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A Preliminary Anthropometry Standard for Australian Army Equipment Evaluation

Mark Edwards, Alistair Furnell, Jemma Coleman and Sheena Davis

Land Division
Defence Science and Technology Organisation

DSTO-TR-3006

ABSTRACT

Anthropometry is the measurement and comparison of different body shapes and sizes in the general population. This standard presents anthropometric data representative of the Australian Defence Force (ADF) Army, specifies the summary values for 84 anthropometric dimensions, provides a set of boundary manikins and provides guidance on how the data presented can be used to perform anthropometric assessments to assess fit, clearance, reach, vision and/or posture of a human operator in a system using a risk based approach.

This standard is to be used to evaluate soldier systems for use by the ADF Army in terms of user fit, clearance, reach, vision and posture. Applicable systems include platforms that soldiers work in, or are transported in, and body worn equipment. Given that a built system is not a requirement of the processes described, this standard can also be used early in the design process to de-risk the design process.

It must be noted that the data provided in this report are representative of the 2012 ADF Army population. The impacts of secular changes are not addressed in this standard. Should secular changes be identified as of importance, appropriate modifications should be made to the data contained in this standard.

This report supports Defence outcomes by providing an up to date anthropometric dataset that is representative of Australian Army personnel. This will allow assessments to be made of the performance of existing and new soldier systems in terms of fit, clearance, reach, vision and posture.

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A Preliminary Anthropometry Standard for Australian Defence Force Army Equipment Evaluation

Executive Summary

Anthropometry is the measurement and comparison of different body shapes and sizes in the general population. Datasets are constructed by measuring body dimensions of a large sample of personnel. In 2012 a survey of male and female Australian Defence Force (ADF) Army personnel was completed. This survey is known as the Australian Warfighter Anthropometry Survey (AWAS). The results of this survey have been used as the basis of this standard and supersede all previous ADF Army anthropometric data.

This standard presents anthropometric data representative of ADF Army personnel. It also presents guidance for the application of this data for assessing the level of physical accommodation provided by the ADF Army equipment and platforms.

This standard is to be used to evaluate soldier systems for use by the ADF Army in terms of user fit, clearance, reach, vision and posture. Applicable systems include platforms that soldiers work in, or are transported in, and body-worn equipment. Given that a built system is not a requirement of the processes described, this standard can also be used early in the design process to de-risk the design process.

Three bodies of data are presented in this standard:

- Univariate statistics; statistical data for 84 human body dimensions.
- Multivariate statistics; seven boundary manikins that represent the extremes of the Army user population.
- Protective Equipment and Clothing Correction Factors (PECCFs); corrections that can be applied to anthropometric data to account for the equipment worn by Army personnel.

Broadly, it is intended that for vehicles and other habitable areas the multivariate boundary manikins can be used to build digital human models and/or select trial participants for vehicle design evaluations. The manikins are naked and the relevant PECCFs should be added according to the equipment ensemble worn by the crew. For dismounted equipment, where an item is designed to fit on or near the skin, it is intended that the univariate statistics be used. The relevant PECCF should be added where an item is required to be worn over the top of existing items.

Guidance on the assessment of user fit, clearance, reach, vision and posture is provided in the report based on identifying key task points and possible risks for each task. The identification of possible risks has been addressed through the use of these five

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keywords: fit, clearance, reach, vision and posture. This guides the reader into the selection of an appropriate assessment procedure.

Guidelines are provided for the performance of univariate and multivariate assessment methods. These include how to use the data contained within this report, how to generate pass/fail criteria and reporting requirements.

It must be noted that the data provided in this report are representative of the 2012 ADF Army population. The impacts of secular changes are not addressed in this standard. Should secular changes be identified as being of importance, appropriate modifications should be made to the data contained in this standard.

This report supports Defence outcomes by providing an up to-date anthropometric dataset that is representative of Australian Army personnel. This will allow assessments to be made of the performance of existing and new soldier systems in terms of fit, clearance, reach, vision and posture.

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1. Scope

1.1 Identification

Anthropometry is the measurement and comparison of different body shapes and sizes in the general population. Datasets are constructed by measuring body dimensions of a large sample of personnel. In 2012 a survey of male and female Australian Defence Force (ADF) Army personnel was completed known as the Australian Warfighter Anthropometry Survey (AWAS). The results of this survey are reported as the basis of this standard and supersede all previous ADF Army anthropometric data.

This standard presents anthropometric data representative of ADF Army personnel and guidance for the application of this data for assessing the level of physical accommodation provided by the ADF Army equipment and platforms.

1.2 Australian Warfighter Anthropometry Survey

The AWAS measured 2138 full time ADF Army personnel (277 females and 1861 males), aged between 18 and 40 years. The Corp profile was broadly representative of the users of Armoured Fighting Vehicles such as the M113 Armoured Personnel Carrier and Australian Light Armoured Vehicle (ASLAV). Corps sampled included Armour, Artillery, Electrical and Mechanical Engineers, Engineers, Infantry, Medical, Transport, Signals, Ordnance and Special Forces.

Given the use of the AWAS as the basis for this standard, this data should only be used for assessment of equipment for use by the Australian Army. Any differences between the data presented in this standard and that for other nations and/or user groups is not quantified in this standard and would require consideration if this data were used for a user group dissimilar to that sampled by AWAS.

1.3 System Overview

This document provides a preliminary standard for anthropometry applicable to the ADF Army. This document has been developed by DSTO and is intended to be used for consultation with ADF stakeholders, international partners and industry prior to it being released as an Australian Defence Standard (DEF (AUST)). As such, the language used reflects the intention for it to be released as an DEF(AUST).

The procedures and data provided within this standard are to be used to evaluate soldier systems for use by the Australian Army in terms of user fit, clearance, reach, vision and posture. Applicable systems include platforms that soldiers work in or are transported in and body worn equipment. In addition to providing a method for producing verification evidence for completed system designs, it is intended that the data and procedures given in this standard can be used early in the design process to de-risk the design process as a built system is not a requirement of the processes described in this standard.

The data provided within this standard can also be used to support the specification of requirements, the design of soldier systems and the specification of trial participants for user trials to evaluate soldier systems.

1.4 Document Overview

This standard identifies and specifies the summary values for 84 anthropometric dimensions, provides a set of boundary manikins and provides guidance on how the data presented can be used to perform anthropometric assessments.

This document is intended to be used by Human Factors Specialists, Requirements Managers and Engineers to define appropriate requirements, design systems to meet said requirements and provide validation evidence that said requirements have been met.

No part of this document is classified for security purposes.

2. Definitions and referenced documents

2.1 Definitions

ADF	Australian Defence Force
Anthropometry	The measurement of the size and proportions of the human body
AWAS	Australian Warfighter Anthropometry Survey
CAD	Computer Aided Design
DEF (AUST)	Australian Defence Standard
DHM	Digital Human Modelling
Eye Point	The location of the operator's view expressed as a monocular point mid-way between the pupils
FPS	Function and Performance Specification
PECCF	Personal Equipment and Clothing Correction Factor
SCE	Soldier Combat Ensemble, defined as soldier systems designed to provide protection to individual combatants from physical threats and the environment, as well as facilitating an efficient means for individuals to carry mission essential items in a close combat environment.
SME	Subject Matter Expert
System	Defined as a combination of components or parts forming a complex or unitary whole which may include hardware systems, software systems, training systems, support systems and personnel, for example a land vehicle or a helicopter

2.2. Referenced Documents

The Australian Macquarie Dictionary is the reference source for all terms used in this standard, except for those defined in this Definitions section.

The following documents form a part of this standard to the extent specified herein. For using this standard, the latest issues of the following documents at the issue date of this standard shall apply:

- MIL-STD (2012). Department of Defense Design Criteria Standard Human Engineering. 1472G. Department of Defense (USA)

3. Application Guidelines

3.1 General Requirements

The Function and Performance Specification (FPS) of a project shall state whether the data required is male and female or one gender only. Where no specific statement exists then both gender data shall be used as the default.

The FPS shall state the level of accommodation required. This is predominantly defined as being either:

- *“Full Accommodation” – The design shall physically accommodate the central 98% of users.*
It is expected that this level of accommodation will be specified at times when operator fit, clearance, reach, vision or posture is a key factor in the system and impinging of any of these factors will result in large safety and/or performance issues.
- *“Majority Accommodation” – The design shall physically accommodate the central 90% of users.*
It is expected that this level of accommodation will be specified at times when operator fit, clearance, reach, vision or posture is a factor in the system and impinging of any of these factors may result in safety and/or performance issues.

Where specifications state “5th to 95th percentile range” as the level of accommodation this should be taken to equate to the “majority accommodation”. However, current good practice for defining accommodation range is to state the percentage of the population that should be accommodated, as per the definitions above. Legacy statements such as “5th to 95th percentile” should be avoided.

3.2 Use of Data

Three bodies of data are presented in this standard:

- Univariate statistics; statistical data for specific human body dimensions (see Section 4).
- Multivariate statistics; a range of boundary manikins that represent the extremes of the Army user population (see Section 5).
- Protective Equipment and Clothing Correction Factors (PECCFs); corrections that can be applied to the univariate and multivariate data to account for the equipment worn by Army personnel (see Section 6).

Broadly, it is intended that for vehicles and other habitable areas the multivariate boundary manikins can be used to build digital human models and/or select trial participants in order to evaluate vehicle design. The manikins are naked and the PECCFs must be added according to the ensemble stated in the FPS. For dismounted Soldier Combat Ensemble (SCE) equipment, where an item is designed to fit on or near the skin, it is intended that the univariate statistics shall be used. Where an item is required to be worn over the top of existing SCE items then the relevant PECCF should be added.

The data provided within this document is intended to be used to assess fit, clearance, reach, vision and/or posture of a human operator in a system, risks and examples are provided in Table 1. It is recommended that the anthropometric assessment types given in Table 1 are

assessed using either univariate or multivariate methods, depending on the complexity of the assessment required. The procedure recommended for choosing between univariate and multivariate assessments is shown in Figure 1. This process is based on identifying key task points where risks may be present within each task. The identification of possible risks is done through the use of five keywords which correspond to the types of assessments that can be performed using anthropometric data; fit, clearance, reach, vision and posture.

