	8.80	3.46
7.80	3.07	45TH	8.90	3.50
7.80	3.07	50TH	9.00	3.54
7.90	3.11	55TH	9.00	3.54
7.90	3.11	60TH	9.10	3.58
8.00	3.15	65TH	9.10	3.58
8.00	3.15	70TH	9.20	3.62
8.10	3.19	75TH	9.20	3.62
8.20	3.23	80TH	9.30	3.66
8.30	3.27	85TH	9.40	3.70
8.40	3.31	90TH	9.50	3.74
8.50	3.35	95TH	9.70	3.82
8.60	3.39	97TH	9.80	3.86
8.70	3.43	98TH	9.90	3.90
8.80	3.46	99TH	10.00	3.94

HAND BREADTH

FEMALES		
CM		INCHES
7.81	MEAN	3.08
0.02	SE (MEAN)	0.01
0.42	STD DEVIATION	0.17
0.01	SE (STD DEV)	0.00
6.70	MINIMUM	2.64
9.10	MAXIMUM	3.58
	SKEWNESS	0.12
	KURTOSIS	2.80
	COEF VAR	5.4%
	N	651

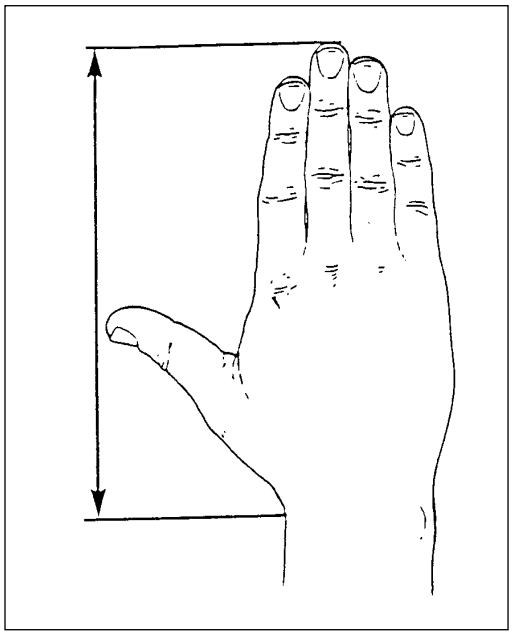
MALES		
CM		INCHES
8.95	MEAN	3.52
0.01	SE (MEAN)	0.00
0.44	STD DEVIATION	0.17
0.01	SE (STD DEV)	0.00
7.4	MINIMUM	2.91
10.7	MAXIMUM	4.21
	SKEWNESS	0.12
	KURTOSIS	3.21
	COEF VAR	4.9%
	N	2811

FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.21	1	0.21	6.65	-	6.75				
4	0.58	5	0.79	6.75	-	6.85				
6	0.87	11	1.66	6.85	-	6.95				
4	0.54	15	2.20	6.95	-	7.05				
19	2.96	34	5.16	7.05	-	7.15				
32	4.92	66	10.08	7.15	-	7.25				
30	4.61	96	14.69	7.25	-	7.35				
27	4.19	123	18.89	7.35	-	7.45	1	0.02	1	0.02
49	7.49	172	26.38	7.45	-	7.55	2	0.06	3	0.08
53	8.12	225	34.49	7.55	-	7.65	1	0.05	4	0.14
68	10.41	293	44.91	7.65	-	7.75	1	0.05	5	0.19
63	9.71	356	54.62	7.75	-	7.85	4	0.15	9	0.34
67	10.28	423	64.90	7.85	-	7.95	12	0.41	21	0.75
47	7.22	470	72.12	7.95	-	8.05	22	0.77	43	1.52
37	5.75	507	77.86	8.05	-	8.15	54	1.92	97	3.45
41	6.29	548	84.16	8.15	-	8.25	63	2.26	160	5.70
31	4.81	579	88.97	8.25	-	8.35	82	2.94	242	8.64
24	3.65	603	92.62	8.35	-	8.45	110	3.93	352	12.57
21	3.27	624	95.89	8.45	-	8.55	146	5.21	498	17.78
12	1.76	636	97.65	8.55	-	8.65	193	6.87	691	24.65
6	0.95	642	98.60	8.65	-	8.75	225	8.01	916	32.65
4	0.64	646	99.24	8.75	-	8.85	263	9.35	1179	42.00
2	0.33	648	99.56	8.85	-	8.95	219	7.78	1398	49.79
2	0.25	650	99.82	8.95	-	9.05	248	8.82	1646	58.60
1	0.18	651	100.00	9.05	-	9.15	279	9.92	1925	68.52
				9.15	-	9.25	211	7.50	2136	76.02
				9.25	-	9.35	212	7.54	2348	83.57
				9.35	-	9.45	127	4.51	2475	88.07
				9.45	-	9.55	113	4.02	2588	92.10
				9.55	-	9.65	65	2.30	2653	94.40
				9.65	-	9.75	58	2.05	2711	96.45
				9.75	-	9.85	40	1.42	2751	97.87
				9.85	-	9.95	21	0.75	2772	98.63
				9.95	-	10.05	17	0.59	2789	99.22
				10.05	-	10.15	8	0.29	2797	99.51
				10.15	-	10.25	3	0.11	2800	99.62
				10.25	-	10.35	4	0.16	2804	99.77
				10.35	-	10.45	2	0.05	2806	99.83
				10.45	-	10.55	2	0.06	2808	99.89
				10.55	-	10.65	2	0.07	2810	99.96
				10.65	-	10.75	1	0.04	2811	100.00

(59) HAND LENGTH

The length of the right hand between the stylion landmark on the wrist and the tip of the middle finger is measured with a Poech sliding caliper. The subject places the palm on a table, the fingers together, and the thumb abducted. The middle finger is parallel to the long axis of the forearm. The two distal phalanges of the fingers lie on a flat surface 8 mm higher than the table.



PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
16.09	6.34	1ST	17.40	6.85
16.40	6.46	2ND	17.70	6.97
16.50	6.50	3RD	17.95	7.07
16.70	6.57	5TH	18.20	7.17
16.93	6.66	10TH	18.40	7.24
17.20	6.77	15TH	18.70	7.36
17.40	6.85	20TH	18.90	7.44
17.50	6.89	25TH	19.00	7.48
17.60	6.93	30TH	19.20	7.56
17.80	7.01	35TH	19.30	7.60
18.00	7.09	40TH	19.40	7.64
18.10	7.13	45TH	19.60	7.72
18.27	7.19	50TH	19.70	7.76
18.40	7.24	55TH	19.80	7.80
18.50	7.28	60TH	20.00	7.87
18.60	7.32	65TH	20.10	7.91
18.80	7.40	70TH	20.20	7.95
19.00	7.48	75TH	20.40	8.03
19.20	7.56	80TH	20.60	8.11
19.40	7.64	85TH	20.80	8.19
19.60	7.72	90TH	21.10	8.31
20.00	7.87	95TH	21.40	8.43
20.20	7.95	97TH	21.80	8.58
20.30	7.99	98TH	22.00	8.66
20.50	8.07	99TH	22.30	8.78

HAND LENGTH

FEMALES		
CM		INCHES
18.26	MEAN	7.19
0.04	SE (MEAN)	0.02
1.00	STD DEVIATION	0.40
0.03	SE (STD DEV)	0.01
15.50	MINIMUM	6.10
21.00	MAXIMUM	8.27
	SKEWNESS	0.09
	KURTOSIS	2.50
	COEF VAR	5.5%
	N	651

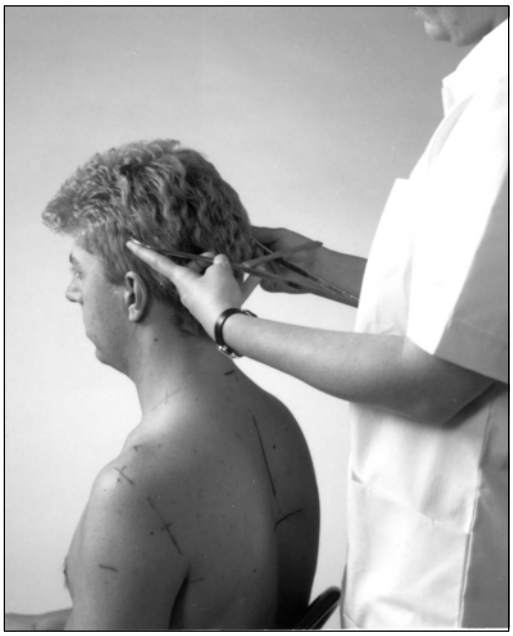
MALES		
CM		INCHES
19.74	MEAN	7.77
0.02	SE (MEAN)	0.01
1.02	STD DEVIATION	0.40
0.01	SE (STD DEV)	0.01
16.70	MINIMUM	6.57
23.50	MAXIMUM	9.25
	SKEWNESS	0.16
	KURTOSIS	3.01
	COEF VAR	5.2%
	N	2811

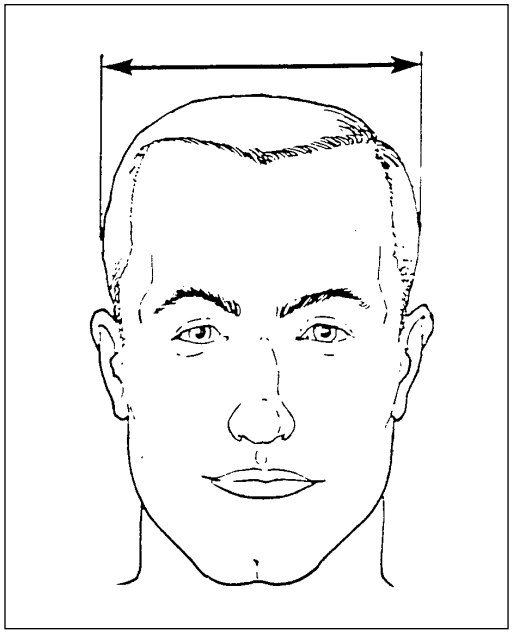
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.12	1	0.12	15.35	-	15.55				
0	0.00	1	0.12	15.55	-	15.75				
3	0.53	4	0.65	15.75	-	15.95				
4	0.56	8	1.21	15.95	-	16.15				
3	0.44	11	1.65	16.15	-	16.35				
12	1.80	23	3.44	16.35	-	16.55				
17	2.65	40	6.10	16.55	-	16.75	1	0.03	1	0.03
25	3.87	65	9.96	16.75	-	16.95	5	0.19	6	0.23
27	4.08	92	14.04	16.95	-	17.15	8	0.27	14	0.50
36	5.54	128	19.57	17.15	-	17.35	10	0.36	24	0.86
48	7.43	176	27.00	17.35	-	17.55	13	0.45	37	1.31
39	5.98	215	32.99	17.55	-	17.75	21	0.74	58	2.05
39	5.94	254	38.93	17.75	-	17.95	26	0.94	84	2.98
47	7.23	301	46.16	17.95	-	18.15	54	1.93	138	4.92
42	6.49	343	52.65	18.15	-	18.35	101	3.60	239	8.52
50	7.69	393	60.34	18.35	-	18.55	95	3.37	334	11.88
55	8.45	448	68.79	18.55	-	18.75	116	4.14	450	16.02
36	5.47	484	74.26	18.75	-	18.95	154	5.47	604	21.49
28	4.32	512	78.59	18.95	-	19.15	194	6.91	798	28.41
41	6.33	553	84.92	19.15	-	19.35	226	8.03	1024	36.44
28	4.36	581	89.28	19.35	-	19.55	234	8.31	1258	44.75
21	3.26	602	92.54	19.55	-	19.75	172	6.11	1430	50.87
14	2.14	616	94.68	19.75	-	19.95	232	8.24	1662	59.11
12	1.90	628	96.58	19.95	-	20.15	234	8.31	1896	67.41
11	1.65	639	98.23	20.15	-	20.35	167	5.96	2063	73.37
8	1.16	647	99.39	20.35	-	20.55	146	5.20	2209	78.57
2	0.25	649	99.64	20.55	-	20.75	131	4.67	2340	83.24
1	0.18	650	99.81	20.75	-	20.95	113	4.03	2453	87.27
1	0.19	651	100.00	20.95	-	21.15	109	3.87	2562	91.14
				21.15	-	21.35	71	2.54	2633	93.68
				21.35	-	21.55	67	2.39	2700	96.07
				21.55	-	21.75	25	0.90	2725	96.97
				21.75	-	21.95	25	0.90	2750	97.87
				21.95	-	22.15	24	0.87	2774	98.74
				22.15	-	22.35	15	0.52	2789	99.26
				22.35	-	22.55	8	0.28	2797	99.54
				22.55	-	22.75	6	0.22	2803	99.76
				22.75	-	22.95	4	0.12	2807	99.88
				22.95	-	23.15	1	0.04	2808	99.92
				23.15	-	23.35	2	0.05	2810	99.97
				23.35	-	23.55	1	0.03	2811	100.00

(60) HEAD BREADTH

The maximum horizontal breadth of the head above the attachment of the ears is measured with a spreading caliper.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
13.58	5.34	1ST	14.30	5.63
13.70	5.39	2ND	14.30	5.63
13.73	5.40	3RD	14.40	5.67
13.90	5.47	5TH	14.60	5.75
14.20	5.59	10TH	14.70	5.79
14.30	5.63	15TH	14.90	5.87
14.38	5.66	20TH	15.00	5.91
14.40	5.67	25TH	15.10	5.94
14.50	5.71	30TH	15.20	5.98
14.50	5.71	35TH	15.30	6.02
14.50	5.71	40TH	15.30	6.02
14.60	5.75	45TH	15.40	6.06
14.70	5.79	50TH	15.50	6.10
14.70	5.79	55TH	15.60	6.14
14.90	5.87	60TH	15.60	6.14
15.00	5.91	65TH	15.70	6.18
15.00	5.91	70TH	15.80	6.22
15.10	5.94	75TH	15.90	6.26
15.20	5.98	80TH	16.00	6.30
15.30	6.02	85TH	16.20	6.38
15.40	6.06	90TH	16.30	6.42
15.60	6.14	95TH	16.50	6.50
15.70	6.18	97TH	16.70	6.57
15.80	6.22	98TH	16.80	6.61
15.90	6.26	99TH	17.00	6.69

HEAD BREADTH

FEMALES		
CM		INCHES
14.75	MEAN	5.81
0.02	SE (MEAN)	0.01
0.51	STD DEVIATION	0.20
0.01	SE (STD DEV)	0.01
13.20	MINIMUM	5.20
16.40	MAXIMUM	6.46
	SKEWNESS	0.13
	KURTOSIS	2.86
	COEF VAR	3.5%
	N	651

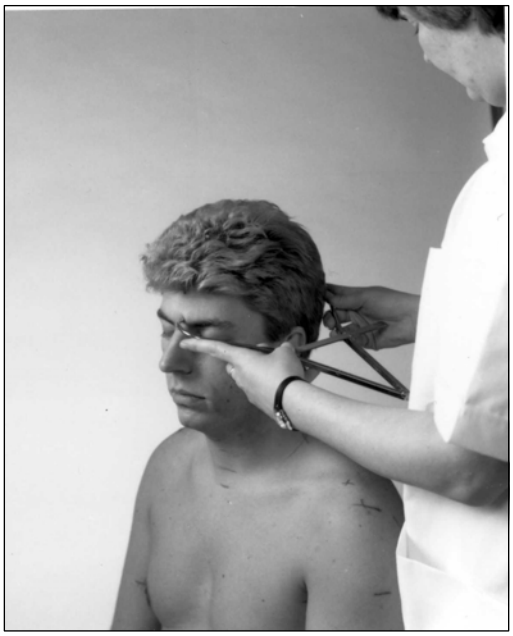
MALES		
CM		INCHES
15.51	MEAN	6.11
0.01	SE (MEAN)	0.00
0.60	STD DEVIATION	0.23
0.01	SE (STD DEV)	0.00
13.60	MINIMUM	5.35
17.70	MAXIMUM	6.97
	SKEWNESS	0.21
	KURTOSIS	3.14
	COEF VAR	3.8%
	N	2811

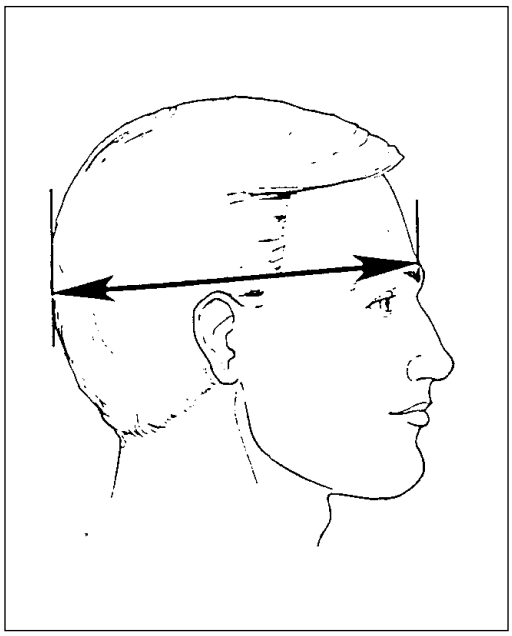
FREQUENCY TABLE

FEMALES				CENTIMETERS			MALES			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
0	0.07	0	0.07	13.15	-	13.25				
0	0.00	0	0.07	13.25	-	13.35				
1	0.20	1	0.27	13.35	-	13.45				
4	0.61	5	0.88	13.45	-	13.55				
4	0.64	9	1.52	13.55	-	13.65	1	0.05	1	0.05
9	1.43	18	2.95	13.65	-	13.75	0	0.01	1	0.07
6	0.91	24	3.86	13.75	-	13.85	1	0.05	2	0.12
8	1.21	32	5.07	13.85	-	13.95	1	0.03	3	0.14
20	3.01	52	8.08	13.95	-	14.05	2	0.08	5	0.22
9	1.40	61	9.48	14.05	-	14.15	10	0.37	15	0.59
27	4.21	88	13.69	14.15	-	14.25	11	0.38	26	0.97
40	6.21	128	19.90	14.25	-	14.35	35	1.25	61	2.21
41	6.25	169	26.15	14.35	-	14.45	29	1.04	90	3.25
93	14.28	262	40.43	14.45	-	14.55	46	1.64	136	4.89
50	7.67	312	48.10	14.55	-	14.65	75	2.65	211	7.54
47	7.21	359	55.30	14.65	-	14.75	89	3.17	300	10.71
28	4.30	387	59.60	14.75	-	14.85	81	2.86	381	13.58
33	5.11	420	64.71	14.85	-	14.95	77	2.73	458	16.31
44	6.68	464	71.39	14.95	-	15.05	146	5.19	604	21.50
27	4.07	491	75.46	15.05	-	15.15	155	5.53	759	27.03
42	6.49	533	81.95	15.15	-	15.25	158	5.62	917	32.65
29	4.41	562	86.36	15.25	-	15.35	229	8.14	1146	40.79
29	4.37	591	90.73	15.35	-	15.45	181	6.43	1327	47.22
15	2.27	606	93.01	15.45	-	15.55	164	5.84	1491	53.06
18	2.78	624	95.79	15.55	-	15.65	219	7.80	1710	60.86
14	2.10	638	97.89	15.65	-	15.75	207	7.36	1917	68.22
7	1.06	645	98.96	15.75	-	15.85	163	5.81	2080	74.03
2	0.36	647	99.31	15.85	-	15.95	94	3.36	2174	77.38
1	0.19	648	99.51	15.95	-	16.05	116	4.13	2290	81.52
0	0.06	648	99.56	16.05	-	16.15	98	3.47	2388	84.99
1	0.18	649	99.74	16.15	-	16.25	98	3.47	2486	88.46
0	0.00	649	99.74	16.25	-	16.35	107	3.82	2593	92.28
2	0.26	651	100.00	16.35	-	16.45	47	1.66	2640	93.94
				16.45	-	16.55	51	1.82	2691	95.77
				16.55	-	16.65	31	1.09	2722	96.86
				16.65	-	16.75	23	0.82	2745	97.68
				16.75	-	16.85	16	0.57	2761	98.25
				16.85	-	16.95	13	0.46	2774	98.71
				16.95	-	17.05	14	0.48	2788	99.20
				17.05	-	17.15	6	0.20	2794	99.40
				17.15	-	17.25	3	0.12	2797	99.52
				17.25	-	17.35	5	0.18	2802	99.69
				17.35	-	17.45	3	0.09	2805	99.78
				17.45	-	17.55	1	0.04	2806	99.82
				17.55	-	17.65	2	0.07	2808	99.89
				17.65	-	17.75	3	0.11	2811	100.00

(62) HEAD LENGTH

The distance from the glabella landmark between the brow ridges to the posterior point on the back of the head is measured with a spreading caliper.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
17.06	6.71	1ST	18.20	7.17
17.40	6.85	2ND	18.50	7.28
17.50	6.89	3RD	18.60	7.32
17.80	7.01	5TH	18.80	7.40
18.10	7.13	10TH	19.10	7.52
18.30	7.20	15TH	19.30	7.60
18.40	7.24	20TH	19.40	7.64
18.50	7.28	25TH	19.60	7.72
18.60	7.32	30TH	19.70	7.76
18.70	7.36	35TH	19.70	7.76
18.80	7.40	40TH	19.80	7.80
18.90	7.44	45TH	20.00	7.87
19.00	7.48	50TH	20.00	7.87
19.10	7.52	55TH	20.10	7.91
19.20	7.56	60TH	20.20	7.95
19.30	7.60	65TH	20.30	7.99
19.40	7.64	70TH	20.40	8.03
19.50	7.68	75TH	20.50	8.07
19.60	7.72	80TH	20.60	8.11
19.70	7.76	85TH	20.70	8.15
19.80	7.80	90TH	21.00	8.27
20.10	7.91	95TH	21.20	8.35
20.20	7.95	97TH	21.40	8.43
20.40	8.03	98TH	21.50	8.46
20.88	8.22	99TH	21.70	8.54

HEAD LENGTH

FEMALES		
CM		INCHES
18.99	MEAN	7.48
0.03	SE (MEAN)	0.01
0.72	STD DEVIATION	0.28
0.02	SE (STD DEV)	0.01
16.20	MINIMUM	6.38
21.60	MAXIMUM	8.50
	SKEWNESS	-0.19
	KURTOSIS	3.71
	COEF VAR	3.8%
	N	651

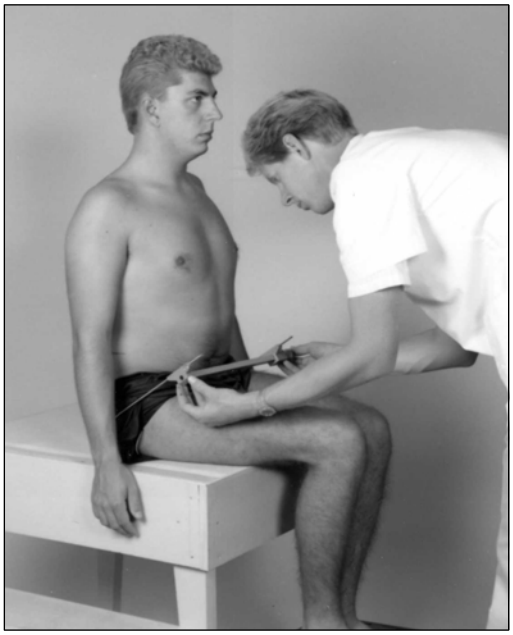
MALES		
CM		INCHES
20.02	MEAN	7.88
0.01	SE (MEAN)	0.01
0.72	STD DEVIATION	0.28
	SE (STD DEV)	
17.60	MINIMUM	6.93
22.60	MAXIMUM	8.90
	SKEWNESS	-0.03
	KURTOSIS	3.16
	COEF VAR	3.6%
	N	2811

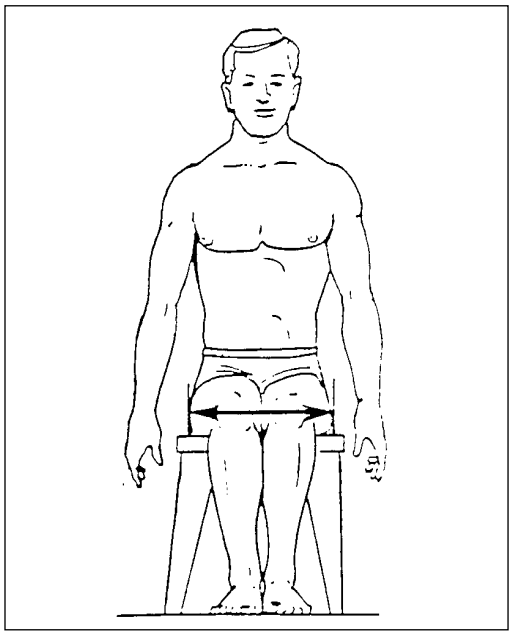
FREQUENCY TABLE

FEMALE							MALE			
F	FPct	CumF	CumFPct	CENTIMETERS			F	FPct	CumF	CumFPct
0	0.06	0	0.06	16.15	-	16.35				
0	0.06	0	0.12	16.35	-	16.55				
3	0.53	3	0.65	16.55	-	16.75				
1	0.10	4	0.74	16.75	-	16.95				
4	0.60	8	1.34	16.95	-	17.15				
3	0.42	11	1.76	17.15	-	17.35				
11	1.66	22	3.41	17.35	-	17.55				
9	1.36	31	4.77	17.55	-	17.75	4	0.13	4	0.13
14	2.18	45	6.95	17.75	-	17.95	3	0.12	7	0.25
22	3.33	67	10.29	17.95	-	18.15	14	0.51	21	0.76
39	6.05	106	16.34	18.15	-	18.35	18	0.65	39	1.41
61	9.41	167	25.75	18.35	-	18.55	24	0.86	63	2.27
73	11.19	240	36.93	18.55	-	18.75	55	1.94	118	4.21
57	8.68	297	45.61	18.75	-	18.95	54	1.92	172	6.13
81	12.36	378	57.97	18.95	-	19.15	139	4.93	311	11.06
58	8.91	436	66.88	19.15	-	19.35	173	6.16	484	17.22
82	12.56	518	79.44	19.35	-	19.55	203	7.22	687	24.44
51	7.90	569	87.34	19.55	-	19.75	302	10.74	989	35.18
34	5.20	603	92.54	19.75	-	19.95	230	8.18	1219	43.37
20	3.09	623	95.64	19.95	-	20.15	409	14.56	1628	57.92
13	2.01	636	97.65	20.15	-	20.35	309	10.97	1937	68.90
6	0.88	642	98.53	20.35	-	20.55	232	8.27	2169	77.16
2	0.36	644	98.90	20.55	-	20.75	225	8.02	2394	85.18
3	0.43	647	99.33	20.75	-	20.95	112	3.98	2506	89.16
3	0.49	650	99.82	20.95	-	21.15	144	5.11	2650	94.27
0	0.00	650	99.82	21.15	-	21.35	73	2.61	2723	96.87
0	0.00	650	99.82	21.35	-	21.55	37	1.33	2760	98.20
1	0.18	651	100.00	21.55	-	21.75	27	0.96	2787	99.17
				21.75	-	21.95	10	0.36	2797	99.53
				21.95	-	22.15	9	0.31	2806	99.85
				22.15	-	22.35	1	0.03	2807	99.88
				22.35	-	22.55	2	0.06	2809	99.94
				22.55	-	22.75	2	0.06	2811	100.00

(66) HIP BREADTH, SITTING

The distance between the lateral points of the hips or thighs (whichever are broader) is measured with a beam caliper. The subject sits erect with the feet and knees together.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
31.70	12.48	1ST	30.92	12.18
32.40	12.76	2ND	31.70	12.48
33.37	13.14	3RD	32.10	12.64
34.00	13.39	5TH	32.60	12.83
35.10	13.82	10TH	33.50	13.19
35.50	13.98	15TH	34.20	13.46
36.40	14.33	20TH	34.70	13.66
36.82	14.50	25TH	35.20	13.86
37.40	14.72	30TH	35.60	14.02
37.90	14.92	35TH	36.00	14.17
38.38	15.11	40TH	36.40	14.33
38.80	15.28	45TH	36.80	14.49
39.20	15.43	50TH	37.20	14.65
39.70	15.63	55TH	37.40	14.72
40.11	15.80	60TH	37.90	14.92
40.70	16.02	65TH	38.30	15.08
41.40	16.30	70TH	38.60	15.20
41.90	16.50	75TH	39.10	15.39
42.60	16.77	80TH	39.60	15.59
43.50	17.13	85TH	40.30	15.87
44.70	17.60	90TH	41.00	16.14
46.12	18.16	95TH	42.70	16.81
47.30	18.62	97TH	43.62	17.18
47.60	18.74	98TH	44.40	17.48
48.70	19.17	99TH	45.51	17.91

HIP BREADTH, SITTING

FEMALES		
CM		INCHES
39.52	MEAN	15.56
0.15	SE (MEAN)	0.06
3.72	STD DEVIATION	1.47
0.10	SE (STD DEV)	0.04
30.10	MINIMUM	11.85
51.90	MAXIMUM	20.43
	SKEWNESS	0.37
	KURTOSIS	3.10
	COEF VAR	9.4%
	N	651

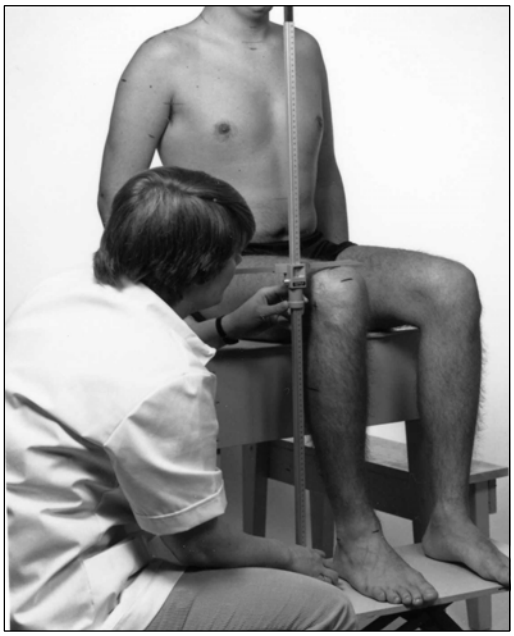
MALES		
CM		INCHES
37.28	MEAN	14.68
0.06	SE (MEAN)	0.02
3.04	STD DEVIATION	1.20
0.04	SE (STD DEV)	0.02
29.10	MINIMUM	11.46
51.30	MAXIMUM	20.20
	SKEWNESS	0.46
	KURTOSIS	3.57
	COEF VAR	8.2%
	N	2811