Stage 1.5 of the procedure shown in Figure 1 requires the assessor to identify if the assessment aspect and task risk is “Defined by a single dimension.” This should be taken to mean the assessment can be performed through the consideration of only one anthropometric measure (or anthropometric measures that are independent of each other). For example, when assessing Fit (assessment aspect) when passing through a doorway (key task point), there is a risk of hitting the head (task risk). In this example there is only one key dimension: Stature (M38). . However, when assessing reach (assessment aspect) to controls when seated in a vehicle (key task point), there is a risk of not being able to reach a control (task risk). In this example there are multiple key dimensions which define the reach envelope; Acromion height, sitting (M10) and Thumbtip reach (M37). Therefore the number of (dependent) dimensions is considered the key factor during the assessment.

3.3 Secular changes considerations

In the context of anthropometry, secular changes are taken to refer to changes in the values for each dimension that occur from generation to generation, and should be taken into account for the life of a system. These changes are commonly attributed to changes in environmental variables such as diet.

The data provided in this report are representative of the 2012 ADF Army population as defined in Section 1.1 and 1.2. The impact of secular growth changes are not addressed in this standard and, should secular growth be identified as of importance, appropriate modifications should be made to the data contained in this standard.

Table 1 Anthropometric assessment types

Assessment type	Definition	Risks	Example
Fit	Does the system accommodate the specified range of users?	<i>Performance</i> – full range of users unable to operate system given that they cannot fit within it or the equipment will not fit them <i>Safety</i> - users may compromise their safety to operate the system	Does a helmet fit the specified user population in terms of head size?
Clearance	Does the system prevent undesirable contact with the body	<i>Performance</i> - if users are immobilised then they will be unable to continue working. If access to controls are impinged, then the user's ability to operate the system will be reduced <i>Safety</i> - injury may be caused by the body striking nearby equipment or getting trapped	Will the driver's head strike equipment fitted to the vehicle ceiling?
Reach	Does the system provide suitable placement of controls and/or equipment?	<i>Performance</i> - if controls cannot be operated then this prevents the system operation <i>Safety</i> - if safety features such as handholds and fire extinguishers cannot be reached then this increases the risk of injury	Can the driver reach the steering whilst simultaneously operating the accelerator/brake?
Vision	Does the system allow a suitable eye point to be achieved to provide the user with an appropriate field of view?	<i>Performance</i> - if the user cannot achieve a suitable eye point to see what is needed for the task then they cannot perform the task optimally <i>Safety</i> - if the user does not see a hazard, then this may result in injury either to themselves or another	Can a suitable eye point be achieved to provide the user with a field of view that allows a sight picture to be taken on a vehicle mounted weapon?
Posture ¹	Does the system allow a safe, comfortable and effective posture to be achieved?	<i>Performance</i> - poor posture will increase user fatigue which may reduce performance <i>Safety</i> - poor posture increases the stress placed on the body and increases the risk of musculoskeletal injury	Does the vehicle allow the driver to maintain a posture that supports the driving task?

¹ Anthropometric analysis is one part of posture assessment. Posture assessment also requires consideration of other aspects such as task frequency, time posture is held, forces applied to/by the body, support of the limbs and joint angles. As such, posture assessment should be performed by a suitably qualified Human Factors Subject Matter Expert (SME).

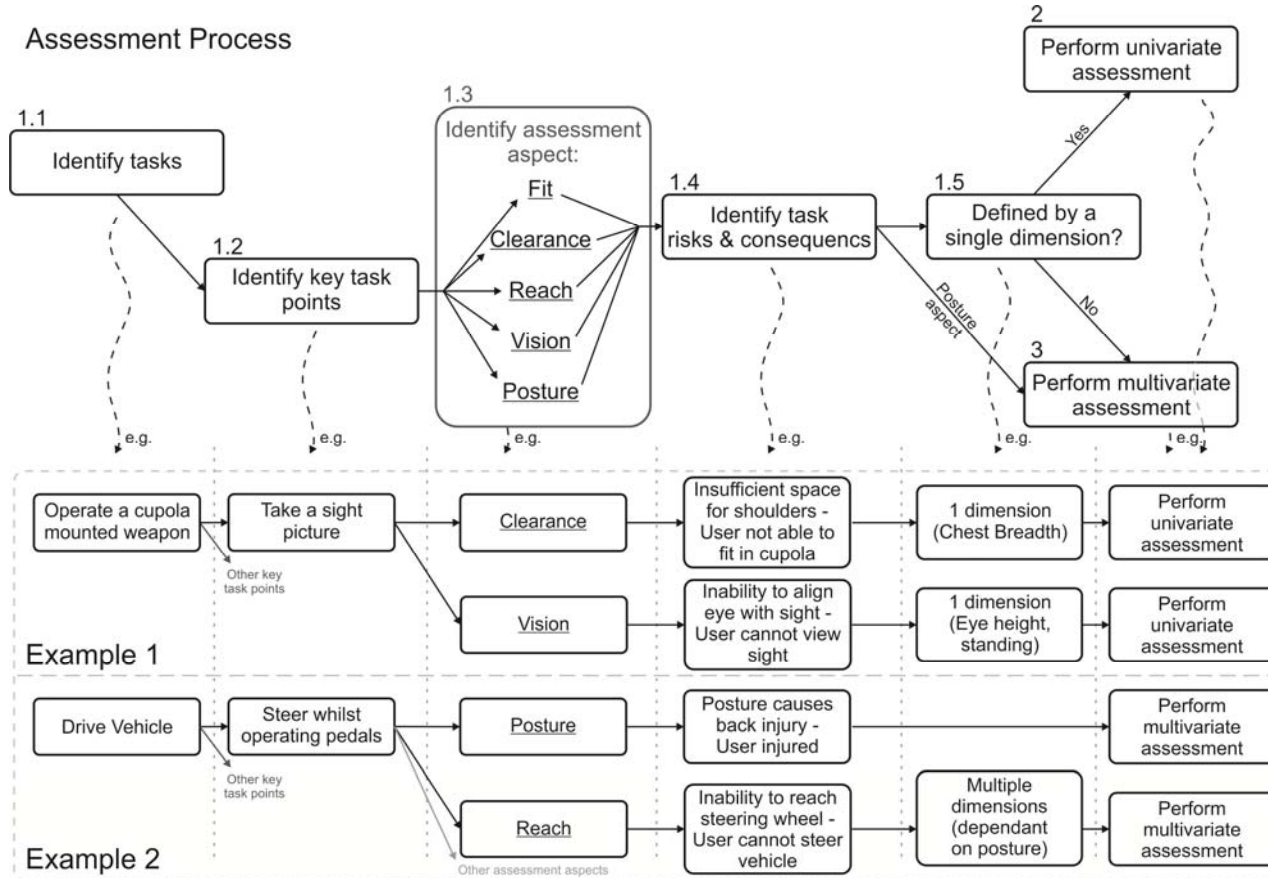


Figure 1 Assessment type selection procedure (top) with examples (bottom)

4. Univariate Statistics

4.1 Introduction

Summary statistics for each of the anthropometric measurements collected by the AWAS study are presented in this section with guidance for their application. All landmarks used during the collection of these measurements are presented in Annex A.

4.2 Univariate Assessment Procedure

The univariate assessment procedure, shown in Figure 2, is intended to be used for assessments where one anthropometric dimension is considered key and unrelated to other body dimensions. For example, Stature might be considered the key dimension when assessing clearance through a doorway. It should be noted that there are some instances where more than one dimension is considered key; however, as they are unrelated each can be assessed separately using the univariate assessment procedure.

This procedure requires four inputs:

- The key anthropometric dimension; determined through consideration of the identified task and risk.
- The relevant PECCF (if required); using the tables provided at Section 6.
- The worst case percentiles based on the specified level of accommodation²; the largest and/or smallest users for the target user population.
- Any miscellaneous adjustments (if required); any other adjustments that should be added, for example a comfort clearance.

These inputs are used to create assessment pass-fail criteria through addition of the relevant percentile measurements for each dimension, PECCFs and miscellaneous adjustments.

For example, if fit (assessment aspect) is being assessed when passing through a doorway (key task point) to identify if there is a risk of hitting the head (task risk), the pass-fail criteria for a majority accommodation requirement can be calculated through the summation shown in Table 2. The pass-fail criteria produced can then be applied to the system; either using Computer Aided Design (CAD) data, drawings of the system or physical measurement of a prototype.

Table 2 Example pass fail criteria calculation

Input	Description	Value (mm)
Key dimension	Stature (M38)	1899
Worst case percentile	95 th percentile, male	
PECCF	Stature, dismounted close combatant (EM01)	71
Miscellaneous adjustments	None identified	0
Pass-fail criteria		1970

² Given that univariate assessments are defined by their use on a single key dimension, "Full accommodation" should be taken to refer to 1st percentile to 99th percentile for the key anthropometric dimension. "Majority accommodation" should be taken to refer to 5th percentile to 95th percentile for the key anthropometric dimension.

Reporting from this assessment should provide sufficient information to permit the assessment to be repeated, including:

- A description of the task assessed, key task points, perceived risk and assessment type.
- A summary of the inputs used.
- A drawing and/or image of the assessment that shows the measurements taken, including relevant body landmarks used.
- Any measurement delta(s) for the assessment, for example clearances between the body and equipment³.
- A risk statement for any assessment failures which states the likelihood and consequence associated with the risk.

³ Provision of the measurement delta is intended to allow the degree of compliance to be identified, which will in turn support the risk assessment

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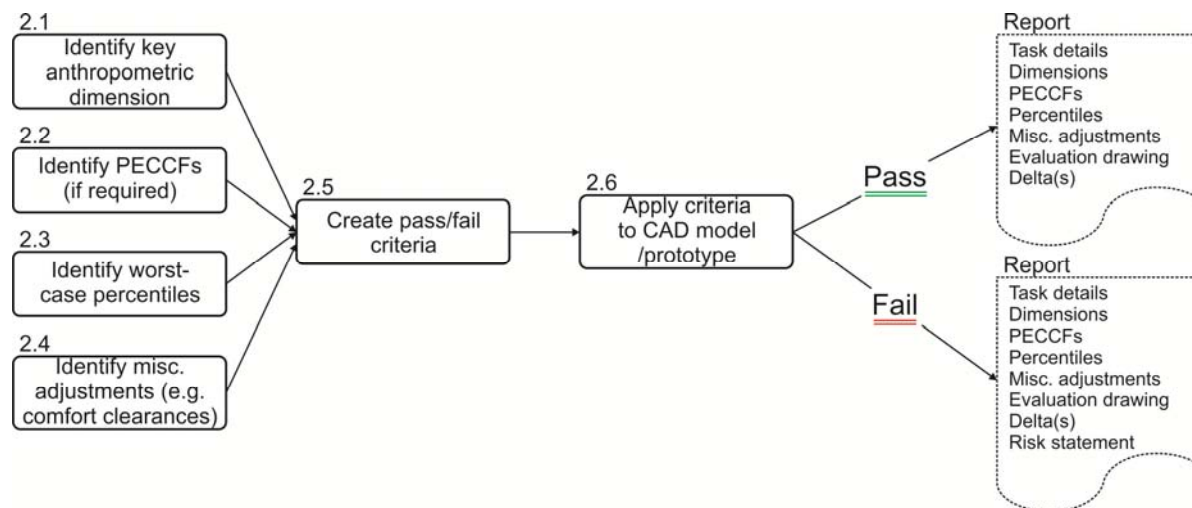


Figure 2 Univariate assessment procedure

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4.3 Measurement Guide

The measurements collected are shown visually in Figure 3 to Figure 7 with reference to the appropriate page for each dimension provided in Table 3 to Table 7 to allow easy identification. The measurements are broken down into whole body dimensions, limb dimensions, body and limb circumference dimensions, seated dimensions, and, heads, hands and feet dimensions. The summary statistics for all 84 dimensions are presented in Section 4.4.

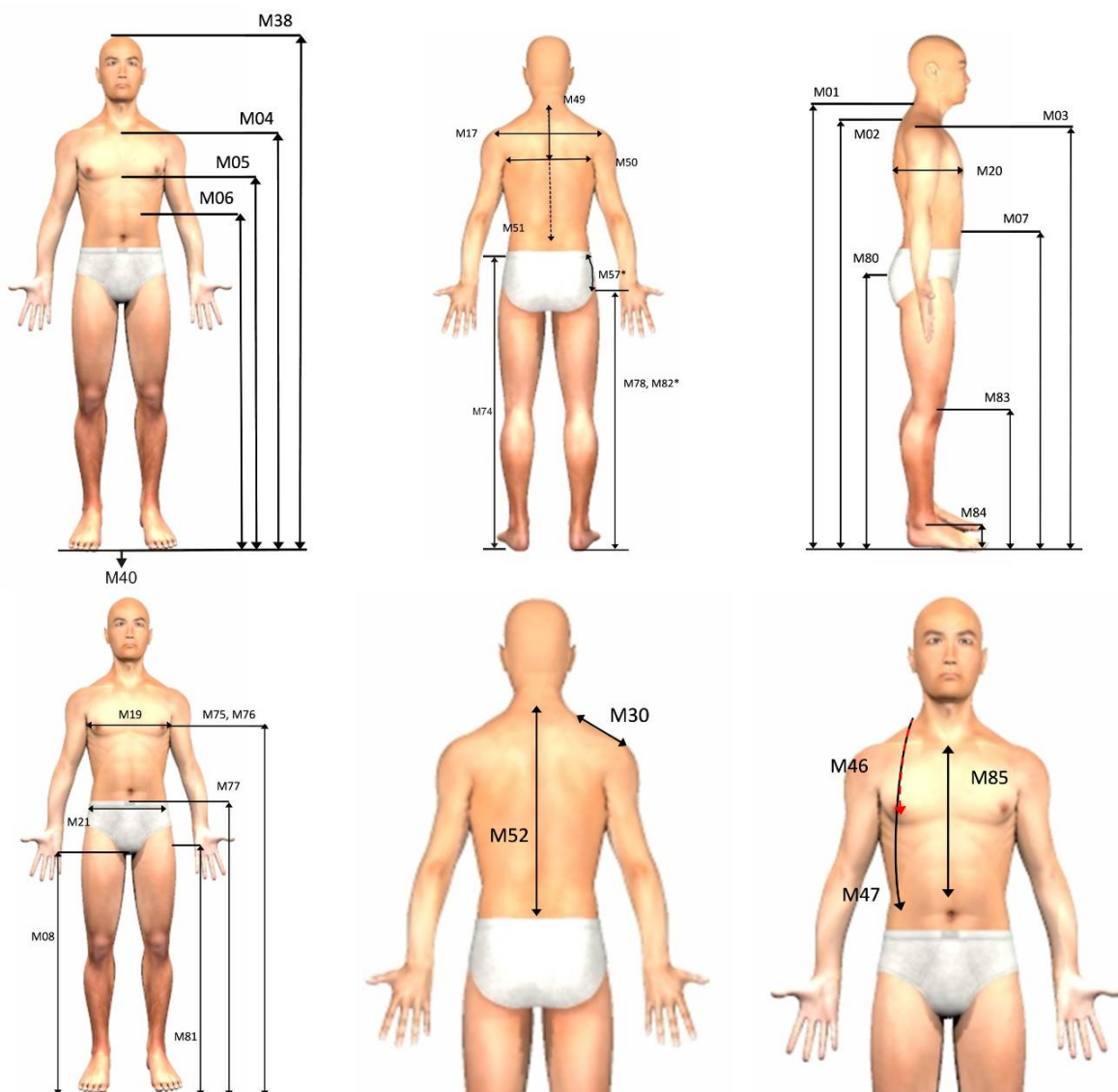


Figure 3 Whole body dimensions

Table 3 Whole body dimension names and page references

#	Name	Page
M01	Cervicale Height	17
M02	T2 Height	18
M03	Acromion Height	19
M04	Suprasternale Height	20
M05	Substernale Height	21
M06	Tenth Rib Height	22
M07	Iliocristale Height	23
M08	Crotch Height	24
M17	Biacromial Breadth	33
M19	Chest Breadth	35
M20	Chest Depth	36
M21	Bicristale Breadth	37
M30	Shoulder Length	46
M38	Stature	54
M40	Weight	56
M46	Nape to Bustpoint Thelion Length	62
M47	Nape to Waist over Bust	63
M49	Scye Depth	64
M50	Back Width	65
M51	Back Length	66
M52	Nape to Waist Centre Back	67
M57	Waist-Hip Distance	72
M74	Outside Leg Length	89
M75	Chest Level	90
M76	Bust Level	90
M77	Waist Level Centre Front	91
M78	Hip Level female	92
M80	Seat Level	94
M81	Trochanteric Height	95
M82	Hip Level	92
M83	Knee Level	96
M84	Ankle Height	97
M85	Front Length	98

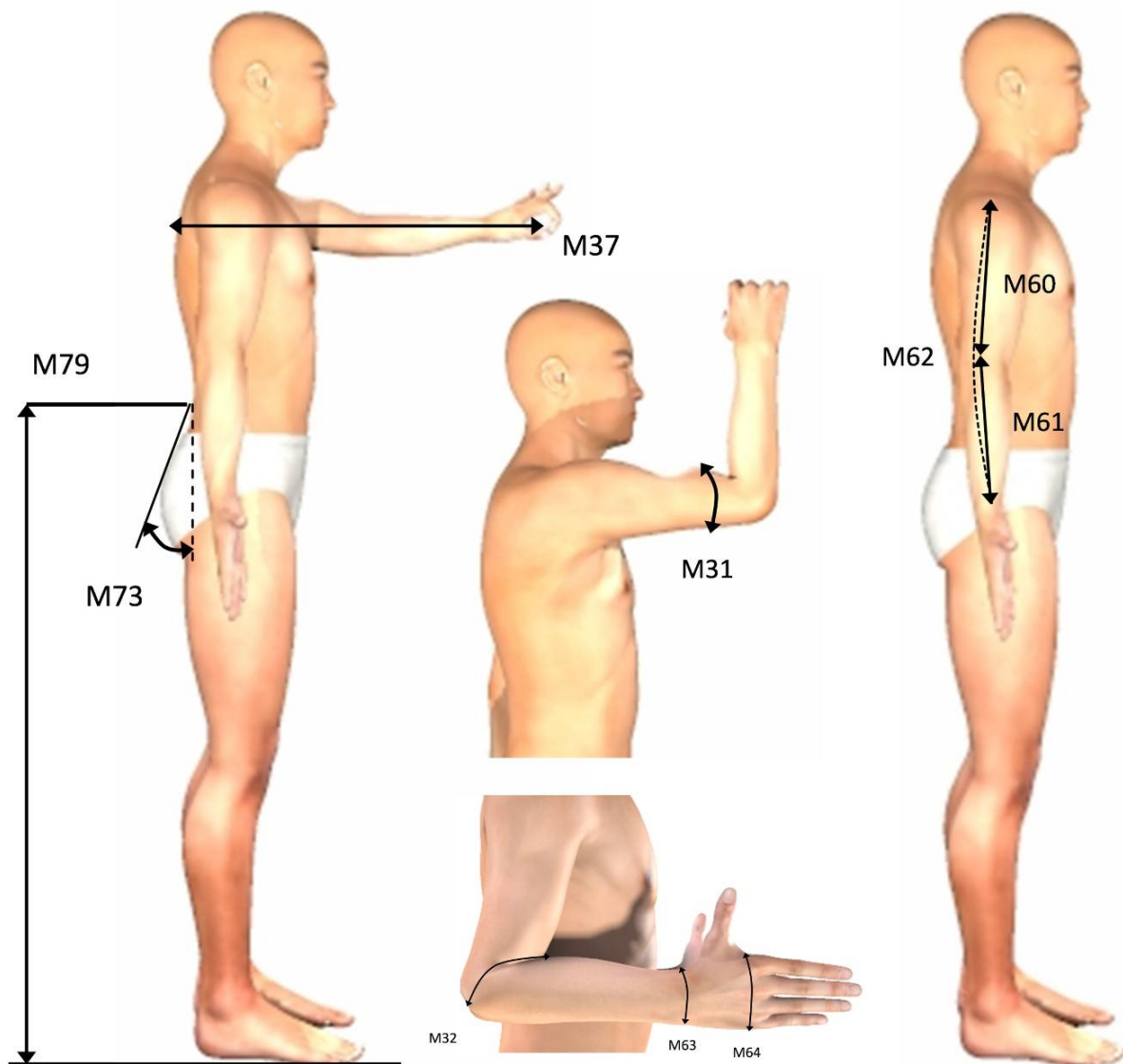


Figure 4 Limb dimensions

Table 4 Limb dimension names and page references

#	Name	Page
M31	Biceps Circumference Flexed	47
M32	Forearm Circumference Flexed	48
M37	Thumbtip Reach	53
M60	Acromion-Radiale Length	75
M61	Radiale-Styleon Length	76
M62	Sleeve Outseam	77
M63	Wrist Circumference	78
M64	Hand Circumference	79
M73	Seat Angle	88
M79	Waist Level Centre Back	93