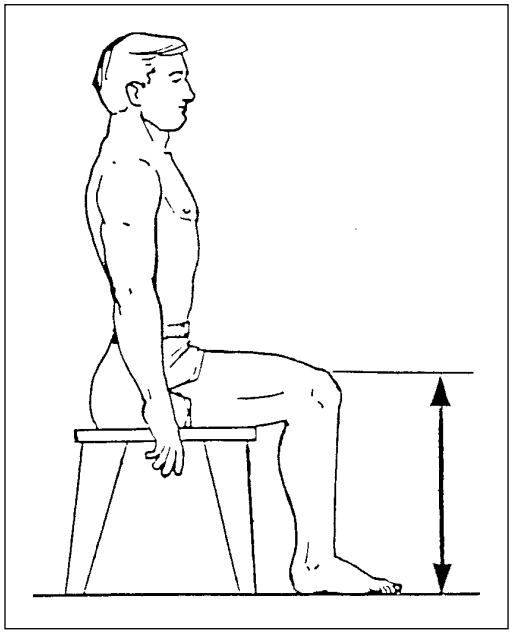
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
				21.75	-	29.25	1	0.04	1	0.04
				29.25	-	29.75	1	0.04	2	0.08
2	0.33	2	0.33	29.75	-	30.25	5	0.19	7	0.28
1	0.19	3	0.52	30.25	-	30.75	15	0.53	22	0.81
1	0.14	4	0.66	30.75	-	31.25	13	0.46	35	1.27
2	0.37	6	1.03	31.25	-	31.75	22	0.77	57	2.04
2	0.37	8	1.40	31.75	-	32.25	42	1.50	99	3.55
8	1.16	16	2.56	32.25	-	32.75	62	2.20	161	5.75
2	0.32	18	2.88	32.75	-	33.25	65	2.32	226	8.07
9	1.30	27	4.18	33.25	-	33.75	111	3.94	337	12.01
12	1.86	39	6.04	33.75	-	34.25	102	3.62	439	15.63
13	2.00	52	8.05	34.25	-	34.75	139	4.95	578	20.58
21	3.19	73	11.24	34.75	-	35.25	154	5.47	732	26.05
34	5.20	107	16.44	35.25	-	35.75	157	5.58	889	31.62
16	2.46	123	18.90	35.75	-	36.25	161	5.72	1050	37.34
38	5.82	161	24.72	36.25	-	36.75	206	7.33	1256	44.67
23	3.55	184	28.27	36.75	-	37.25	182	6.48	1438	51.15
35	5.41	219	33.69	37.25	-	37.75	207	7.35	1645	58.51
38	5.76	257	39.45	37.75	-	38.25	165	5.89	1810	64.39
34	5.23	291	44.68	38.25	-	38.75	198	7.03	2008	71.42
41	6.33	332	51.00	38.75	-	39.25	152	5.42	2160	76.85
28	4.26	360	55.26	39.25	-	39.75	123	4.37	2283	81.22
36	5.55	396	60.81	39.75	-	40.25	99	3.51	2382	84.73
33	5.06	429	65.88	40.25	-	40.75	99	3.52	2481	88.25
19	2.91	448	68.79	40.75	-	41.25	66	2.36	2547	90.61
35	5.43	483	74.22	41.25	-	41.75	41	1.48	2588	92.08
24	3.69	507	77.91	41.75	-	42.25	51	1.83	2639	93.91
18	2.78	525	80.69	42.25	-	42.75	33	1.16	2672	95.07
20	3.10	545	83.79	42.75	-	43.25	34	1.21	2706	96.28
18	2.76	563	86.55	43.25	-	43.75	25	0.87	2731	97.15
13	2.02	576	88.57	43.75	-	44.25	16	0.58	2747	97.73
11	1.73	587	90.30	44.25	-	44.75	22	0.78	2769	98.51
19	2.86	606	93.17	44.75	-	45.25	13	0.45	2782	98.96
8	1.15	614	94.31	45.25	-	45.75	3	0.11	2785	99.07
5	0.82	619	95.13	45.75	-	46.25	6	0.22	2791	99.30
10	1.46	629	96.59	46.25	-	46.75	7	0.23	2798	99.53
2	0.31	631	96.90	46.75	-	47.25	2	0.09	2800	99.62
9	1.42	640	98.32	47.25	-	47.75	2	0.07	2802	99.68
2	0.29	642	98.61	47.75	-	48.25	3	0.12	2805	99.80
4	0.54	646	99.15	48.25	-	48.75	0	0.00	2805	99.80
0	0.00	646	99.15	48.75	-	49.25	2	0.07	2807	99.87
1	0.19	647	99.34	49.25	-	49.75	2	0.08	2809	99.95
0	0.00	647	99.34	49.75	-	50.25	0	0.00	2809	99.95
0	0.06	647	99.39	50.25	-	50.75	1	0.03	2810	99.98
0	0.00	647	99.39	50.75	-	51.25	0	0.00	2810	99.98
3	0.42	650	99.82	51.25	-	51.75	1	0.02	2811	100.00
1	0.18	651	100.00	51.75	-	52.25				

(73) KNEE HEIGHT, SITTING

The vertical distance between a footrest surface and the suprapatella landmark at the top of the right knee (located and drawn while the subject stands) is measured with an anthropometer. The subject sits with the thighs parallel, the knees flexed 90 degrees, and the feet in line with the thighs.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
45.99	18.11	1ST	49.30	19.41
46.20	18.19	2ND	49.90	19.65
46.60	18.35	3RD	50.40	19.84
47.10	18.54	5TH	51.00	20.08
48.00	18.90	10TH	52.00	20.47
48.70	19.17	15TH	52.70	20.75
49.07	19.32	20TH	53.30	20.98
49.60	19.53	25TH	53.70	21.14
50.00	19.69	30TH	54.10	21.30
50.30	19.80	35TH	54.50	21.46
50.60	19.92	40TH	54.80	21.57
51.10	20.12	45TH	55.20	21.73
51.40	20.24	50TH	55.50	21.85
51.70	20.35	55TH	55.90	22.01
52.10	20.51	60TH	56.20	22.13
52.40	20.63	65TH	56.50	22.24
52.80	20.79	70TH	57.00	22.44
53.20	20.94	75TH	57.40	22.60
53.70	21.14	80TH	58.00	22.83
54.20	21.34	85TH	58.50	23.03
54.90	21.61	90TH	59.30	23.35
55.90	22.01	95TH	60.40	23.78
56.30	22.17	97TH	61.03	24.03
56.69	22.32	98TH	61.60	24.25
57.13	22.49	99TH	62.60	24.65

KNEE HEIGHT, SITTING

FEMALES		
CM		INCHES
51.42	MEAN	20.25
0.10	SE (MEAN)	0.04
2.62	STD DEVIATION	1.03
0.07	SE (STD DEV)	0.03
44.70	MINIMUM	17.60
60.00	MAXIMUM	23.62
	SKEWNESS	0.09
	KURTOSIS	2.71
	COEF VAR	5.1%
	N	651

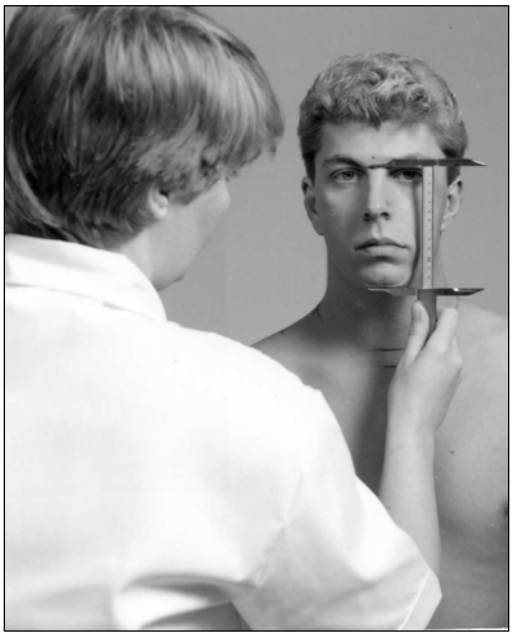
MALES		
CM		INCHES
55.59	MEAN	21.88
0.05	SE (MEAN)	0.02
2.83	STD DEVIATION	1.11
0.04	SE (STD DEV)	0.01
47.00	MINIMUM	18.50
65.80	MAXIMUM	25.91
	SKEWNESS	0.14
	KURTOSIS	3.06
	COEF VAR	5.1%
	N	2811

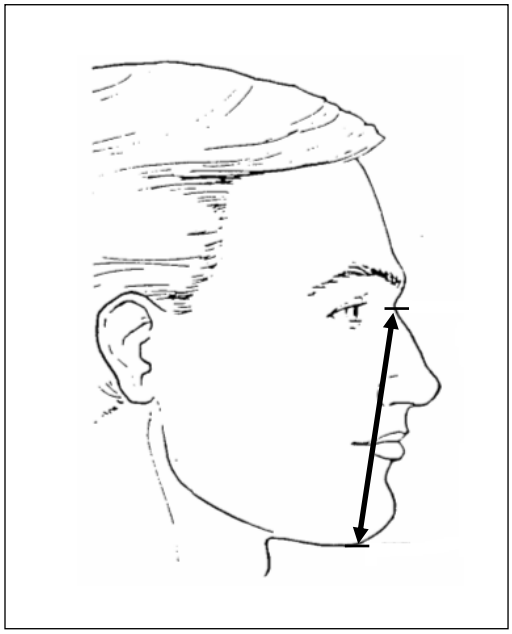
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.13	1	0.13	44.25	-	44.75				
3	0.49	4	0.62	44.75	-	45.25				
1	0.14	5	0.76	45.25	-	45.75				
9	1.35	14	2.11	45.75	-	46.25				
10	1.51	24	3.62	46.25	-	46.75				
17	2.56	41	6.18	46.75	-	47.25	1	0.03	1	0.03
13	1.96	54	8.13	47.25	-	47.75	5	0.16	6	0.19
23	3.58	77	11.71	47.75	-	48.25	6	0.20	12	0.39
22	3.39	99	15.11	48.25	-	48.75	10	0.35	22	0.74
40	6.11	139	21.22	48.75	-	49.25	4	0.15	26	0.89
40	6.09	179	27.31	49.25	-	49.75	21	0.74	47	1.64
41	6.38	220	33.68	49.75	-	50.25	28	0.98	75	2.61
55	8.40	275	42.08	50.25	-	50.75	37	1.33	112	3.94
28	4.26	303	46.34	50.75	-	51.25	56	2.00	168	5.94
59	9.01	362	55.35	51.25	-	51.75	76	2.71	244	8.65
42	6.44	404	61.79	51.75	-	52.25	93	3.32	337	11.97
52	8.02	456	69.81	52.25	-	52.75	100	3.57	437	15.53
36	5.48	492	75.29	52.75	-	53.25	121	4.29	558	19.83
37	5.68	529	80.97	53.25	-	53.75	156	5.55	714	25.38
31	4.84	560	85.81	53.75	-	54.25	187	6.66	901	32.04
22	3.42	582	89.23	54.25	-	54.75	197	7.02	1098	39.06
14	2.15	596	91.38	54.75	-	55.25	179	6.36	1277	45.42
14	2.12	610	93.50	55.25	-	55.75	226	8.05	1503	53.47
22	3.35	632	96.85	55.75	-	56.25	212	7.52	1715	61.00
9	1.47	641	98.32	56.25	-	56.75	178	6.34	1893	67.34
5	0.82	646	99.14	56.75	-	57.25	146	5.19	2039	72.53
2	0.25	648	99.40	57.25	-	57.75	152	5.42	2191	77.95
1	0.24	649	99.64	57.75	-	58.25	147	5.23	2338	83.18
1	0.18	650	99.81	58.25	-	58.75	105	3.72	2443	86.90
0	0.00	650	99.81	58.75	-	59.25	83	2.94	2526	89.84
0	0.00	650	99.81	59.25	-	59.75	68	2.43	2594	92.27
1	0.19	651	100.00	59.75	-	60.25	63	2.24	2657	94.50
				60.25	-	60.75	51	1.83	2708	96.33
				60.75	-	61.25	26	0.92	2734	97.26
				61.25	-	61.75	33	1.18	2767	98.43
				61.75	-	62.25	10	0.35	2777	98.78
				62.25	-	62.75	11	0.40	2788	99.19
				62.75	-	63.25	10	0.37	2798	99.55
				63.25	-	63.75	2	0.06	2800	99.62
				63.75	-	64.25	3	0.12	2803	99.74
				64.25	-	64.75	5	0.18	2808	99.92
				64.75	-	65.25	0	0.00	2808	99.92
				65.25	-	65.75	2	0.06	2810	99.97
				65.75	-	66.25	1	0.03	2811	100.00

(77) MENTON-SELLION LENGTH

The distance between the menton landmark at the bottom of the chin and the sellion landmark at the deepest point of the nasal root depression is measured with a sliding caliper. The teeth are lightly occluded.





PERCENTILES

FEMALES			MALES	
CM	INCHES		CM	INCHES
9.90	3.90	1ST	10.60	4.17
10.20	4.02	2ND	10.80	4.25
10.30	4.06	3RD	10.90	4.29
10.40	4.09	5TH	11.00	4.33
10.60	4.17	10TH	11.30	4.45
10.80	4.25	15TH	11.40	4.49
10.90	4.29	20TH	11.50	4.53
11.00	4.33	25TH	11.60	4.57
11.10	4.37	30TH	11.70	4.61
11.20	4.41	35TH	11.80	4.65
11.30	4.45	40TH	11.90	4.69
11.40	4.49	45TH	12.00	4.72
11.40	4.49	50TH	12.10	4.76
11.50	4.53	55TH	12.20	4.80
11.60	4.57	60TH	12.30	4.84
11.60	4.57	65TH	12.30	4.84
11.70	4.61	70TH	12.50	4.92
11.80	4.65	75TH	12.60	4.96
11.90	4.69	80TH	12.70	5.00
12.09	4.76	85TH	12.80	5.04
12.30	4.84	90TH	13.00	5.12
12.40	4.88	95TH	13.30	5.24
12.50	4.92	97TH	13.50	5.31
12.60	4.96	98TH	13.60	5.35
12.80	5.04	99TH	13.80	5.43

MENTON-SELLION LENGTH

FEMALES		
CM		IN
11.43	MEAN	4.50
0.02	SE (MEAN)	0.01
0.61	STD DEVIATION	0.24
0.02	SE (STD DEV)	0.01
9.50	MINIMUM	3.74
13.10	MAXIMUM	5.16
	SKEWNESS	-0.04
	KURTOSIS	3.03
	COEF VAR	5.3%
	N	651

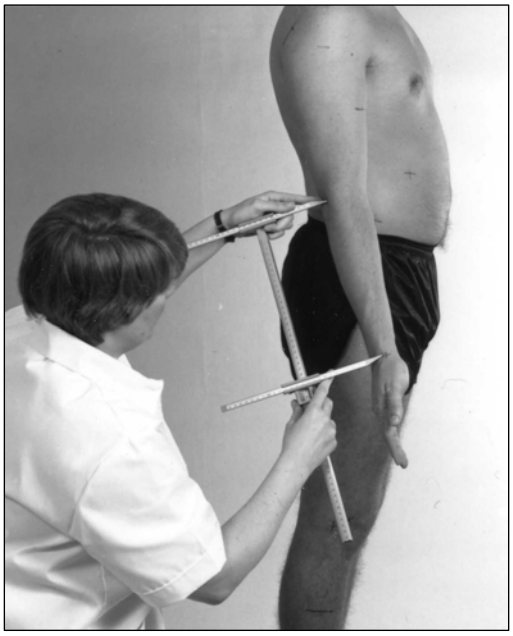
MALES		
CM		IN
12.11	MEAN	4.77
0.01	SE (MEAN)	0.01
0.68	STD DEVIATION	0.27
0.01	SE (STD DEV)	0.00
10.10	MINIMUM	3.98
14.50	MAXIMUM	5.71
	SKEWNESS	0.19
	KURTOSIS	2.98
	COEF VAR	5.6%
	N	2811