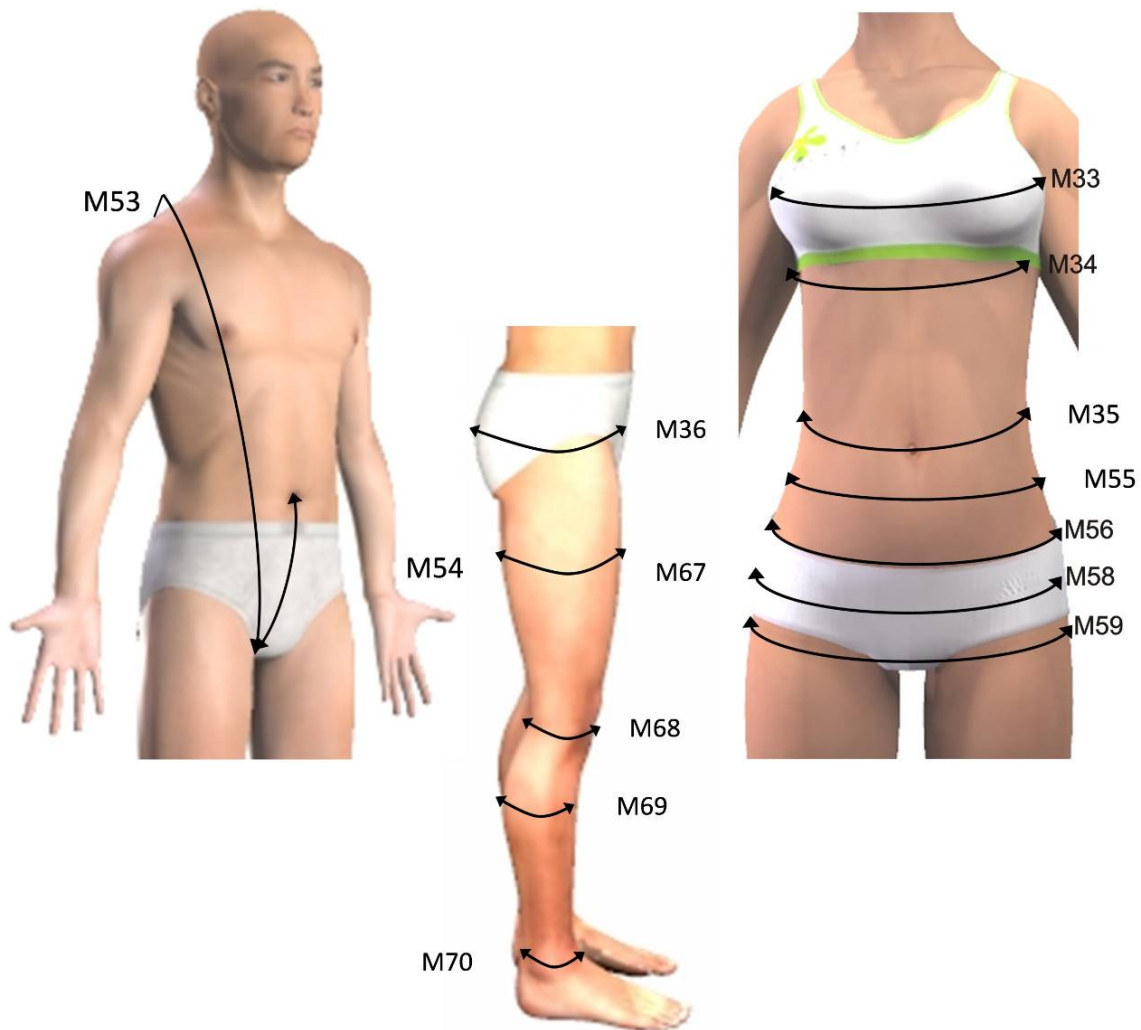


Figure 5 Body and limb circumference dimensions

Table 5 Body and limb circumference dimension names and page references

#	Name	Page
M33	Chest Circumference	49
M34	Chest Circumference Below Breast	50
M35	Waist Circumference Omphalion	51
M36	Buttock Circumference	52
M53	Vertical Trunk Circumference Wide	68
M54	Crotch Length Omphalion	69
M55	Waist Circumference Preferred	70
M56	Maximum Hip Circumference	71
M58	High Hip	73
M59	Hip Circumference	74
M67	Thigh Circumference	82
M68	Knee Circumference	83
M69	Calf Circumference	84
M70	Ankle Circumference	85

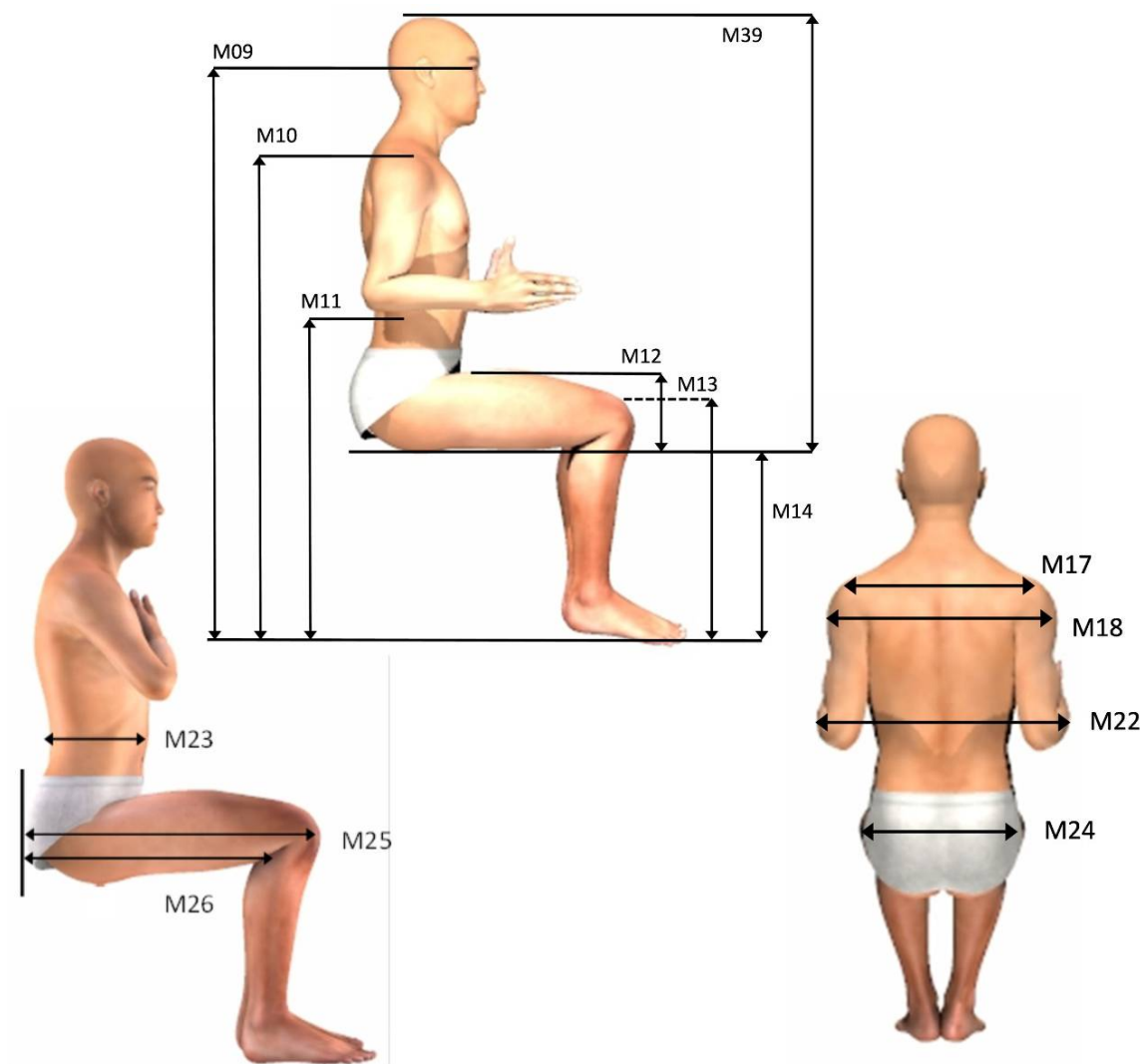


Figure 6 Seated dimensions

Table 6 Seated dimension names and page references

#	Name	Page
M09	Eye Height Sitting	25
M10	Acromion Height Sitting	26
M11	Elbow Rest Height	27
M12	Thigh Clearance	28
M13	Knee Height Sitting	29
M14	Popliteal Height	30
M17	Biacromial Breadth	33
M18	Bideltoid Breadth	34
M22	Forearm-Forearm Breadth	38
M23	Abdominal Extension Depth Sitting	39
M24	Hip Breadth Sitting	40
M25	Buttock-Knee Length	41
M26	Buttock-Popliteal Length	42
M39	Sitting Height	55