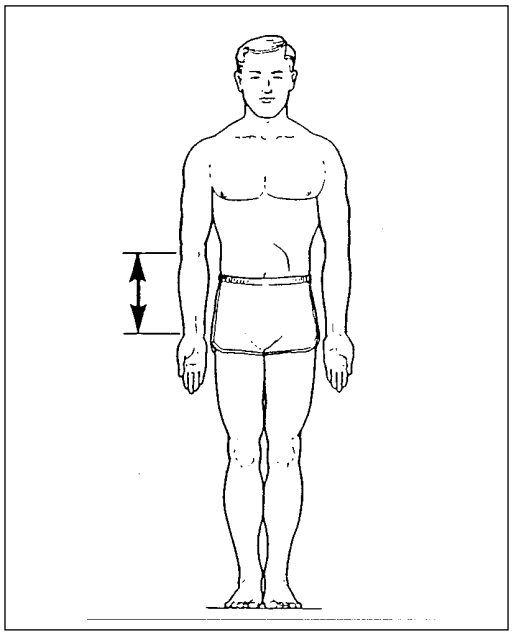
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
2	0.33	2	0.33	9.45	-	9.55				
1	0.09	3	0.43	9.55	-	9.65				
0	0.00	3	0.43	9.65	-	9.75				
3	0.38	6	0.81	9.75	-	9.85				
1	0.22	7	1.03	9.85	-	9.95				
1	0.13	8	1.16	9.95	-	10.05				
4	0.53	12	1.68	10.05	-	10.15	0	0.02	0	0.02
6	0.87	18	2.55	10.15	-	10.25	2	0.06	2	0.08
6	0.90	24	3.46	10.25	-	10.35	4	0.14	6	0.22
14	2.11	38	5.56	10.35	-	10.45	5	0.20	11	0.42
11	1.74	49	7.31	10.45	-	10.55	5	0.17	16	0.59
19	2.96	68	10.27	10.55	-	10.65	16	0.57	32	1.16
16	2.50	84	12.77	10.65	-	10.75	15	0.55	47	1.70
26	4.01	110	16.77	10.75	-	10.85	29	1.03	76	2.73
26	4.00	136	20.77	10.85	-	10.95	23	0.80	99	3.53
36	5.58	172	26.35	10.95	-	11.05	47	1.66	146	5.19
42	6.52	214	32.87	11.05	-	11.15	52	1.84	198	7.04
36	5.56	250	38.43	11.15	-	11.25	72	2.57	270	9.61
40	6.16	290	44.59	11.25	-	11.35	114	4.05	384	13.66
37	5.66	327	50.25	11.35	-	11.45	74	2.62	458	16.28
52	7.90	379	58.15	11.45	-	11.55	123	4.38	581	20.66
53	8.15	432	66.30	11.55	-	11.65	154	5.47	735	26.13
40	6.13	472	72.42	11.65	-	11.75	130	4.64	865	30.77
29	4.40	501	76.82	11.75	-	11.85	136	4.84	1001	35.61
23	3.60	524	80.42	11.85	-	11.95	138	4.90	1139	40.50
30	4.58	554	84.99	11.95	-	12.05	200	7.11	1339	47.61
18	2.73	572	87.73	12.05	-	12.15	176	6.25	1515	53.86
11	1.62	583	89.34	12.15	-	12.25	135	4.79	1650	58.65
19	2.92	602	92.26	12.25	-	12.35	182	6.47	1832	65.12
19	2.94	621	95.20	12.35	-	12.45	128	4.54	1960	69.66
13	2.05	634	97.25	12.45	-	12.55	138	4.93	2098	74.59
7	1.11	641	98.35	12.55	-	12.65	121	4.29	2219	78.88
3	0.48	644	98.83	12.65	-	12.75	114	4.07	2333	82.95
2	0.35	646	99.19	12.75	-	12.85	88	3.13	2421	86.08
2	0.34	648	99.53	12.85	-	12.95	52	1.84	2473	87.92
0	0.00	648	99.53	12.95	-	13.05	87	3.09	2560	91.01
3	0.47	651	100.00	13.05	-	13.15	57	2.03	2617	93.03
				13.15	-	13.25	46	1.64	2663	94.68
				13.25	-	13.35	46	1.65	2709	96.33
				13.35	-	13.45	19	0.67	2728	97.00
				13.45	-	13.55	18	0.66	2746	97.66
				13.55	-	13.65	22	0.79	2768	98.44
				13.65	-	13.75	13	0.46	2781	98.90
				13.75	-	13.85	7	0.24	2788	99.14
				13.85	-	13.95	7	0.27	2795	99.40
				13.95	-	14.05	5	0.18	2800	99.58
				14.05	-	14.15	3	0.10	2803	99.68
				14.15	-	14.25	3	0.12	2806	99.80
				14.25	-	14.35	2	0.09	2808	99.89
				14.35	-	14.45	2	0.08	2810	99.97
				14.45	-	14.55	1	0.03	2811	100.00

(87) RADIALE-STYLION LENGTH

The distance between the radiale landmark on the right elbow and the stylion landmark on the right wrist is measured with a beam caliper held parallel to the long axis of the forearm. The subject stands with the arms relaxed at the sides. The hand and fingers are held straight in line with the long axis of the forearm.





PERCENTILES

FEMALES			MALES	
CM	INCHES		CM	INCHES
20.90	8.23	1ST	23.10	9.09
21.28	8.38	2ND	23.60	9.29
21.60	8.50	3RD	23.90	9.41
21.84	8.60	5TH	24.30	9.57
22.30	8.78	10TH	24.80	9.76
22.80	8.98	15TH	25.20	9.92
23.00	9.06	20TH	25.40	10.00
23.30	9.17	25TH	25.60	10.08
23.50	9.25	30TH	25.90	10.20
23.80	9.37	35TH	26.20	10.31
24.10	9.49	40TH	26.40	10.39
24.20	9.53	45TH	26.70	10.51
24.30	9.57	50TH	27.00	10.63
24.50	9.65	55TH	27.10	10.67
24.80	9.76	60TH	27.30	10.75
25.10	9.88	65TH	27.50	10.83
25.20	9.92	70TH	27.87	10.97
25.40	10.00	75TH	28.10	11.06
25.80	10.16	80TH	28.30	11.14
26.10	10.28	85TH	28.60	11.26
26.50	10.43	90TH	29.10	11.46
27.18	10.70	95TH	29.88	11.76
27.80	10.94	97TH	30.30	11.93
28.11	11.06	98TH	30.64	12.07
28.52	11.23	99TH	31.30	12.32

RADIALE-STYLION LENGTH

FEMALES		
CM		INCHES
24.44	MEAN	9.62
0.06	SE (MEAN)	0.03
1.63	STD DEVIATION	0.64
0.05	SE (STD DEV)	0.02
20.10	MINIMUM	7.91
30.70	MAXIMUM	12.09
	SKEWNESS	0.24
	KURTOSIS	3.18
	COEF VAR	6.7%
	N	651

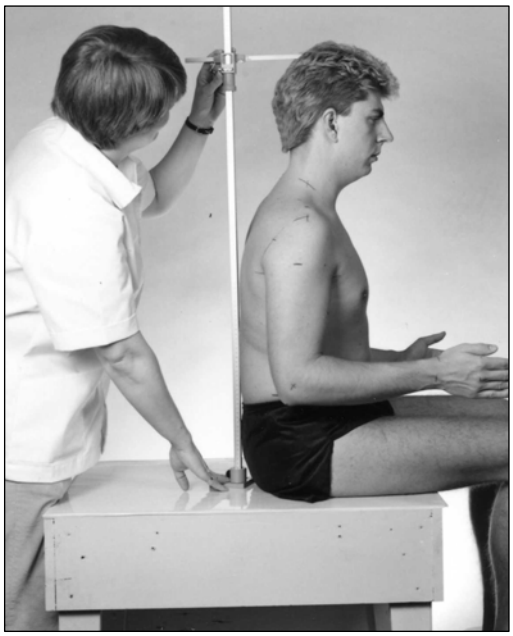
MALES		
CM		INCHES
26.93	MEAN	10.60
0.03	SE (MEAN)	0.01
1.71	STD DEVIATION	0.67
0.02	SE (STD DEV)	0.01
21.40	MINIMUM	8.43
33.10	MAXIMUM	13.03
	SKEWNESS	0.24
	KURTOSIS	3.12
	COEF VAR	6.4%
	N	2811

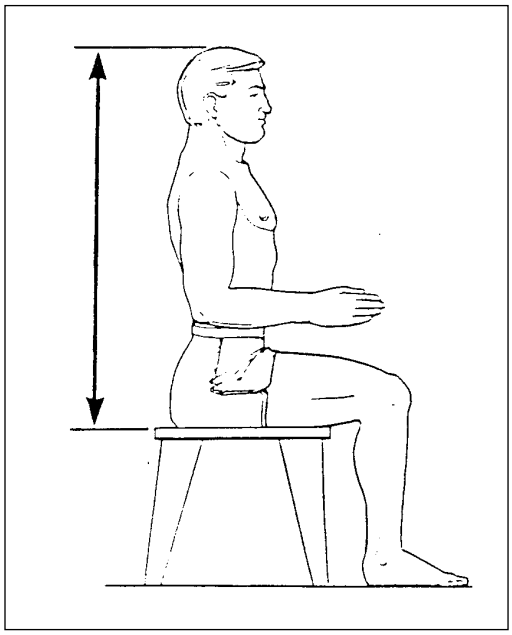
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
2	0.33	2	0.33	19.75	-	20.25				
1	0.23	3	0.57	20.25	-	20.75				
9	1.32	12	1.88	20.75	-	21.25				
14	2.22	26	4.11	21.25	-	21.75	1	0.04	1	0.04
34	5.24	60	9.34	21.75	-	22.25	1	0.03	2	0.06
33	5.07	93	14.41	22.25	-	22.75	8	0.30	10	0.37
56	8.61	149	23.02	22.75	-	23.25	22	0.79	32	1.16
74	11.33	223	34.35	23.25	-	23.75	36	1.28	68	2.44
84	12.84	307	47.19	23.75	-	24.25	52	1.85	120	4.29
74	11.35	381	58.54	24.25	-	24.75	145	5.15	265	9.44
78	11.93	459	70.47	24.75	-	25.25	206	7.35	471	16.79
62	9.50	521	79.97	25.25	-	25.75	306	10.89	777	27.68
41	6.26	562	86.22	25.75	-	26.25	242	8.60	1019	36.28
40	6.17	602	92.39	26.25	-	26.75	294	10.46	1313	46.74
19	2.95	621	95.34	26.75	-	27.25	316	11.23	1629	57.97
10	1.57	631	96.91	27.25	-	27.75	298	10.59	1927	68.56
10	1.53	641	98.43	27.75	-	28.25	262	9.33	2189	77.90
6	0.87	647	99.31	28.25	-	28.75	246	8.75	2435	86.65
3	0.51	650	99.81	28.75	-	29.25	145	5.14	2580	91.79
0	0.00	650	99.81	29.25	-	29.75	82	2.92	2662	94.72
0	0.00	650	99.81	29.75	-	30.25	61	2.16	2723	96.87
1	0.19	651	100.00	30.25	-	30.75	37	1.31	2760	98.18
				30.75	-	31.25	20	0.71	2780	98.90
				31.25	-	31.75	14	0.51	2794	99.40
				31.75	-	32.25	8	0.29	2802	99.69
				32.25	-	32.75	4	0.13	2806	99.82
				32.75	-	33.25	5	0.18	2811	100.00

(93) SITTING HEIGHT

The vertical distance between a sitting surface and the top of the head is measured with an anthropometer. The subject sits erect with the head in the Frankfort plane. The shoulders and upper arms are relaxed, and the forearms and hands are extended forward horizontally with the palms facing each other. The thighs are parallel and the knees are flexed 90 degrees with the feet in line with the thighs. The measurement is made at the maximum point of quiet respiration.





PERCENTILES

FEMALES			MALES	
CM	INCHES		CM	INCHES
77.92	30.68	1ST	83.66	32.93
78.80	31.02	2ND	84.50	33.27
79.30	31.22	3RD	85.10	33.50
79.87	31.45	5TH	85.83	33.79
81.50	32.09	10TH	87.10	34.29
82.50	32.48	15TH	88.10	34.69
83.00	32.68	20TH	88.90	35.00
83.60	32.91	25TH	89.50	35.24
84.15	33.13	30TH	89.90	35.39
84.50	33.27	35TH	90.40	35.59
85.20	33.54	40TH	90.90	35.79
85.50	33.66	45TH	91.40	35.98
85.90	33.82	50TH	91.80	36.14
86.40	34.02	55TH	92.30	36.34
86.90	34.21	60TH	92.70	36.50
87.30	34.37	65TH	93.20	36.69
87.70	34.53	70TH	93.70	36.89
88.30	34.76	75TH	94.20	37.09
89.00	35.04	80TH	94.80	37.32
89.50	35.24	85TH	95.60	37.64
90.30	35.55	90TH	96.50	37.99
91.80	36.14	95TH	97.99	38.58
92.55	36.44	97TH	98.90	38.94
93.46	36.79	98TH	99.75	39.27
94.21	37.09	99TH	100.60	39.61

FEMALES		
CM		INCHES
85.96	MEAN	33.84
0.14	SE (MEAN)	0.05
3.48	STD DEVIATION	1.37
0.10	SE (STD DEV)	0.04
75.40	MINIMUM	29.69
97.60	MAXIMUM	38.43
	SKEWNESS	0.05
	KURTOSIS	3.01
	COEF VAR	4.0%
	N	651

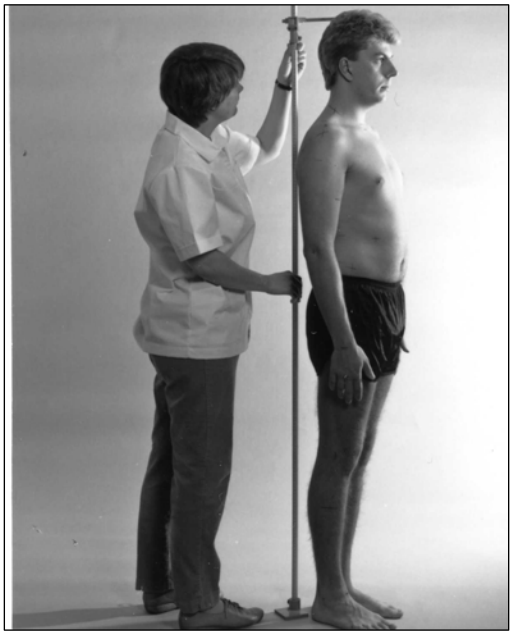
MALES		
CM		INCHES
91.86	MEAN	36.17
0.07	SE (MEAN)	0.03
3.66	STD DEVIATION	1.44
0.05	SE (STD DEV)	0.02
76.70	MINIMUM	30.20
107.60	MAXIMUM	42.36
	SKEWNESS	0.13
	KURTOSIS	3.27
	COEF VAR	4.0%
	N	2811

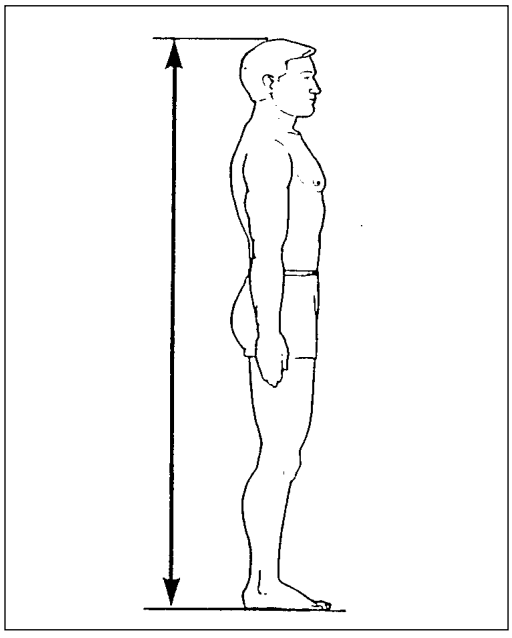
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.19	1	0.19	74.55	-	75.55				
0	0.00	1	0.19	75.55	-	76.55				
1	0.16	2	0.35	76.55	-	77.55	1	0.03	1	0.03
7	1.06	9	1.40	77.55	-	78.55	1	0.04	2	0.06
15	2.30	24	3.71	78.55	-	79.55	0	0.00	2	0.07
18	2.76	42	6.47	79.55	-	80.55	0	0.00	2	0.07
25	3.79	67	10.26	80.55	-	81.55	2	0.07	4	0.14
33	5.07	100	15.34	81.55	-	82.55	5	0.19	9	0.33
60	9.13	160	24.47	82.55	-	83.55	15	0.53	24	0.86
70	10.71	230	35.18	83.55	-	84.55	34	1.22	58	2.08
70	10.82	300	46.00	84.55	-	85.55	56	1.98	114	4.06
76	11.60	376	57.60	85.55	-	86.55	93	3.30	207	7.36
69	10.61	445	68.21	86.55	-	87.55	132	4.69	339	12.05
60	9.27	505	77.49	87.55	-	88.55	168	5.97	507	18.02
51	7.84	556	85.33	88.55	-	89.55	222	7.88	729	25.90
38	5.89	594	91.22	89.55	-	90.55	299	10.64	1028	36.54
18	2.73	612	93.95	90.55	-	91.55	303	10.77	1331	47.31
20	3.13	632	97.08	91.55	-	92.55	312	11.09	1643	58.40
8	1.18	640	98.25	92.55	-	93.55	288	10.25	1931	68.65
7	1.14	647	99.39	93.55	-	94.55	275	9.79	2206	78.44
2	0.24	649	99.63	94.55	-	95.55	184	6.55	2390	84.98
1	0.18	650	99.81	95.55	-	96.55	143	5.09	2533	90.07
0	0.00	650	99.81	96.55	-	97.55	98	3.48	2631	93.55
1	0.19	651	100.00	97.55	-	98.55	81	2.87	2712	96.42
				98.55	-	99.55	37	1.33	2749	97.75
				99.55	-	100.55	35	1.26	2784	99.01
				100.55	-	101.55	10	0.37	2794	99.38
				101.55	-	102.55	6	0.22	2800	99.60
				102.55	-	103.55	8	0.28	2808	99.88
				103.55	-	104.55	1	0.04	2809	99.92
				104.55	-	105.55	0	0.00	2809	99.92
				105.55	-	106.55	0	0.00	2809	99.92
				106.55	-	107.55	1	0.04	2810	99.95
				107.55	-	108.55	1	0.05	2811	100.00

(99) STATURE

The vertical distance from a standing surface to the top of the head is measured with an anthropometer. The subject stands erect with the head in the Frankfort plane. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
147.10	57.91	1ST	159.58	62.82
150.01	59.06	2ND	161.60	63.62
151.20	59.53	3RD	162.70	64.06
152.03	59.85	5TH	164.30	64.69
154.44	60.80	10TH	166.56	65.57
156.40	61.57	15TH	168.50	66.34
157.90	62.17	20TH	169.90	66.89
158.80	62.52	25TH	171.00	67.32
159.70	62.87	30TH	172.00	67.72
160.50	63.19	35TH	172.90	68.07
161.50	63.58	40TH	173.60	68.35
162.20	63.86	45TH	174.50	68.70
163.10	64.21	50TH	175.50	69.09
164.00	64.57	55TH	176.40	69.45
164.60	64.80	60TH	177.30	69.80
165.50	65.16	65TH	178.20	70.16
166.50	65.55	70TH	179.00	70.47
167.33	65.88	75TH	180.00	70.87
168.30	66.26	80TH	181.20	71.34
169.77	66.84	85TH	182.70	71.93
171.00	67.32	90TH	184.44	72.62
173.03	68.12	95TH	187.24	73.72
174.20	68.58	97TH	189.11	74.45
175.39	69.05	98TH	190.20	74.88
177.97	70.06	99TH	192.99	75.98

STATURE

FEMALES		
CM		INCHES
162.96	MEAN	64.16
0.25	SE (MEAN)	0.10
6.39	STD DEVIATION	2.52
0.18	SE (STD DEV)	0.07
144.20	MINIMUM	56.77
183.60	MAXIMUM	72.28
	SKEWNESS	-0.06
	KURTOSIS	2.96
	COEF VAR	3.9%
	N	651

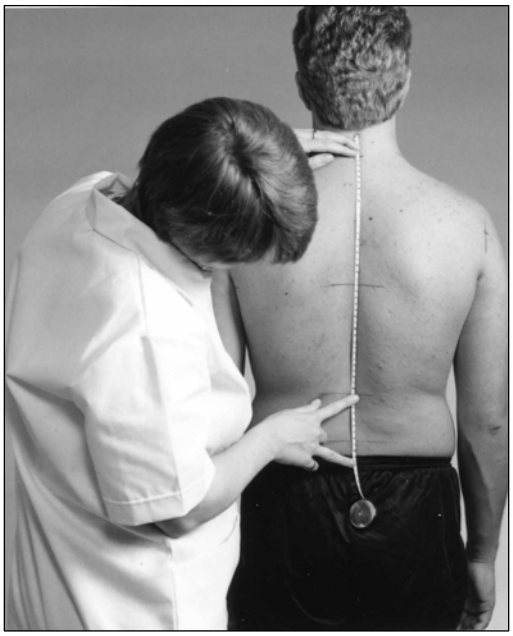
MALES		
CM		INCHES
175.55	MEAN	69.11
0.13	SE (MEAN)	0.05
6.99	STD DEVIATION	2.75
0.09	SE (STD DEV)	0.04
154.00	MINIMUM	60.63
204.80	MAXIMUM	80.63
	SKEWNESS	0.14
	KURTOSIS	3.23
	COEF VAR	4.0%
	N	2811

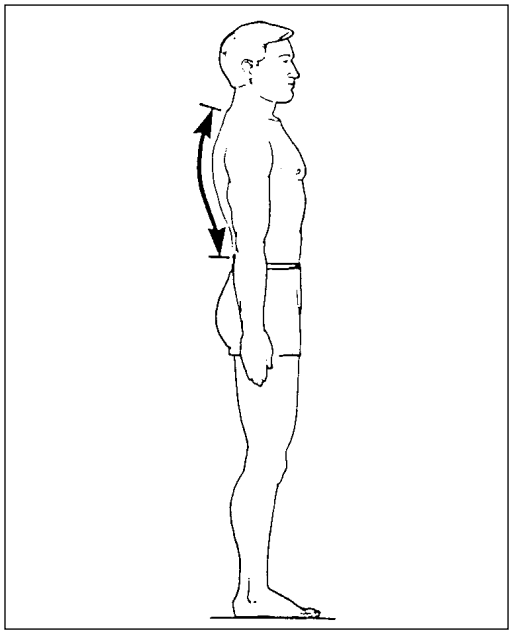
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.14	1	0.14	142.75	-	144.25				
0	0.00	1	0.14	144.25	-	145.75				
6	0.91	7	1.06	145.75	-	147.25				
4	0.63	11	1.68	147.25	-	148.75				
5	0.74	16	2.42	148.75	-	150.25				
11	1.61	27	4.03	150.25	-	151.75				
21	3.29	48	7.32	151.75	-	153.25				
24	3.68	72	11.00	153.25	-	154.75	2	0.07	2	0.07
25	3.78	97	14.77	154.75	-	156.25	5	0.17	7	0.24
30	4.58	127	19.36	156.25	-	157.75	7	0.25	14	0.49
56	8.66	183	28.02	157.75	-	159.25	10	0.37	24	0.86
50	7.68	233	35.70	159.25	-	160.75	18	0.63	42	1.49
70	10.75	303	46.45	160.75	-	162.25	34	1.22	76	2.71
48	7.37	351	53.82	162.25	-	163.75	46	1.63	122	4.34
64	9.79	415	63.61	163.75	-	165.25	79	2.79	201	7.14
52	7.99	467	71.60	165.25	-	166.75	87	3.11	288	10.24
53	8.06	520	79.66	166.75	-	168.25	112	3.99	400	14.24
35	5.41	555	85.08	168.25	-	169.75	147	5.24	547	19.48
37	5.66	592	90.73	169.75	-	171.25	197	6.99	744	26.47
24	3.72	616	94.45	171.25	-	172.75	222	7.89	966	34.36
18	2.77	634	97.22	172.75	-	174.25	266	9.47	1232	43.83
9	1.40	643	98.62	174.25	-	175.75	207	7.38	1439	51.20
3	0.47	646	99.09	175.75	-	177.25	243	8.66	1682	59.86
0	0.00	646	99.09	177.25	-	178.75	231	8.20	1913	68.06
3	0.49	649	99.57	178.75	-	180.25	231	8.23	2144	76.29
0	0.06	649	99.63	180.25	-	181.75	175	6.23	2319	82.52
1	0.18	650	99.81	181.75	-	183.25	123	4.37	2442	86.89
1	0.19	651	100.00	183.25	-	184.75	114	4.04	2556	90.93
				184.75	-	186.25	65	2.32	2621	93.25
				186.25	-	187.75	70	2.47	2691	95.73
				187.75	-	189.25	38	1.33	2729	97.06
				189.25	-	190.75	33	1.19	2762	98.25
				190.75	-	192.25	20	0.70	2782	98.94
				192.25	-	193.75	6	0.21	2788	99.16
				193.75	-	195.25	9	0.33	2797	99.49
				195.25	-	196.75	4	0.16	2801	99.64
				196.75	-	198.25	6	0.20	2807	99.84
				198.25	-	199.75	1	0.05	2808	99.89
				199.75	-	201.25	1	0.04	2809	99.92
				201.25	-	202.75	0	0.00	2809	99.92
				202.75	-	204.25	1	0.05	2810	99.97
				204.25	-	205.75	1	0.03	2811	100.00

(111) WAIST BACK LENGTH (OMPHALION)

The surface distance between the cervicale landmark at the back of the neck and the posterior-waist (omphalion) landmark at the level of the navel is measured with a tape. The subject stands erect with the head in the Frankfort plane. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
37.33	14.70	1ST	41.60	16.38
38.94	15.32	2ND	42.32	16.66
39.19	15.43	3RD	43.00	16.93
39.80	15.67	5TH	43.60	17.17
40.90	16.10	10TH	44.70	17.60
41.60	16.38	15TH	45.42	17.88
42.10	16.57	20TH	46.00	18.11
42.54	16.74	25TH	46.50	18.31
43.00	16.93	30TH	46.90	18.46
43.50	17.13	35TH	47.30	18.62
43.80	17.24	40TH	47.70	18.78
44.20	17.40	45TH	48.00	18.90
44.60	17.56	50TH	48.40	19.06
45.00	17.72	55TH	48.70	19.17
45.30	17.83	60TH	49.10	19.33
45.70	17.99	65TH	49.50	19.49
46.00	18.11	70TH	49.90	19.65
46.80	18.43	75TH	50.30	19.80
47.50	18.70	80TH	50.90	20.04
48.35	19.04	85TH	51.50	20.28
49.00	19.29	90TH	52.30	20.59
50.20	19.76	95TH	53.40	21.02
51.10	20.12	97TH	54.20	21.34
51.60	20.31	98TH	55.00	21.65
52.58	20.70	99TH	56.00	22.05

WAIST BACK LENGTH (OMPHALION)

FEMALES		
CM		INCHES
44.76	MEAN	17.62
0.12	SE (MEAN)	0.05
3.17	STD DEVIATION	1.25
0.09	SE (STD DEV)	0.03
36.60	MINIMUM	14.41
56.50	MAXIMUM	22.24
	SKEWNESS	0.26
	KURTOSIS	3.12
	COEF VAR	7.1%
	N	651

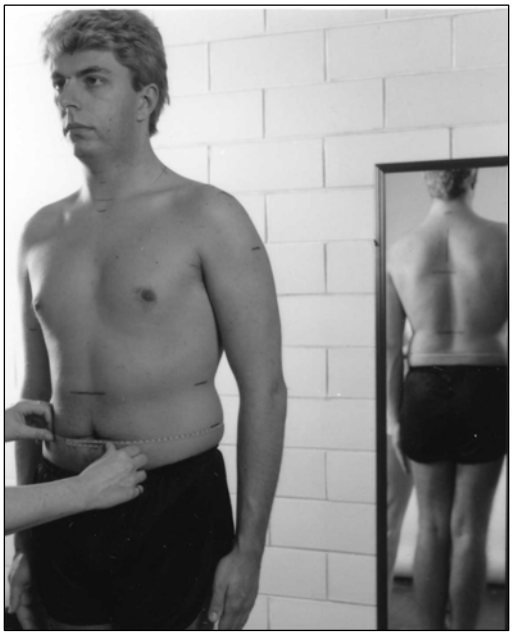
MALES		
CM		INCHES
48.46	MEAN	19.08
0.06	SE (MEAN)	0.02
2.98	STD DEVIATION	1.17
0.04	SE (STD DEV)	0.02
38.40	MINIMUM	15.12
58.60	MAXIMUM	23.07
	SKEWNESS	0.13
	KURTOSIS	3.13
	COEF VAR	6.1%
	N	2811

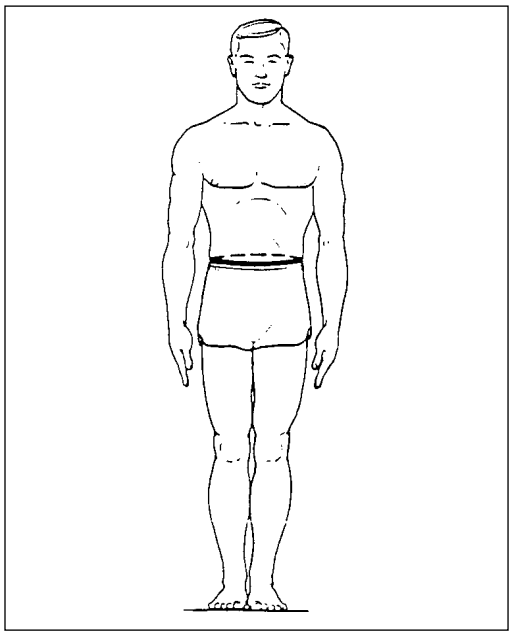
FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
4	0.65	4	0.65	36.25	-	36.75				
2	0.25	6	0.90	36.75	-	37.25				
3	0.41	9	1.31	37.25	-	37.75				
0	0.00	9	1.31	37.75	-	38.25				
3	0.46	12	1.76	38.25	-	38.75	0	0.01	0	0.01
10	1.54	22	3.30	38.75	-	39.25	0	0.00	0	0.01
10	1.49	32	4.79	39.25	-	39.75	1	0.05	1	0.07
14	2.15	46	6.94	39.75	-	40.25	4	0.14	5	0.21
10	1.56	56	8.50	40.25	-	40.75	5	0.19	10	0.40
29	4.45	85	12.96	40.75	-	41.25	6	0.22	16	0.62
23	3.57	108	16.52	41.25	-	41.75	19	0.67	35	1.28
32	4.95	140	21.47	41.75	-	42.25	13	0.48	48	1.76
35	5.36	175	26.83	42.25	-	42.75	21	0.74	69	2.50
34	5.20	209	32.03	42.75	-	43.25	33	1.16	102	3.65
50	7.68	259	39.70	43.25	-	43.75	54	1.91	156	5.57
37	5.76	296	45.46	43.75	-	44.25	68	2.41	224	7.98
42	6.43	338	51.90	44.25	-	44.75	61	2.17	285	10.15
47	7.18	385	59.07	44.75	-	45.25	82	2.91	367	13.06
48	7.31	433	66.38	45.25	-	45.75	116	4.12	483	17.18
31	4.81	464	71.19	45.75	-	46.25	142	5.07	625	22.25
24	3.68	488	74.88	46.25	-	46.75	172	6.11	797	28.36
25	3.79	513	78.67	46.75	-	47.25	177	6.29	974	34.64
18	2.70	531	81.37	47.25	-	47.75	186	6.63	1160	41.27
23	3.58	554	84.95	47.75	-	48.25	190	6.76	1350	48.03
18	2.76	572	87.71	48.25	-	48.75	205	7.31	1555	55.34
26	3.93	598	91.64	48.75	-	49.25	190	6.74	1745	62.08
12	1.82	610	93.46	49.25	-	49.75	157	5.57	1902	67.65
13	2.00	623	95.46	49.75	-	50.25	173	6.15	2075	73.80
9	1.46	632	96.92	50.25	-	50.75	132	4.69	2207	78.48
4	0.67	636	97.59	50.75	-	51.25	122	4.34	2329	82.83
5	0.75	641	98.35	51.25	-	51.75	95	3.37	2424	86.19
3	0.45	644	98.80	51.75	-	52.25	98	3.48	2522	89.67
3	0.40	647	99.20	52.25	-	52.75	73	2.59	2595	92.26
0	0.00	647	99.20	52.75	-	53.25	66	2.34	2661	94.59
2	0.39	649	99.59	53.25	-	53.75	41	1.47	2702	96.06
1	0.22	650	99.81	53.75	-	54.25	28	1.01	2730	97.07
0	0.00	650	99.81	54.25	-	54.75	15	0.55	2745	97.62
0	0.00	650	99.81	54.75	-	55.25	19	0.68	2764	98.30
0	0.00	650	99.81	55.25	-	55.75	18	0.66	2782	98.96
0	0.00	650	99.81	55.75	-	56.25	7	0.26	2789	99.22
1	0.19	651	100.00	56.25	-	56.75	6	0.21	2795	99.43
				56.75	-	57.25	6	0.23	2801	99.65
				57.25	-	57.75	5	0.19	2806	99.84
				57.75	-	58.25	4	0.13	2810	99.97
				58.25	-	58.75	1	0.03	2811	100.00