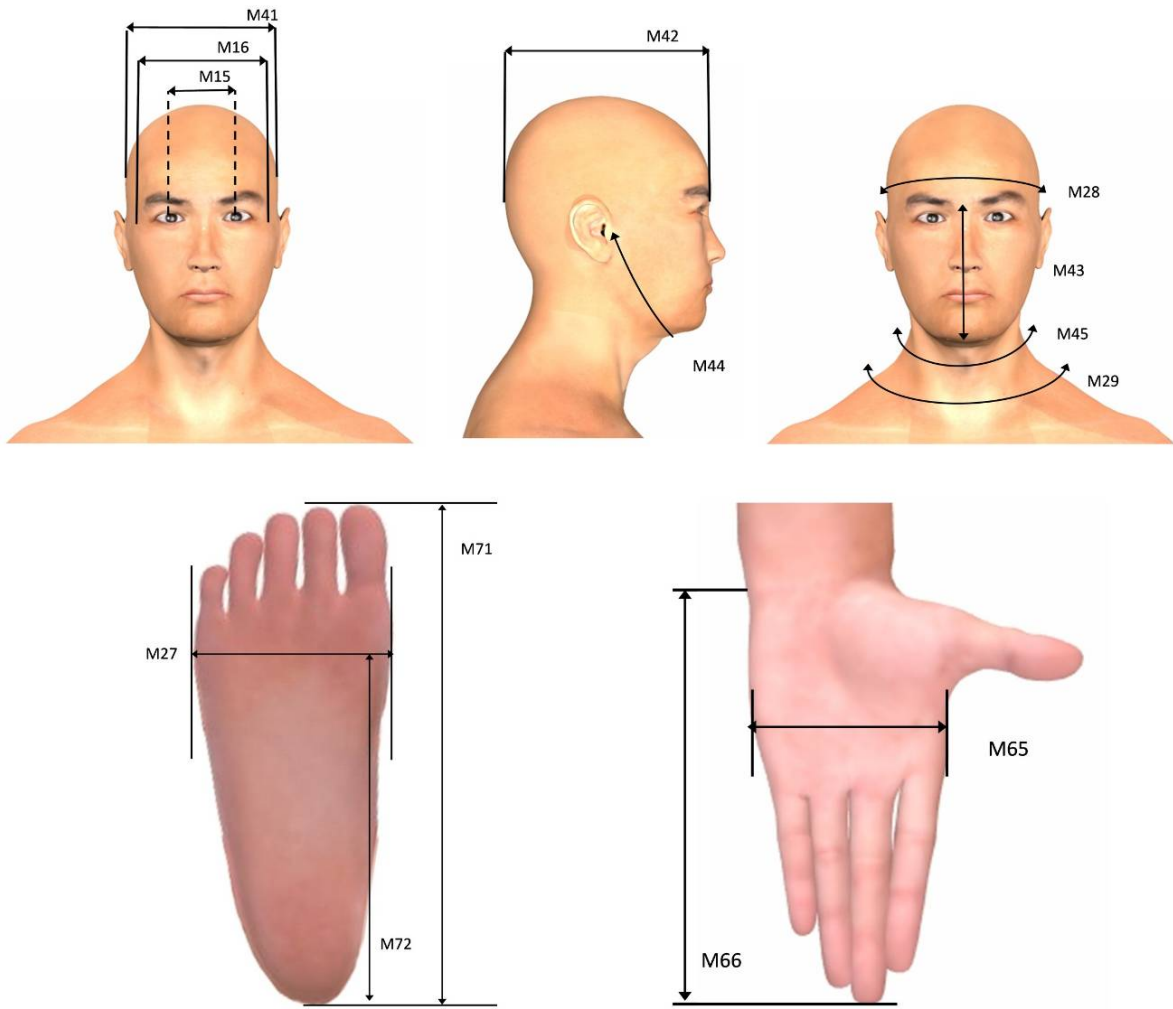


Figure 7 Head, hands and feet dimensions

Table 7 Head, hands and feet dimension names and page references

#	Name	Page
M15	Interpupillary Breadth	31
M16	Bizygomatic Breadth	32
M27	Foot Breadth	43
M28	Head Circumference	44
M29	Neck Circumference Base	45
M41	Head Breadth	57
M42	Head Length	58
M43	Menton-Sellion Length	59
M44	Bitrignon Submandibular Arc	60
M45	Neck Circumference	61
M65	Hand Breadth	80
M66	Hand Length	81
M71	Foot Length	86
M72	Ball of Foot Length	87

4.4 Summary Statistics

Summary statistics for each of the anthropometric measurements collected by the AWAS study are presented in this section. All landmarks used during the collection of these measurements are presented in Annex A. It should be noted that some standards use an estimate of the population to calculate various percentiles. This is not recommended for the data presented in this document, instead the percentile data presented in this section should be used.

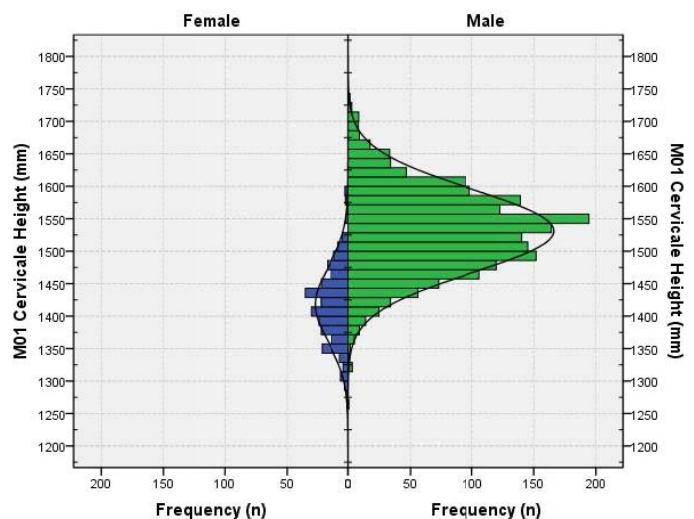
2138 of the participants sampled were asked about their handedness. 9.4% (n=201) self-reported themselves as being left handed. 1509 participants were asked about their rifle master-handedness. 9.6% (n=145) self-reported as using their left hand as their master-hand with their rifles.

4.4.1 Cervicale Height (M01)

Posture: Anthropometric Standing with the head in the Frankfort plane.

Definition: Standing surface to Cervicale.

FEMALES		MALES
277	n	1861
1418	Mean	1531
3.5	SE (mean)	1.5
57.7	SD	63.8
1266	Minimum	1259
1599	Maximum	1735
0.272	Skewness	0.016
0.376	Kurtosis	0.170
4.1%	Coefficient of variation	4.2%
	Percentiles	
1287	1 st	1383
1302	2 nd	1401
1309	3 rd	1411
1327	5 th	1428
1346	10 th	1451
1356	15 th	1465
1368	20 th	1477
1380	25 th	1487
1387	30 th	1496
1395	35 th	1505
1400	40 th	1514
1409	45 th	1525
1418	50 th	1532
1425	55 th	1540
1433	60 th	1549
1436	65 th	1556
1444	70 th	1563
1454	75 th	1574
1465	80 th	1583
1476	85 th	1595
1490	90 th	1609
1512	95 th	1640
1523	97 th	1654
1561	98 th	1666
1593	99 th	1692

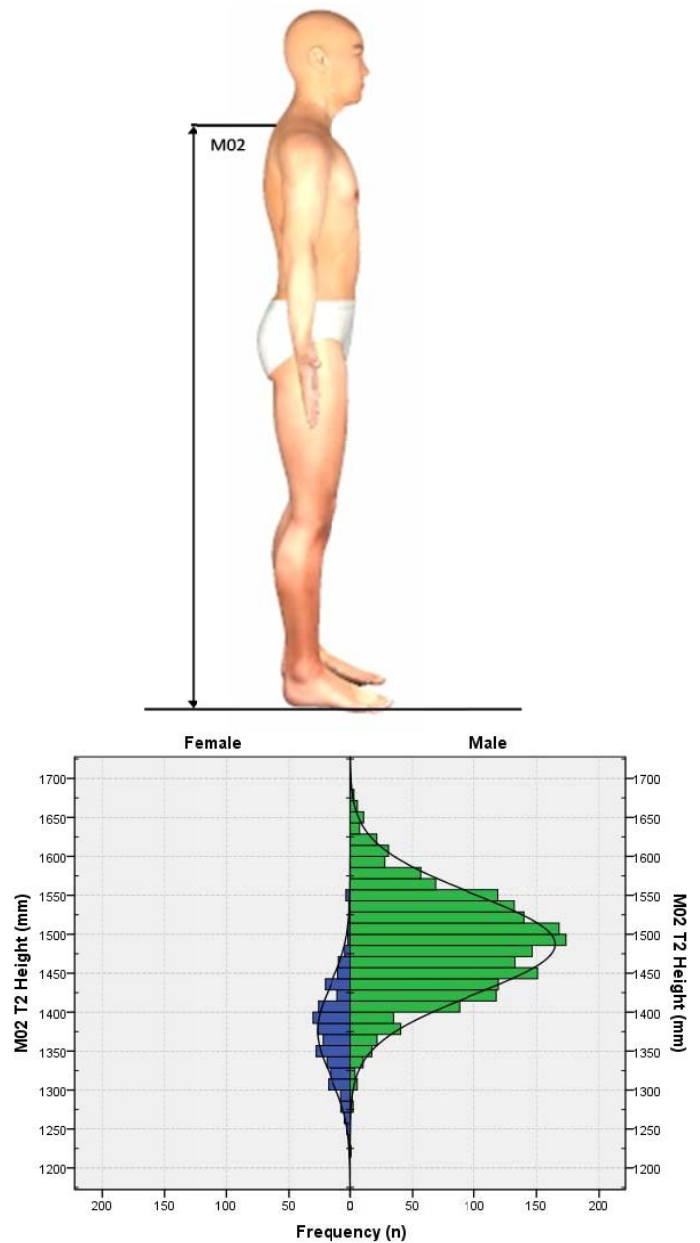


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4.4.2 T2 Height (M02)

Posture: Anthropometric Standing.**Definition:** Standing surface to T2.