(114) WAIST CIRCUMFERENCE (OMPHALION)

The horizontal circumference of the waist at the level of the center of the navel (omphalion) is measured with a tape. The subject stands erect looking straight ahead. The heels are together with the weight distributed equally on both feet. The measurement is made at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
65.90	25.94	1ST	72.10	28.39
67.30	26.50	2ND	73.40	28.90
68.60	27.01	3RD	74.80	29.45
69.86	27.50	5TH	76.50	30.12
72.00	28.35	10TH	79.30	31.22
74.20	29.21	15TH	81.71	32.17
75.90	29.88	20TH	84.00	33.07
77.30	30.43	25TH	85.74	33.76
78.96	31.09	30TH	87.40	34.41
80.00	31.50	35TH	89.05	35.06
81.18	31.96	40TH	90.80	35.75
82.25	32.38	45TH	92.60	36.46
83.20	32.76	50TH	93.90	36.97
84.60	33.31	55TH	95.54	37.61
86.90	34.21	60TH	97.02	38.20
88.90	35.00	65TH	98.40	38.74
90.70	35.71	70TH	100.10	39.41
92.60	36.46	75TH	101.40	39.92
94.50	37.20	80TH	103.30	40.67
97.10	38.23	85TH	105.70	41.61
99.98	39.36	90TH	108.00	42.52
102.91	40.51	95TH	112.59	44.33
109.54	43.13	97TH	115.40	45.43
110.21	43.40	98TH	117.21	46.14
115.28	45.39	99TH	121.30	47.76

WAIST CIRCUMFERENCE (OMPHALION)

FEMALES		
CM		INCHES
85.23	MEAN	33.55
0.42	SE (MEAN)	0.17
10.70	STD DEVIATION	4.21
0.30	SE (STD DEV)	0.12
61.50	MINIMUM	24.21
121.60	MAXIMUM	47.87
	SKEWNESS	0.56
	KURTOSIS	3.05
	COEF VAR	12.6%
	N	651

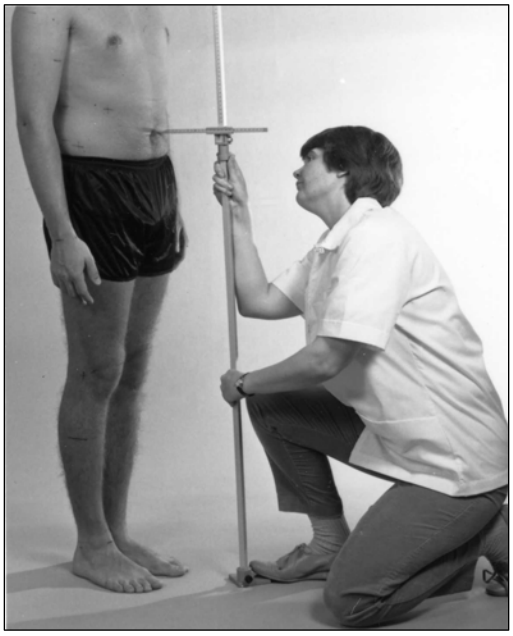
MALES		
CM		INCHES
94.02	MEAN	37.01
0.21	SE (MEAN)	0.08
11.10	STD DEVIATION	4.37
0.15	SE (STD DEV)	0.06
65.90	MINIMUM	25.94
132.40	MAXIMUM	52.13
	SKEWNESS	0.22
	KURTOSIS	2.80
	COEF VAR	11.8%
	N	2811

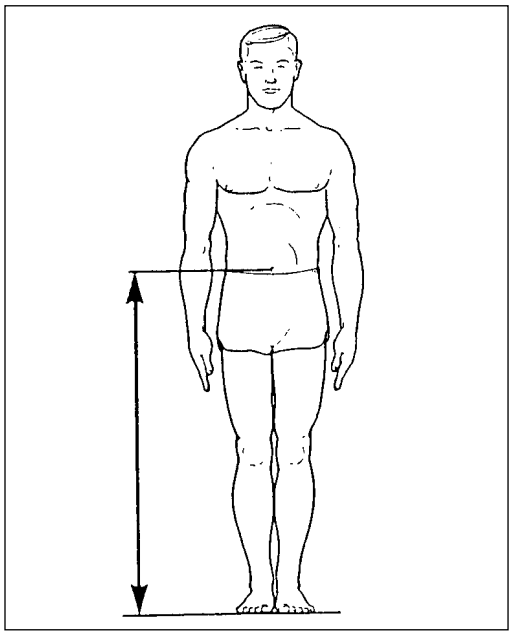
FREQUENCY TABLE

FEMALE						MALE			
F	FPct	CumF	CumFPct	CENTIMETERS		F	FPct	CumF	CumFPct
1	0.19	1	0.19	60.75	62.25				
0	0.00	1	0.19	62.25	63.75				
1	0.14	2	0.33	63.75	65.25				
9	1.38	11	1.71	65.25	66.75	2	0.07	2	0.07
5	0.83	16	2.55	66.75	68.25	5	0.17	7	0.24
15	2.24	31	4.78	68.25	69.75	2	0.09	9	0.33
11	1.61	42	6.40	69.75	71.25	12	0.44	21	0.77
31	4.72	73	11.11	71.25	72.75	20	0.71	41	1.47
27	4.17	100	15.28	72.75	74.25	26	0.92	67	2.40
29	4.51	129	19.80	74.25	75.75	49	1.74	116	4.13
32	4.98	161	24.77	75.75	77.25	62	2.20	178	6.33
31	4.81	192	29.59	77.25	78.75	76	2.70	254	9.03
46	6.98	238	36.57	78.75	80.25	70	2.49	324	11.52
41	6.24	279	42.80	80.25	81.75	98	3.48	422	15.00
48	7.34	327	50.14	81.75	83.25	85	3.02	507	18.03
34	5.19	361	55.33	83.25	84.75	118	4.21	625	22.24
17	2.56	378	57.88	84.75	86.25	117	4.16	742	26.39
31	4.72	409	62.60	86.25	87.75	137	4.86	879	31.26
27	4.16	436	66.77	87.75	89.25	116	4.13	995	35.39
23	3.59	459	70.36	89.25	90.75	120	4.26	1115	39.65
26	4.03	485	74.39	90.75	92.25	120	4.27	1235	43.91
23	3.49	508	77.88	92.25	93.75	155	5.53	1390	49.44
20	3.13	528	81.00	93.75	95.25	127	4.51	1517	53.95
19	2.88	547	83.88	95.25	96.75	142	5.06	1659	59.01
19	2.92	566	86.80	96.75	98.25	147	5.22	1806	64.22
19	2.95	585	89.75	98.25	99.75	136	4.83	1942	69.05
26	4.06	611	93.81	99.75	101.25	155	5.53	2097	74.58
8	1.22	619	95.04	101.25	102.75	129	4.59	2226	79.17
4	0.63	623	95.66	102.75	104.25	86	3.06	2312	82.23
4	0.56	627	96.22	104.25	105.75	84	3.00	2396	85.23
1	0.19	628	96.41	105.75	107.25	95	3.37	2491	88.60
5	0.69	633	97.10	107.25	108.75	72	2.56	2563	91.16
7	1.04	640	98.14	108.75	110.25	38	1.37	2601	92.53
2	0.37	642	98.51	110.25	111.75	49	1.73	2650	94.25
2	0.36	644	98.88	111.75	113.25	37	1.31	2687	95.56
1	0.18	645	99.05	113.25	114.75	28	0.99	2715	96.55
0	0.06	645	99.11	114.75	116.25	28	0.99	2743	97.54
3	0.42	648	99.53	116.25	117.75	19	0.68	2762	98.21
1	0.10	649	99.63	117.75	119.25	10	0.35	2772	98.56
0	0.00	649	99.63	119.25	120.75	8	0.30	2780	98.86
2	0.37	651	100.00	120.75	122.25	8	0.29	2788	99.15
				122.25	123.75	4	0.13	2792	99.28
				123.75	125.25	4	0.14	2796	99.42
				125.25	126.75	3	0.12	2799	99.55
				126.75	128.25	4	0.15	2803	99.70
				128.25	129.75	4	0.16	2807	99.85
				129.75	131.25	2	0.08	2809	99.93
				131.25	132.75	2	0.07	2811	100.00

(119) WAIST HEIGHT (OMPHALION)

The vertical distance between a standing surface and the center of the navel (omphalion) is measured with an anthropometer. The subject stands erect looking straight ahead. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is made at the maximum point of quiet respiration.





PERCENTILES				
FEMALES			MALES	
CM	INCHES		CM	INCHES
88.07	34.67	1ST	94.10	37.05
89.09	35.08	2ND	95.31	37.52
89.90	35.39	3RD	96.30	37.91
91.10	35.87	5TH	97.20	38.27
92.50	36.42	10TH	99.00	38.98
93.80	36.93	15TH	100.40	39.53
94.80	37.32	20TH	101.31	39.88
95.50	37.60	25TH	102.20	40.24
96.30	37.91	30TH	103.00	40.55
97.06	38.21	35TH	103.70	40.83
97.60	38.43	40TH	104.40	41.10
98.00	38.58	45TH	105.10	41.38
98.69	38.85	50TH	105.80	41.65
99.40	39.13	55TH	106.50	41.93
99.80	39.29	60TH	107.10	42.17
100.60	39.61	65TH	107.90	42.48
101.40	39.92	70TH	108.60	42.76
102.51	40.35	75TH	109.20	42.99
103.40	40.71	80TH	110.20	43.39
104.20	41.02	85TH	111.40	43.86
105.00	41.34	90TH	112.78	44.40
106.50	41.93	95TH	115.10	45.31
107.16	42.19	97TH	116.30	45.79
107.90	42.48	98TH	117.39	46.21
110.43	43.47	99TH	119.00	46.85

WAIST HEIGHT (OMPHALION)

FEMALES		
CM		INCHES
98.82	MEAN	38.91
0.19	SE (MEAN)	0.07
4.79	STD DEVIATION	1.89
0.13	SE (STD DEV)	0.05
85.10	MINIMUM	33.50
112.20	MAXIMUM	44.17
-0.03	SKEWNESS	-0.03
-0.28	KURTOSIS	2.72
	COEF VAR	4.8%
	N	651

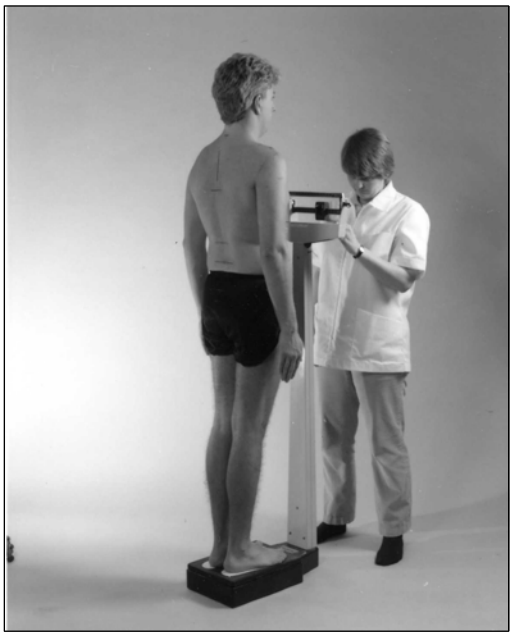
MALES		
CM		INCHES
105.87	MEAN	41.68
0.10	SE (MEAN)	0.04
5.36	STD DEVIATION	2.11
0.07	SE (STD DEV)	0.03
87.60	MINIMUM	34.49
128.30	MAXIMUM	50.51
	SKEWNESS	0.14
	KURTOSIS	3.10
	COEF VAR	5.1%
	N	2811

FREQUENCY TABLE

FEMALE				CENTIMETERS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.10	1	0.10	84.55	-	85.55				
4	0.59	5	0.69	85.55	-	86.55				
1	0.20	6	0.89	86.55	-	87.55				
2	0.36	8	1.26	87.55	-	88.55	3	0.12	3	0.12
9	1.31	17	2.57	88.55	-	89.55	0	0	3	0.12
12	1.83	29	4.40	89.55	-	90.55	1	0.02	4	0.14
24	3.59	53	7.99	90.55	-	91.55	3	0.12	7	0.27
13	2.02	66	10.01	91.55	-	92.55	4	0.16	11	0.42
26	4.02	92	14.04	92.55	-	93.55	9	0.33	20	0.75
26	4.03	118	18.07	93.55	-	94.55	16	0.57	36	1.32
46	7.10	164	25.17	94.55	-	95.55	22	0.78	58	2.10
37	5.70	201	30.87	95.55	-	96.55	52	1.85	110	3.94
56	8.52	257	39.39	96.55	-	97.55	52	1.86	162	5.81
66	10.17	323	49.56	97.55	-	98.55	74	2.64	236	8.45
54	8.30	377	57.86	98.55	-	99.55	96	3.42	332	11.87
44	6.74	421	64.60	99.55	-	100.55	108	3.84	440	15.71
40	6.19	461	70.79	100.55	-	101.55	151	5.39	591	21.10
28	4.31	489	75.10	101.55	-	102.55	171	6.08	762	27.17
39	6.01	528	81.11	102.55	-	103.55	196	6.99	958	34.16
46	7.00	574	88.12	103.55	-	104.55	192	6.82	1150	40.98
31	4.80	605	92.92	104.55	-	105.55	202	7.18	1352	48.16
15	2.25	620	95.16	105.55	-	106.55	206	7.34	1558	55.50
16	2.48	636	97.64	106.55	-	107.55	200	7.11	1758	62.61
6	0.91	642	98.55	107.55	-	108.55	196	6.97	1954	69.58
2	0.35	644	98.91	108.55	-	109.55	184	6.54	2138	76.13
2	0.34	646	99.25	109.55	-	110.55	162	5.76	2300	81.89
3	0.51	649	99.76	110.55	-	111.55	117	4.16	2417	86.05
2	0.24	651	100.00	111.55	-	112.55	89	3.15	2506	89.21
				112.55	-	113.55	82	2.91	2588	92.12
				113.55	-	114.55	59	2.09	2647	94.20
				114.55	-	115.55	51	1.80	2698	96.00
				115.55	-	116.55	40	1.43	2738	97.43
				116.55	-	117.55	21	0.73	2759	98.16
				117.55	-	118.55	15	0.52	2774	98.67
				118.55	-	119.55	17	0.60	2791	99.28
				119.55	-	120.55	6	0.22	2797	99.49
				120.55	-	121.55	4	0.13	2801	99.62
				121.55	-	122.55	6	0.22	2807	99.85
				122.55	-	123.55	2	0.08	2809	99.92
				123.55	-	124.55	1	0.05	2810	99.97
				124.55	-	125.55	0	0.00	2810	99.97
				125.55	-	126.55	0	0.00	2810	99.97
				126.55	-	127.55	0	0.00	2810	99.97
				127.55	-	128.55	1	0.03	2811	100.00

(124) WEIGHT

The weight of the subject is taken to the nearest tenth of a kilogram. The subject stands on the platform of a scale.



PERCENTILES				
FEMALES			MALES	
KG	LBS		KG	LBS
47.00	103.60	1ST	57.10	125.90
47.89	105.59	2ND	59.70	131.60
49.56	109.23	3RD	61.50	135.60
51.37	113.24	5TH	63.90	140.90
54.43	119.99	10TH	67.70	149.30
56.32	124.14	15TH	70.80	156.10
58.25	128.39	20TH	73.40	161.80
59.80	131.80	25TH	75.40	166.20
60.95	134.41	30TH	77.30	170.40
62.52	137.85	35TH	79.00	174.20
64.17	141.43	40TH	80.90	178.40
66.00	145.50	45TH	82.50	181.90
67.60	149.00	50TH	84.19	185.58
69.30	152.80	55TH	85.80	189.20
71.00	156.50	60TH	87.70	193.30
72.30	159.40	65TH	89.50	197.30
74.20	163.60	70TH	91.60	201.90
76.25	168.11	75TH	93.80	206.80
79.10	174.40	80TH	96.60	213.00
81.90	180.60	85TH	99.80	220.00
85.62	188.74	90TH	103.13	227.35
93.00	205.00	95TH	110.66	243.92
96.50	212.70	97TH	114.44	252.28
98.90	218.00	98TH	117.30	258.60
103.90	229.10	99TH	123.38	271.98

FEMALES		
KG		LBS
68.92	MEAN	151.94
0.48	SE (MEAN)	1.07
12.35	STD DEVIATION	27.22
0.34	SE (STD DEV)	0.75
43.20	MINIMUM	95.20
113.30	MAXIMUM	249.80
	SKEWNESS	0.65
	KURTOSIS	3.33
	COEF VAR	17.9%
	N	651

MALES		
KG		LBS
85.18	MEAN	187.80
0.26	SE (MEAN)	0.58
14.01	STD DEVIATION	30.89
0.19	SE (STD DEV)	0.41
49.10	MINIMUM	108.20
144.10	MAXIMUM	317.70
	SKEWNESS	0.44
	KURTOSIS	3.26
	COEF VAR	16.4%
	N	2811

FREQUENCY TABLE

FEMALE				KILOGRAMS			MALE			
F	FPct	CumF	CumFPct				F	FPct	CumF	CumFPct
1	0.19	1	0.19	42.55	-	44.55				
1	0.21	2	0.40	44.55	-	46.55				
14	2.06	16	2.46	46.55	-	48.55				
12	1.90	28	4.36	48.55	-	50.55	2	0.06	2	0.06
16	2.39	44	6.75	50.55	-	52.55	2	0.08	4	0.14
22	3.44	66	10.19	52.55	-	54.55	5	0.17	9	0.31
34	5.19	100	15.38	54.55	-	56.55	15	0.53	24	0.83
34	5.15	134	20.53	56.55	-	58.55	19	0.69	43	1.52
46	7.06	180	27.60	58.55	-	60.55	22	0.77	65	2.29
48	7.42	228	35.02	60.55	-	62.55	41	1.45	106	3.74
39	5.96	267	40.98	62.55	-	64.55	59	2.12	165	5.86
38	5.89	305	46.87	64.55	-	66.55	69	2.46	234	8.32
38	5.78	343	52.65	66.55	-	68.55	77	2.73	311	11.05
40	6.20	383	58.85	68.55	-	70.55	89	3.18	400	14.23
44	6.78	427	65.63	70.55	-	72.55	126	4.50	526	18.73
39	5.99	466	71.62	72.55	-	74.55	100	3.58	626	22.30
26	4.00	492	75.62	74.55	-	76.55	152	5.40	778	27.70
26	3.93	518	79.55	76.55	-	78.55	164	5.83	942	33.53
17	2.59	535	82.14	78.55	-	80.55	153	5.46	1095	38.99
26	4.04	561	86.18	80.55	-	82.55	173	6.16	1268	45.15
19	2.92	580	89.10	82.55	-	84.55	161	5.74	1429	50.89
12	1.83	592	90.93	84.55	-	86.55	167	5.95	1596	56.85
12	1.89	604	92.82	86.55	-	88.55	149	5.32	1745	62.16
9	1.38	613	94.20	88.55	-	90.55	154	5.50	1899	67.66
4	0.68	617	94.88	90.55	-	92.55	128	4.55	2027	72.20
11	1.65	628	96.54	92.55	-	94.55	117	4.18	2144	76.38
4	0.66	632	97.20	94.55	-	96.55	97	3.44	2241	79.82
5	0.71	637	97.91	96.55	-	98.55	103	3.67	2344	83.49
6	0.89	643	98.80	98.55	-	100.55	91	3.23	2435	86.72
1	0.17	644	98.97	100.55	-	102.55	67	2.39	2502	89.11
2	0.23	646	99.20	102.55	-	104.55	62	2.20	2564	91.31
1	0.19	647	99.39	104.55	-	106.55	41	1.44	2605	92.75
0	0.00	647	99.39	106.55	-	108.55	28	1.01	2633	93.76
2	0.23	649	99.62	108.55	-	110.55	34	1.19	2667	94.95
1	0.19	650	99.81	110.55	-	112.55	31	1.09	2698	96.04
1	0.19	651	100.00	112.55	-	114.55	29	1.03	2727	97.07
				114.55	-	116.55	22	0.79	2749	97.87
				116.55	-	118.55	14	0.49	2763	98.35
				118.55	-	120.55	8	0.27	2771	98.63
				120.55	-	122.55	10	0.36	2781	98.99
				122.55	-	124.55	6	0.20	2787	99.19
				124.55	-	126.55	7	0.25	2794	99.44
				126.55	-	128.55	7	0.24	2801	99.67
				128.55	-	130.55	3	0.10	2804	99.77
				130.55	-	132.55	1	0.02	2805	99.79
				132.55	-	134.55	3	0.11	2808	99.90
				134.55	-	136.55	0	0.01	2808	99.92
				136.55	-	138.55	1	0.03	2809	99.94
				138.55	-	140.55	0	0.00	2809	99.94
				140.55	-	142.55	0	0.00	2809	99.94
				142.55	-	144.55	2	0.06	2811	100.00

CHAPTER V

RESULTS AND RECOMMENDATIONS

One of the purposes of this pilot study was to determine whether there are sufficient anthropometric differences between the Army's existing anthropometric database (ANSUR) and its current soldiers to warrant redesign or resizing of Army clothing and equipment. Other publications will detail the statistical differences between the current active duty force and the Reserves and National Guard. They will also examine the statistical differences between the active duty 1988 Army and the active duty 2007 Army, as well as detail the long-term implications of continuing change in the body size and shape of soldiers. This section describes the practical design implications of using ANSUR as a design database for current and future Army needs.

As noted in the Introduction, today's fighting force comprises significant contributions of the Army Reserve and the National Guard. These forces were not represented in ANSUR, yet they use equipment, clothing, and personal protection gear designed from that database. One way to gauge the impact of the data acquired in this study is to compare ANSUR summary statistics with those of the current pilot study. If the values are generally similar, then designers of current and future clothing and equipment may safely assume that they are adequately accommodating the current force. If the values are markedly different, then the sizing and design of those items may be called into question. This comparison uses a weighted pilot study sample (see Chapter III) that is representative of today's total fighting force—including active duty, Reserves, and National Guard, each in the appropriate proportion.

Tables 8 and 9 compare, for males and females, respectively, the ANSUR values (labeled "ANSUR I") with the pilot study values (labeled "A2P"). In males (Table 8), some of the A2P means are smaller, especially in the dimensions that are composed of largely skeletal elements. These would include Acromion-Radiale Length, Cervicale Height, Crotch Height, and Knee Height Sitting. Other dimensions, especially those that have a significantly fleshy component, are larger; these include major circumferences (buttock, waist, and chest) and weight. What is striking, especially in the male results, is that all of the standard deviations show an increase. Clearly some of the increases are very small—less than a millimeter—and obviously inconsequential, but some are substantial. The largest increases in standard deviation are in the major circumferences and weight. This suggests that not only is the Army getting larger in some key dimensions, but also more variable. This has a direct impact on clothing tariffs and design guidelines, which are typically not based on the population means, but on extreme values, both large and small.

Tables 8 and 9 also include the 5^{th} and 95^{th} percentile values, which are generally used as boundaries of the targeted design range. At the high end of the distribution, the male 95^{th} percentile values (Table 8) are substantially larger in the current population for at least three dimensions that are critical in clothing design, sizing, and tariffing and one dimension that is critical in workspace layout. The three dimensions are Buttock Circumference, larger by nearly 3 inches (73 mm); Chest Circumference, larger by nearly 4 inches (97 mm); and Waist Circumference, larger by over 4 inches (111 mm). Bideltoid Breadth, the dimension useful in clothing as well as workspace design, is larger at the 95^{th} percentile by just under 1 inch (22 mm). The unifying theme among all these dimensions is Weight; its 95^{th} percentile value is 11.9 kg (26 pounds) larger than the ANSUR 95^{th} percentile. Weight is not generally a design dimension alone (although it is used in the design of safety harnesses and similar equipment), but it influences many other dimensions that have a direct impact on design.

The male 5^{th} percentile values, sometimes used at the other end of the design range, are larger, too, in Buttock Circumference (just under 1 inch, 22 mm) and in Waist Circumference (just over 1 inch,

TABLE 8. Comparison of Summary Statistics: ANSUR and A2P – Males.
(values in mm and kg/10; Delta = A2P – ANSUR I)

Dimension	Males											
	Mean			Std. Dev.			5th %'ile			95th %'ile		
	ANSUR I	A2P	Delta	ANSUR I	A2P	Delta	ANSUR I	A2P	Delta	ANSUR I	A2P	Delta
Acrom-Radiale Length	340.8	331.6	-9.2	17.16	17.65	0.49	313	303	-10	370	361	-9
Biacromial Breadth	397.0	408.7	11.7	17.96	19.62	1.66	367	377	10	427	441	14
Bideltoid Breadth	491.8	501.8	10.1	25.93	32.63	6.70	450	451	1	535	557	22
Bizygomatic Breadth	140.5	144.1	3.7	5.60	6.50	0.90	132	134	2	150	155	5
Buttock Circumference	983.7	1028.7	45.0	62.18	74.77	12.59	890	912	22	1087	1160	73
Buttock-Knee Length	616.4	616.8	0.4	29.87	31.14	1.27	568	566	-2	668	668	0
Cervicale Height	1519.4	1516.2	-3.2	62.76	65.43	2.66	1420	1408	-12	1622	1624	2
Chest Circumference	991.4	1048.0	56.7	69.06	92.67	23.61	886	903	17	1115	1212	97
Crotch Height	837.2	827.5	-9.7	46.25	50.03	3.78	766	748	-18	916	912	-4
Foot Breadth, Horizontal	100.6	100.1	-0.6	5.26	5.71	0.45	92	91	-1	110	110	0
Foot Length	269.7	268.0	-1.7	13.10	13.73	0.63	249	245	-4	292	291	-1
Hand Breadth	90.4	89.5	-1.0	4.22	4.37	0.15	84	82	-2	97	97	0
Hand Length	193.8	197.4	3.6	9.78	10.20	0.42	179	182	3	210	214	4
Head Breadth	151.7	155.1	3.4	5.40	5.96	0.56	143	146	3	161	165	4
Head Length	197.1	200.2	3.1	7.06	7.22	0.16	185	188	3	209	212	3
Hip Breadth, Sitting	366.8	372.8	6.0	25.18	30.43	5.25	329	326	-3	412	427	15
Knee Height, Sitting	558.8	555.9	-2.9	27.91	28.27	0.36	514	510	-4	605	604	-1
Menton-Sellion Length	121.9	121.1	-0.8	6.49	6.81	0.32	112	110	-2	133	133	0
Radiale-Stylion Length	269.9	269.3	-0.6	15.66	17.12	1.47	245	243	-2	297	299	2
Sitting Height	913.9	918.6	4.7	35.58	36.63	1.06	855	858	3	972	980	8
Stature	1755.8	1755.5	-0.3	66.81	69.89	3.09	1649	1643	-6	1868	1872	4
Waist Back Length, Omphalion	478.5	484.6	6.1	26.82	29.76	2.95	435	436	1	521	534	13
Waist Circ., Omphalion	862.4	940.2	77.7	86.40	111.02	24.62	735	765	30	1015	1126	111
Waist Height, Omphalion	1058.8	1058.7	-0.1	50.93	53.63	2.70	977	972	-5	1144	1151	7
Weight, 10th Kg	784.9	851.8	67.0	111.06	140.09	29.03	618	639	21	988	1107	119

TABLE 9. Comparison of Summary Statistics: ANSUR and A2P – Females.
(values in mm and kg/10; Delta = A2P – ANSUR I)

Dimension	Females											
	Mean			Std. Dev.			5th %'ile			95th %'ile		
	ANSUR I	A2P	Delta	ANSUR I	A2P	Delta	ANSUR I	A2P	Delta	ANSUR I	A2P	Delta
Acrom-Radiale Length	311.9	309.0	-2.9	16.68	17.42	0.74	285	280	-5	340	338	-2
Biacromial Breadth	362.6	366.0	3.4	17.41	19.04	1.62	333	333	0	390	395	5
Bideltoid Breadth	432.6	446.5	13.9	22.63	30.77	8.13	397	401	4	471	502	31
Bizygomatic Breadth	131.3	134.7	3.4	5.04	5.75	0.71	123	125	2	140	144	4
Buttock Circumference	966.9	1019.1	52.2	60.18	83.54	23.36	873	899	26	1068	1180	112
Buttock-Knee Length	588.9	589.3	0.4	29.63	32.16	2.53	542	536	-6	640	642	2
Cervicale Height	1408.0	1406.1	-1.9	59.23	58.97	-0.26	1315	1305	-10	1508	1500	-8
Chest Circumference	907.1	954.9	47.8	63.52	88.48	24.97	814	822	8	1022	1114	92
Crotch Height	771.4	777.7	6.4	44.14	42.96	-1.18	702	709	7	845	851	6
Foot Breadth, Horizontal	89.7	90.4	0.8	4.93	5.28	0.35	82	82	0	98	99	1
Foot Length	244.4	242.5	-1.8	12.22	12.21	-0.02	224	222	-2	265	263	-2
Hand Breadth	79.4	78.1	-1.3	3.75	4.20	0.45	73	71	-2	86	85	-1
Hand Length	180.5	182.6	2.2	9.68	10.03	0.35	165	167	2	197	200	3
Head Breadth	144.4	147.5	3.1	4.94	5.11	0.18	137	139	2	153	156	3
Head Length	187.2	189.9	2.7	6.41	7.21	0.79	176	178	2	197	201	4
Hip Breadth, Sitting	384.5	395.2	10.7	27.25	37.24	10.00	343	340	-3	433	461	29
Knee Height, Sitting	515.4	514.2	-1.2	26.33	26.19	-0.13	474	471	-3	561	559	-2
Menton-Sellion Length	113.5	114.3	0.8	5.96	6.07	0.11	104	104	0	123	124	1
Radiale-Stylion Length	243.4	244.4	0.9	15.45	16.26	0.80	220	218	-2	269	272	3
Sitting Height	852.0	859.6	7.6	34.90	34.79	-0.11	795	799	4	911	918	7
Stature	1629.4	1629.6	0.2	63.60	63.91	0.31	1528	1520	-8	1738	1730	-7
Waist Back Length, Omphalion	442.5	447.6	5.1	24.62	31.67	7.05	404	398	-6	484	502	18
Waist Circ., Omphalion	791.9	852.3	60.4	82.72	106.96	24.25	675	699	24	946	1029	83
Waist Height, Omphalion	982.1	988.2	6.1	48.81	47.91	-0.90	905	911	6	1064	1065	1
Weight, 10th Kg	620.1	689.2	69.1	83.51	123.48	39.96	497	514	17	774	930	156

30 mm). This would suggest that the whole distribution for lower body garments, from trousers to anti-G suits, should be shifted to the right, as well as increased. It is interesting to note that the 5th percentile value for Crotch Height decreased by about 3/4 inch (18 mm), reflecting larger diversity in this dimension as well.