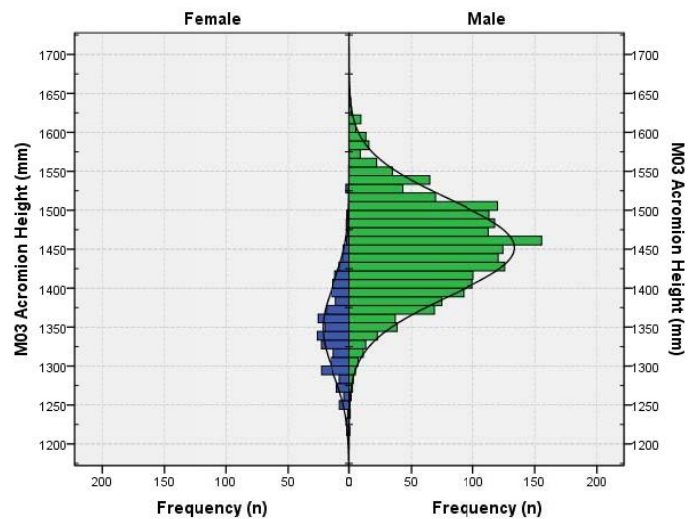
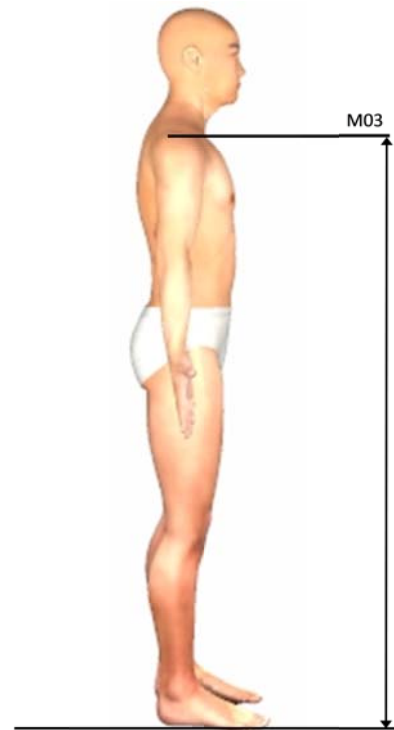
FEMALES		MALES
277	n	1860
1377	Mean	1487
3.5	SE (mean)	1.5
58.2	SD	64.3
1225	Minimum	1215
1554	Maximum	1686
0.266	Skewness	-0.001
0.305	Kurtosis	0.151
4.2%	Coefficient of variation	4.3%
Percentiles		
1251	1 st	1336
1258	2 nd	1354
1268	3 rd	1366
1281	5 th	1382
1302	10 th	1408
1313	15 th	1420
1327	20 th	1431
1336	25 th	1443
1348	30 th	1453
1354	35 th	1461
1361	40 th	1471
1369	45 th	1481
1377	50 th	1489
1384	55 th	1497
1391	60 th	1504
1397	65 th	1512
1405	70 th	1520
1410	75 th	1530
1425	80 th	1540
1438	85 th	1552
1450	90 th	1566
1470	95 th	1595
1491	97 th	1611
1518	98 th	1622
1551	99 th	1650



4.4.3 Acromion Height (M03)

Posture: Anthropometric Standing.**Definition:** Standing surface to Acromion Right.

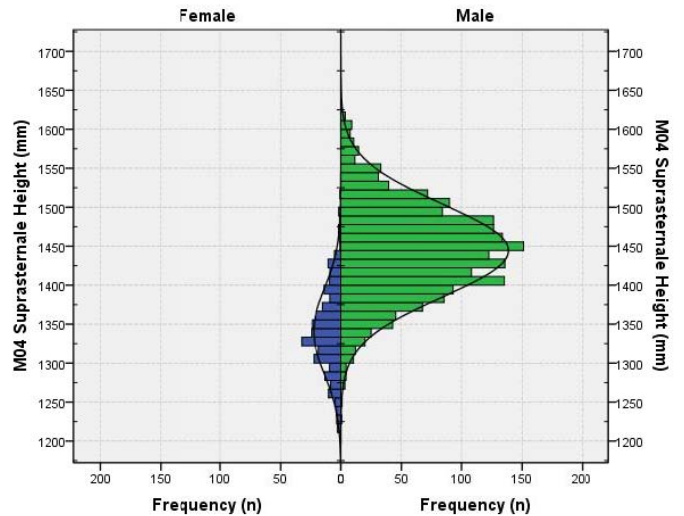
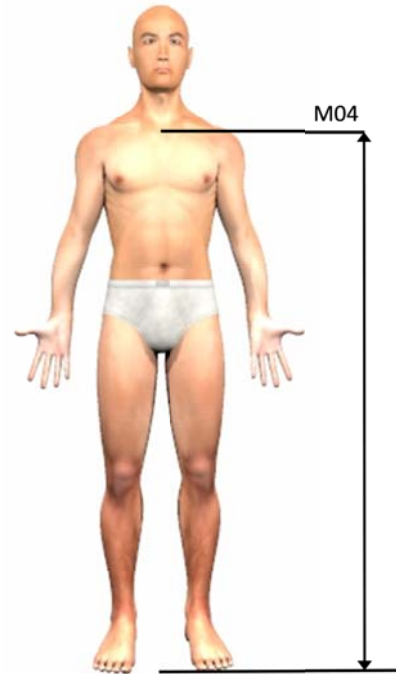
FEMALES		MALES
277	n	1861
1349	Mean	1452
3.4	SE (mean)	1.4
56.4	SD	61.7
1203	Minimum	1213
1533	Maximum	1645
0.303	Skewness	-0.018
0.333	Kurtosis	0.078
4.2%	Coefficient of variation	4.3%
Percentiles		
1219	1 st	1310
1242	2 nd	1325
1248	3 rd	1338
1256	5 th	1352
1280	10 th	1375
1292	15 th	1387
1297	20 th	1398
1309	25 th	1410
1320	30 th	1420
1327	35 th	1428
1334	40 th	1437
1340	45 th	1446
1347	50 th	1455
1353	55 th	1460
1360	60 th	1468
1366	65 th	1476
1372	70 th	1486
1384	75 th	1494
1397	80 th	1503
1408	85 th	1513
1418	90 th	1532
1441	95 th	1552
1459	97 th	1573
1485	98 th	1586
1514	99 th	1602



4.4.4 Suprasternale Height (M04)

Posture: Anthropometric Standing.**Definition:** Standing surface to Suprasternale.

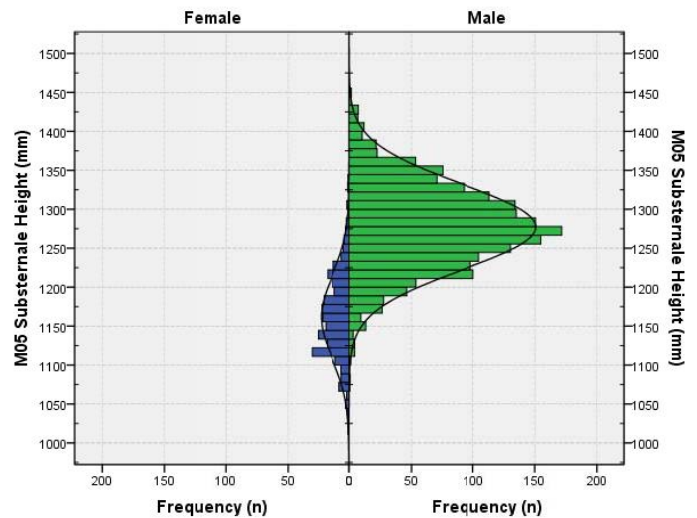
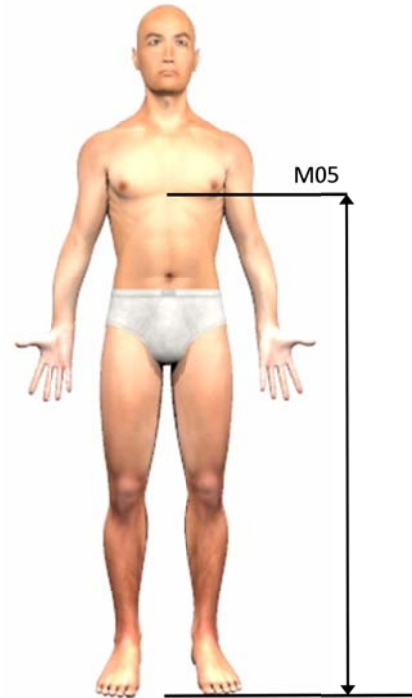
FEMALES		MALES
277	n	1861
1341	Mean	1444
3.3	SE (mean)	1.4
54.3	SD	59.5
1210	Minimum	1230
1521	Maximum	1633
0.214	Skewness	0.027
0.137	Kurtosis	0.072
4.1 %	Coefficient of variation	4.1 %
Percentiles		
1215	1 st	1304
1225	2 nd	1323
1240	3 rd	1332
1255	5 th	1346
1272	10 th	1370
1284	15 th	1383
1298	20 th	1396
1306	25 th	1404
1313	30 th	1412
1322	35 th	1422
1326	40 th	1429
1333	45 th	1438
1337	50 th	1445
1344	55 th	1453
1349	60 th	1459
1357	65 th	1467
1364	70 th	1476
1374	75 th	1484
1388	80 th	1493
1399	85 th	1506
1416	90 th	1519
1432	95 th	1544
1440	97 th	1557
1469	98 th	1571
1489	99 th	1593



4.4.5 Substernale Height (M05)

Posture: Anthropometric Standing.**Definition:** Standing surface to Substernale.