The female 5th percentile values (Table 9), which are often used in design specifications are not generally as different as the male 95th percentile values. Just two of those values—Buttock Circumference and Waist Circumference—changed by a substantial amount (26 mm and 24 mm, respectively); both increased by about 1 inch. This suggests that the lower end of the design range on some items may need to be shifted.

There were six dimensions on which the female 95th percentile values were markedly increased. Most were clothing-related dimensions, but Bideltoid Breadth (31 mm, 1-1/4 inch, greater) and Hip Breadth, Sitting (28 mm, just over 1 inch greater) are both important workspace layout dimensions. The 95th percentile female clothing dimensions are somewhat less relevant for single-sized garments, since typically male dimensions drive the upper end of the distribution. However, on female-only garments, the 95th percentile would typically define the accommodation range. In these dimensions, the 95th percentile of Buttock Circumference increased by 112 mm (nearly 4-1/2 inches), Chest Circumference increased by 92 mm (over 3-1/2 inches), and Waist Circumference increased by 83 mm (3-1/4 inches). These changes are consistent with an increase in the 95th percentile of Weight by 15.6 kg (34 pounds).

While some dimensions do not appear to have changed there are a number of dimensions that did change. Further, they changed by substantial amounts that impact equipment comfort and safety. One may draw the conclusion that continuing reliance on the historic database will eventually put soldiers at risk. In addition, only 25 dimensions were measured inAP2. In 1987, 132 dimensions were identified as sufficiently important in clothing, equipment, and workspace design to be included in the first ANSUR database. It is not known how many of the other 107 dimensions have changed by substantial amounts, nor is it known whether those with substantial change are also those most important for future design.

Based on these observations, it is recommended that this pilot study be used as the basis for a new anthropometric survey that would include the active-duty Army, Army National Guard, and Army Reserves. The forces should be sampled in approximately equal proportion, with a statistically robust sample of each component, so that as the mix of components in the fighting force changes in the future, the database can be statistically reweighted to remain continuously accurate into the future.

This document reports research undertaken at the U.S. Army Natick Soldier Research, Development and Engineering Center, Natick, MA, and has been assigned No. NATICK/TR- 09 / 014 in a series of reports approved for publication.

CHAPTER VI

REFERENCES

Churchill E, Churchill T, McConville JT, and White RM. 1977. Anthropometry of Women of the U.S. Army - 1977 Report No. 2 - The Basic Univariate Statistics. Natick, MA: U.S. Army Natick Research and Development Command. Report nr NATICK/TR-77/024. 287 pp.

Churchill TD, Bradtmiller B, and Gordon CC. 1988. Computer Software Used in U.S. Army Anthropometric Survey 1987-1988. Natick, MA: U. S. Army Natick Research, Development and Engineering Center. Report nr TR NATICK/TR-88/045. 117 pp.

Clauser C, Tebbetts I, Bradtmiller B, McConville J, and Gordon CC. 1988. Measurer's Handbook: U.S. Army Anthropometric Survey 1987-1988. Natick, MA: U.S. Army Natick Research, Development and Engineering Center. Report nr NATICK/TR-88/043. 334 pp.

Gordon CC, Bradtmiller B, Churchill T, Clauser CE, McConville JT, Tebbetts I, and Walker RA. 1989. 1988 Anthropometric Survey of US Army Personnel: Methods and Summary Statistics. Natick, MA: US Army Natick Research, Development and Engineering Center. Report nr NATICK/TR-89-044. 652 pp.

Kikta P, and Churchill T. 1978. Editing Procedure for Anthropometric Survey Data. Wright-Patterson AFB, OH: Aerospace Medical Research Laboratory. Report nr AMRL-TR-78-38. 138 pp.

Bradtmiller, B. 2005. JSList Tariff Verification Study. Quantico, VA: US Marine Corps Systems Command. Final Report.prepared under Subcontract KR-0048-AT under Prime Contract N00421-01-C0048.

Laubach LL, McConville JT, Churchill E, and White RM. 1977. Anthropometry of Women of the U.S. Army--1977 Report No. 1- Methodology and Survey Plan. Natick, MA: U.S. Army Natick Research and Development Command. Report nr NATICK/TR-77/021. 202 pp.

Ogden CL, Carroll MD, McDowell MA, and Flegal KM. 2007. Obesity Among Adults in the United States—No Statistically Significant Change Since 2003-2004. Safer Healthier People NCHS Data Brief 1:8.

Sokal, Robert R. and F. James Rohlf (1994) Biometry: The Principles and Practices of Statistics in Biological Research, 3rd Edition. San Francisco: W.H. Freeman.

StataCorp (2005) Stata Statistical Software Release 9. College Station,TX: StataCorp LP.

White RM, and Churchill E. 1971. The Body Size of Soldiers U.S. Army Anthropometry - 1966. In: Army, editor. Natick, MA: Clothing and Personal Life Support Equipment Laboratory. p 329.

Zar, Jerold H. (1998) Biostatistical Analysis, 4th Edition. Englewood Cliffs NJ: Prentice-Hall.

APPENDIX A

IMAGE RELEASE FORM

IMAGE RELEASE FORM

Release Granting Permission to Use 3D Scan Images

from an Approved Human Research Study in US Army Publications and Presentations

I am a participant in the human research study entitled, "ANSUR II" under the direction of Steven P. Paquette of the US Army Natick Soldier Center.

Initial one:

_____ I hereby **grant** permission to use 3D scan images of me from the above study in US Army publications and presentations.

_____ I hereby **grant** permission to use 3D scan images of me from the above study in US Army publications and presentations **only if I cannot be recognized in the image**.

_____ I hereby **do not grant** permission to use 3D scan images of me from the above study in US Army publications and presentations.

This page intentionally left blank.

APPENDIX B

QUESTIONNAIRE

ANSUR II
BACKGROUND QUESTIONNAIRE
(PLEASE PRINT)

Date _____ **Post** _____
(mm/dd/yr)

Name _____ **SSN** _____
(first middle initial last)

Component: ____ Regular Army ____Army Reserve ____Army National Guard

Rank/Grade: _____
(ex: LTC/05)

Type of Unit: (check one type only)

Combat

____ Infantry
____ Armor
____ Artillery
____ Aviation (Pilot)
____ Aviation (Maintenance/Other)

Combat Support

____ Chemical
____ Military Police
____ Engineers
____ Signal
____ Military Intelligence
____ Ordnance

Combat Service & Support

____ Medical
____ Maintenance
____ Transportation
____ Supply
____ Quartermaster
____ Adjutant General
____ Finance
____ Other: _____

Age: _____ **Sex:** ____ Male ____ Female

Birthdate: _____
(*mm/dd/yr*)

Est. Your Height: _____ **Est. Your Weight:** _____
feet/inches) *(pounds)*

Writing Preference: ____Right hand ____Left hand ____Either hand

Your Birthplace: _____
(country, state, city)

Mother's Birthplace: _____
(country, state, city)

Father's Birthplace: _____
(country, state, city)

Population Subgroup:

____ White, not of Hispanic Origin

____ Black, not of Hispanic Origin

____ Hispanic (*specify*):

Mexican
Puerto Rican
Cuban
Latin American: _____
Other Hispanic : _____

____ Asian or Pacific Islander (*specify)*:

Chinese
Japanese
Korean
Vietnamese
Filipino
Samoan
Guamanian/Chamorro
Melanesian
Micronesian
Polynesian
Other Pacific Islander: _____
Other Asian: _____

____ Native American (*specify)*:

Eskimo
Aleut
US/Canadian Tribe(s): _____

____ Other (*specify)*:

East/Asian Indian
Middle Eastern: _____
Other: _____

____ Two or More Groups (*specify)*:

_____ _____
_____ _____

Mother's Population Subgroup

White, not of Hispanic Origin ____ Black, not of Hispanic Origin

Hispanic: _____ ____ Asian or Pacific Islander: _____

Native American: _____ ____ Other: _____

Two or more groups:_____ ____ Don't Know

_____

_____

Father's Population Subgroup

White, not of Hispanic Origin ____ Black, not of Hispanic Origin

Hispanic: _____ ____ Asian or Pacific Islander: _____

Native American: _____ ____ Other: _____

Two or more groups: _____ ____ Don't Know

_____

_____

APPENDIX C.

DATA FORM

ANSUR II

MEASUREMENT DATA FORM

Name _____ **Date** _____ **Sex** *(circle)* Male/Female **SSN** (last 4)_____
First Middle Initial Last *mm/dd/yr*

Dimension (kg, mm)		**remeasure**
1. Weight		
2. Stature		
3. Hand Length		
4. Hand Breadth		
5. Menton-Sellion Length		
6. Bizygomatic Breadth		
7. Head Length		
8. Head Breadth		
9. Sitting Height		
10. Buttock-Knee Length		
11. Knee Height, Sitting		
12. Biacromial Breadth		
13. Bideltoid Breadth		
14. Hip Breadth, Sitting		
15. Span		
16. Cervicale Height		
17. Waist Height (O)		
18. Crotch Height		
19. Foot Length		
20. Foot Breadth		
21. Waist Back Length (O)		
22. Chest Circumference		
23. Waist Circumference (O)		
24. Buttock Circumference		
25. Acromion-Radiale Length		
26. Radiale-Stylion Length		

Measurement Comments: _____ **Meas ___ Rec ___**

This page intentionally left blank.

APPENDIX D

CALCULATION OF TOTAL ARMY WEIGHTS FOR MALES AND FEMALES

MALES

Total A2P Sample: Cell proportions are pS

ACTIVE	White	Black	Hispanic	All Other
≤20	0.077197	0.013874	0.010317	0.018499
21-25	0.117752	0.022768	0.022412	0.023835
26-35	0.087158	0.024191	0.01921	0.029883
≥36	0.027392	0.018855	0.003557	0.007826
RESERVE	White	Black	Hispanic	All Other
≤20	0.029171	0.005336	0.004625	0.007115
21-25	0.055852	0.012095	0.01174	0.011384
26-35	0.031306	0.013874	0.011028	0.004625
≥36	0.050516	0.014586	0.00498	0.006048
GUARD	White	Black	Hispanic	All Other
≤20	0.013163	0.001779	0.001779	0.001067
21-25	0.036998	0.005692	0.004625	0.005692
26-35	0.036286	0.006048	0.011384	0.003557
≥36	0.044824	0.012807	0.012095	0.003202

Total Army, March 2007: Cell proportions are pT

ACTIVE	White	Black	Hispanic	All Other
≤20	0.036596	0.005819	0.005775	0.002208
21-25	0.094063	0.018514	0.015567	0.007269
26-35	0.090471	0.029359	0.015766	0.011156
≥36	0.050736	0.021329	0.006737	0.006627
RESERVE	White	Black	Hispanic	All Other
≤20	0.011953	0.0022	0.001844	0.000939
21-25	0.039984	0.008577	0.007384	0.004375
26-35	0.041798	0.010694	0.007836	0.005351
≥36	0.099194	0.028232	0.011217	0.006972
GUARD	White	Black	Hispanic	All Other
≤20	0.032941	0.004012	0.002571	0.001669
21-25	0.055044	0.006958	0.004443	0.003453
26-35	0.061462	0.008844	0.006539	0.004201
≥36	0.074796	0.014316	0.00845	0.003762

Total Army Weights: Males W=pT/pS

ACTIVE	White	Black	Hispanic	All Other
≤20	0.4741	0.4194	0.5597	0.1194
21-25	0.7988	0.8132	0.6946	0.305
26-35	1.038	1.2136	0.8207	0.3733
≥36	1.8522	1.1312	1.8937	0.8467
RESERVE	White	Black	Hispanic	All Other
≤20	0.4097	0.4123	0.3988	0.132
21-25	0.7159	0.7091	0.629	0.3843
26-35	1.3351	0.7708	0.7105	1.157
≥36	1.9636	1.9356	2.2523	1.1529
GUARD	White	Black	Hispanic	All Other
≤20	2.5026	2.2553	1.4453	1.5634
21-25	1.4878	1.2224	0.9607	0.6066
26-35	1.6938	1.4624	0.5744	1.1808
≥36	1.6687	1.1178	0.6986	1.1749

FEMALES

Total A2P Sample

ACTIVE	White	Black	Hispanic	All Other
≤20	0.046083	0.016897	0.013825	0.021505
21-25	0.070661	0.043011	0.023041	0.02765
26-35	0.038402	0.039939	0.012289	0.033794
≥36	0.021505	0.016897	0.001536	0.013825
RESERVE	White	Black	Hispanic	All Other
≤20	0.030722	0.021505	0.001536	0.009217
21-25	0.069124	0.024578	0.013825	0.009217
26-35	0.039939	0.015361	0.00768	0.004608
≥36	0.061444	0.049155	0.009217	0.010753
GUARD	White	Black	Hispanic	All Other
≤20	0.018433	0.003072	0.001536	0.003072
21-25	0.038402	0.003072	0.009217	0.009217
26-35	0.026114	0.013825	0.010753	0.004608
≥36	0.024578	0.004608	0.006144	0.004608

Total Army, March 2007

ACTIVE	White	Black	Hispanic	All Other
≤20	0.027833	0.013305	0.00858	0.003554
21-25	0.058724	0.037562	0.017898	0.009982
26-35	0.048309	0.048641	0.012899	0.012329
≥36	0.024379	0.033285	0.004408	0.005785
RESERVE	White	Black	Hispanic	All Other
≤20	0.01919	0.009292	0.004493	0.00222
21-25	0.049748	0.029662	0.014691	0.007989
26-35	0.045825	0.032183	0.011723	0.008743
≥36	0.07371	0.05287	0.008654	0.007288
GUARD	White	Black	Hispanic	All Other
≤20	0.040072	0.012587	0.005273	0.002964
21-25	0.047671	0.015261	0.005822	0.004435
26-35	0.03762	0.015841	0.005374	0.003971
≥36	0.034472	0.015878	0.004192	0.002816

Total Army Weights for Females Weight=pT/pS

ACTIVE	White	Black	Hispanic	All Other
≤20	0.604	0.7874	0.6206	0.1653
21-25	0.8311	0.8733	0.7768	0.361
26-35	1.258	1.2179	1.0496	0.3648
≥36	1.1336	1.9699	2.8699	0.4184

RESERVE Weight=pT/pS

	White	Black	Hispanic	All Other
≤20	0.6246	0.4321	2.9249	0.2409
21-25	0.7197	1.2069	1.0627	0.8668
26-35	1.1474	2.0951	1.5263	1.8973
≥36	1.1996	1.0756	0.9389	0.6778

GUARD Weight=pT/pS

	White	Black	Hispanic	All Other
≤20	2.1739	4.0972	3.4329	0.9647
21-25	1.2413	4.9674	0.6317	0.4812
26-35	1.4406	1.1458	0.4997	0.8617
≥36	1.4026	3.4455	0.6823	0.6111