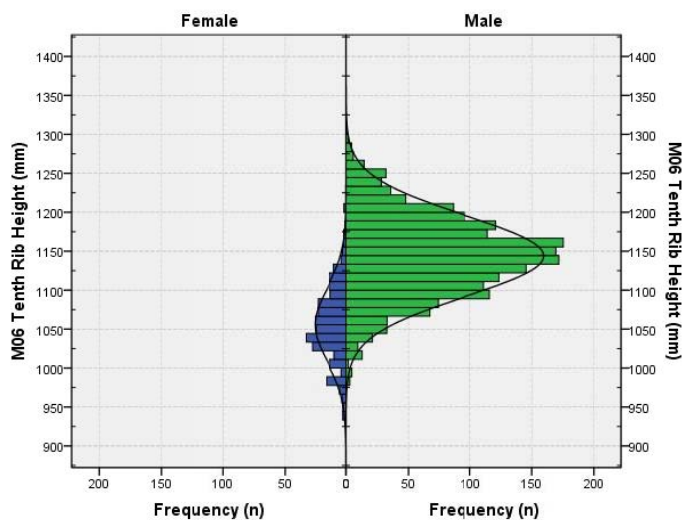
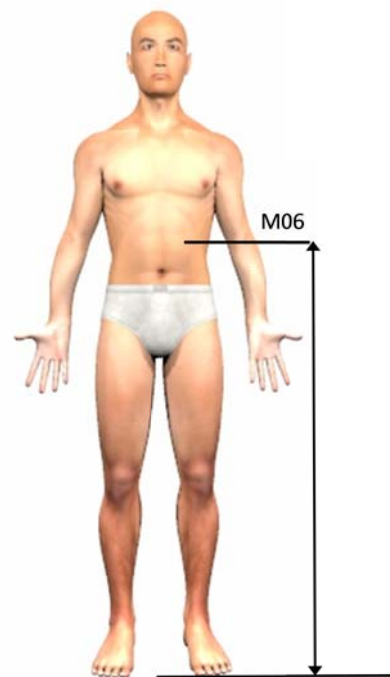
FEMALES		MALES
277	n	1861
1162	Mean	1277
3.2	SE (mean)	1.3
53.1	SD	54.7
1016	Minimum	1075
1342	Maximum	1454
0.322	Skewness	0.002
0.148	Kurtosis	0.151
4.6%	Coefficient of variation	4.1%
Percentiles		
1046	1 st	1149
1064	2 nd	1164
1068	3 rd	1175
1075	5 th	1189
1100	10 th	1210
1112	15 th	1221
1118	20 th	1231
1123	25 th	1240
1130	30 th	1249
1136	35 th	1258
1141	40 th	1264
1150	45 th	1270
1160	50 th	1276
1165	55 th	1284
1172	60 th	1290
1180	65 th	1297
1187	70 th	1305
1199	75 th	1314
1209	80 th	1323
1217	85 th	1334
1231	90 th	1347
1254	95 th	1365
1272	97 th	1379
1279	98 th	1391
1306	99 th	1412



4.4.6 Tenth Rib Height (M06)

Posture: Anthropometric Standing.**Definition:** Standing surface to Tenth Rib.

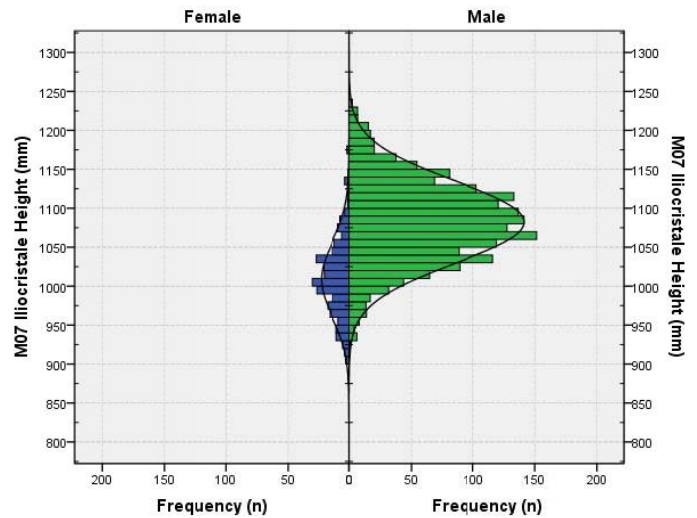
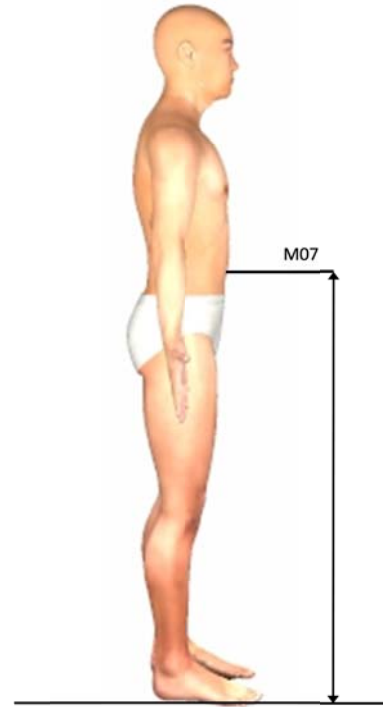
FEMALES		MALES
277	n	1860
1056	Mean	1144
2.9	SE (mean)	1.2
47.6	SD	51.7
939	Minimum	982
1206	Maximum	1311
0.134	Skewness	-0.032
0.124	Kurtosis	-0.009
4.5%	Coefficient of variation	4.5%
Percentiles		
945	1 st	1020
956	2 nd	1035
967	3 rd	1045
979	5 th	1058
987	10 th	1078
1008	15 th	1091
1019	20 th	1099
1027	25 th	1109
1033	30 th	1117
1038	35 th	1125
1040	40 th	1132
1049	45 th	1139
1055	50 th	1145
1059	55 th	1149
1066	60 th	1157
1072	65 th	1163
1079	70 th	1169
1085	75 th	1178
1095	80 th	1188
1108	85 th	1196
1119	90 th	1209
1133	95 th	1232
1148	97 th	1245
1164	98 th	1251
1177	99 th	1263



4.4.7 Iliocristale Height (M07)

Posture: Anthropometric Standing.**Definition:** Standing surface to Iliocristale.

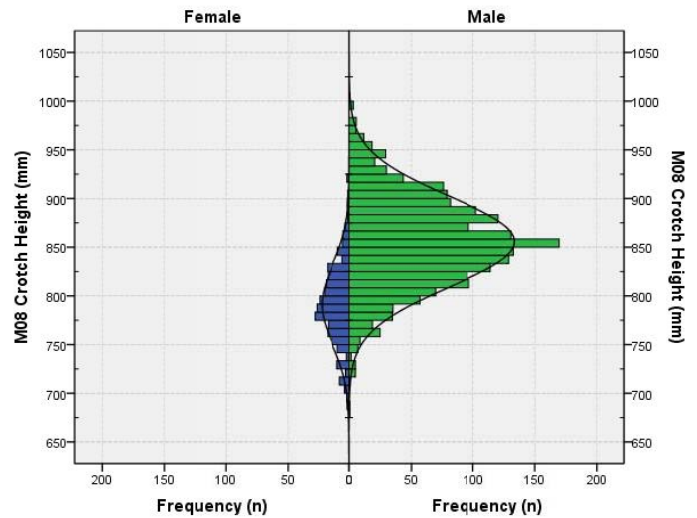
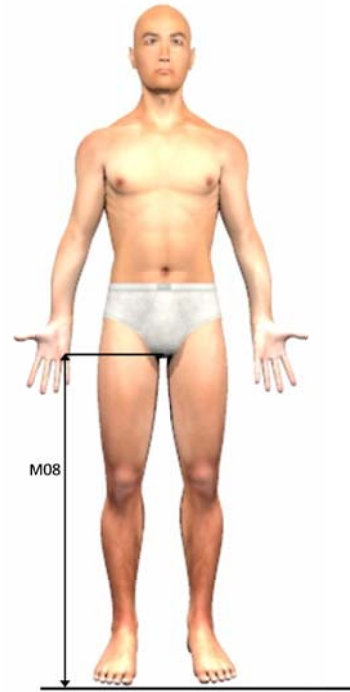
FEMALES		MALES
277	n	1861
1009	Mean	1082
2.9	SE (mean)	1.2
47.9	SD	52.5
888	Minimum	912
1171	Maximum	1237
0.323	Skewness	0.034
0.477	Kurtosis	-0.018
4.8%	Coefficient of variation	4.9%
Percentiles		
903	1 st	958
916	2 nd	971
922	3 rd	985
932	5 th	998
943	10 th	1016
959	15 th	1027
969	20 th	1037
978	25 th	1046
984	30 th	1054
994	35 th	1062
998	40 th	1068
1003	45 th	1075
1006	50 th	1083
1011	55 th	1089
1019	60 th	1095
1028	65 th	1103
1032	70 th	1110
1036	75 th	1116
1045	80 th	1126
1056	85 th	1137
1073	90 th	1149
1087	95 th	1168
1110	97 th	1186
1130	98 th	1198
1146	99 th	1207



4.4.8 Crotch Height (M08)

Posture: Anthropometric Standing.**Definition:** Standing surface to Crotch.

FEMALES		MALES
277	n	1861
791	Mean	856
2.5	SE (mean)	1.1
40.9	SD	46.3
688	Minimum	683
921	Maximum	1001
0.100	Skewness	0.010
0.393	Kurtosis	0.095
5.2%	Coefficient of variation	5.4%
Percentiles		
696	1 st	748
705	2 nd	762
710	3 rd	767
713	5 th	778
738	10 th	798
751	15 th	809
760	20 th	817
766	25 th	825
773	30 th	832
780	35 th	838
782	40 th	844
786	45 th	850
790	50 th	855
796	55 th	860
800	60 th	866
805	65 th	873
811	70 th	879
817	75 th	887
823	80 th	895
828	85 th	905
843	90 th	914
861	95 th	934
868	97 th	945
886	98 th	953
901	99 th	961

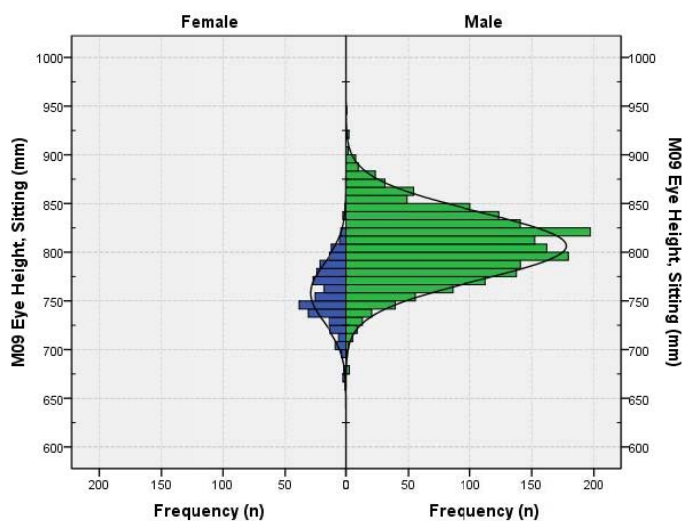
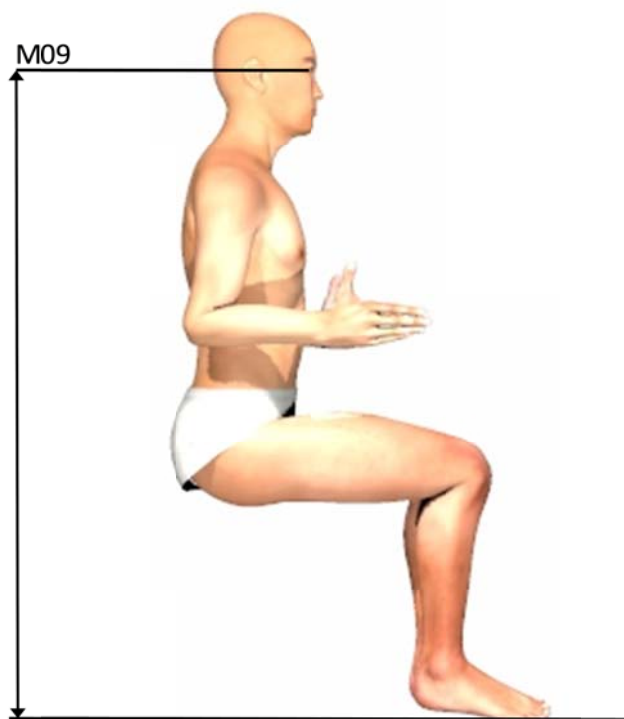


4.4.9 Eye Height, Sitting (M09)

Posture: Anthropometric Sitting with the head in the Frankfort plane.

Definition: Sitting surface to Ectocanthus.

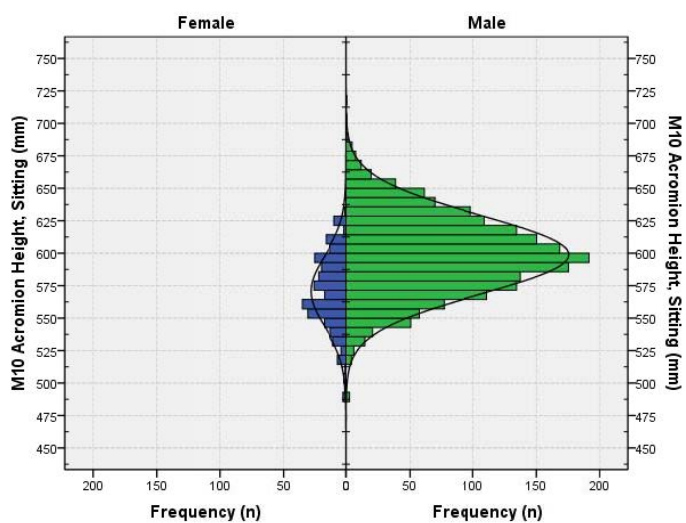
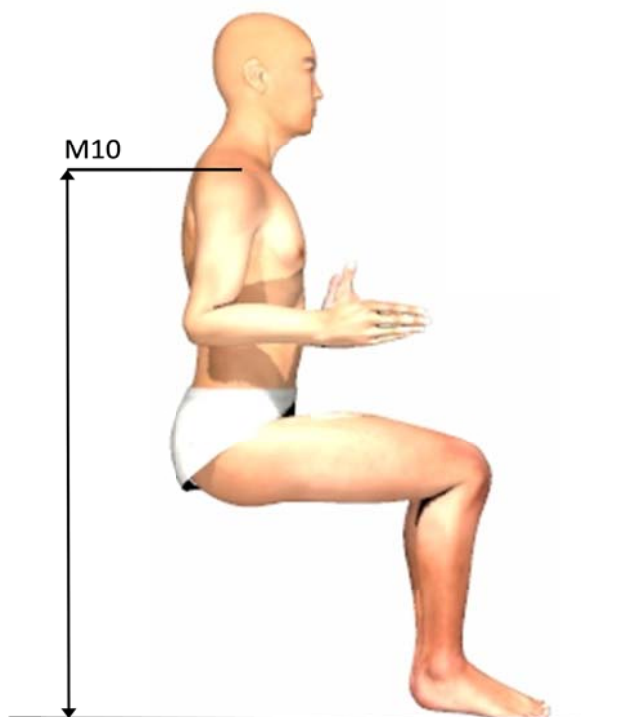
FEMALES		MALES
277	n	1861
758	Mean	806
1.9	SE (mean)	0.8
31.2	SD	34.8
666	Minimum	679
846	Maximum	942
-0.104	Skewness	-0.027
0.098	Kurtosis	0.139
4.1%	Coefficient of variation	4.3%
Percentiles		
673	1 st	722
689	2 nd	734
696	3 rd	742
706	5 th	750
721	10 th	762
728	15 th	770
734	20 th	777
739	25 th	783
742	30 th	787
744	35 th	793
748	40 th	798
752	45 th	802
757	50 th	806
761	55 th	813
767	60 th	816
773	65 th	820
776	70 th	825
781	75 th	830
785	80 th	835
790	85 th	842
798	90 th	849
808	95 th	864
816	97 th	871
821	98 th	878
836	99 th	886



4.4.10 Acromion Height, Sitting (M10)

Posture: Anthropometric Sitting.**Definition:** Sitting surface to Acromion (Right).

FEMALES		MALES
277	n	1858
571	Mean	599
1.7	SE (mean)	0.7
27.8	SD	30.2
487	Minimum	491
632	Maximum	716
-0.204	Skewness	0.047
-0.105	Kurtosis	-0.016
4.9%	Coefficient of variation	5.0%
Percentiles		
493	1 st	532
508	2 nd	538
515	3 rd	543
526	5 th	550
536	10 th	561
544	15 th	568
549	20 th	573
552	25 th	578
557	30 th	583
559	35 th	587
562	40 th	591
565	45 th	595
569	50 th	598
574	55 th	602
577	60 th	606
583	65 th	611
587	70 th	614
592	75 th	620
596	80 th	624
601	85 th	631
608	90 th	639
613	95 th	649
623	97 th	655
625	98 th	662
627	99 th	667

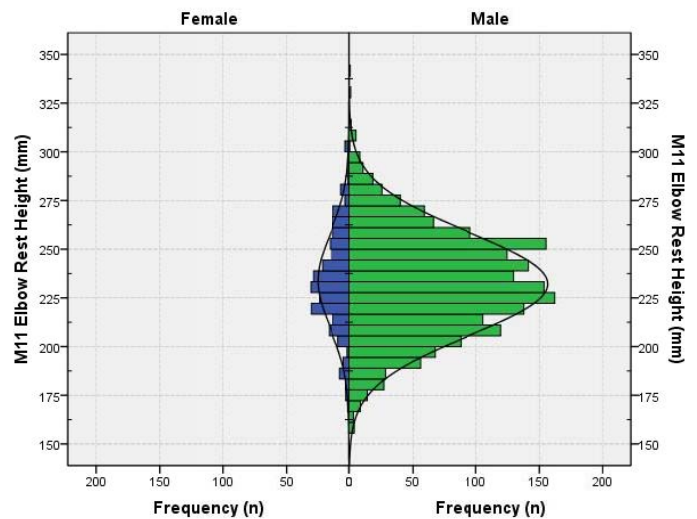
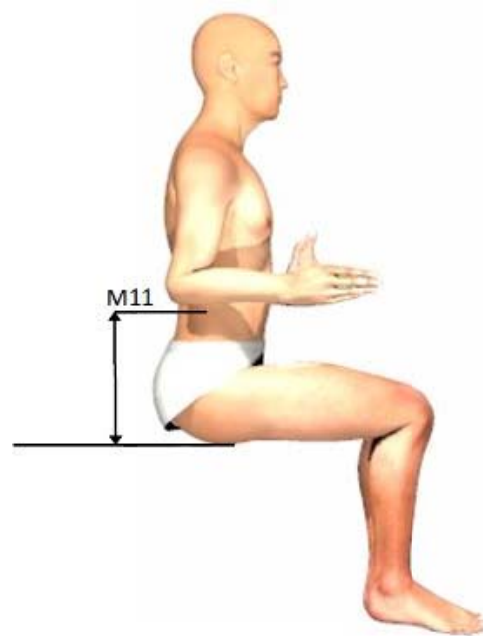


4.4.11 Elbow Rest Height (M11)

Posture: Anthropometric Sitting.

Definition: Sitting surface to Olecranon Bottom.

FEMALES		MALES
277	n	1861
234	Mean	232
1.5	SE (mean)	0.6
24.3	SD	26.3
169	Minimum	160
305	Maximum	344
0.079	Skewness	0.094
0.199	Kurtosis	0.028
10.4%	Coefficient of variation	11.3%
Percentiles		
175	1 st	173
181	2 nd	179
185	3 rd	182
188	5 th	190
205	10 th	198
210	15 th	204
215	20 th	210
220	25 th	214
222	30 th	219
224	35 th	222
227	40 th	225
230	45 th	228
233	50 th	232
235	55 th	235
237	60 th	239
240	65 th	243
245	70 th	246
249	75 th	251
255	80 th	254
261	85 th	259
266	90 th	266
276	95 th	275
280	97 th	282
283	98 th	288
302	99 th	295

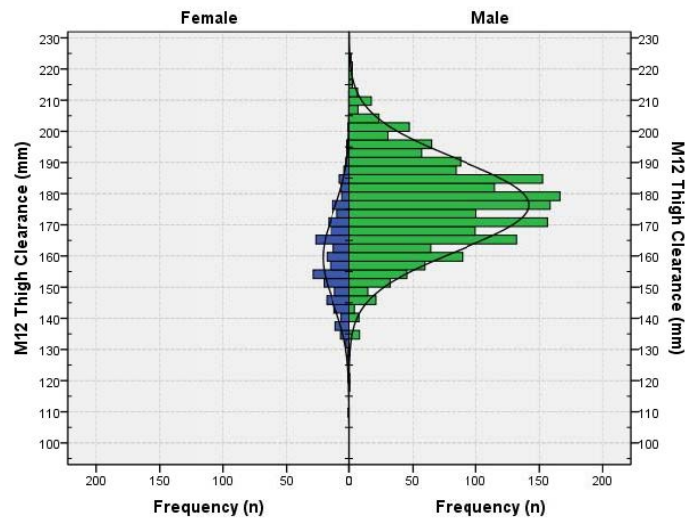
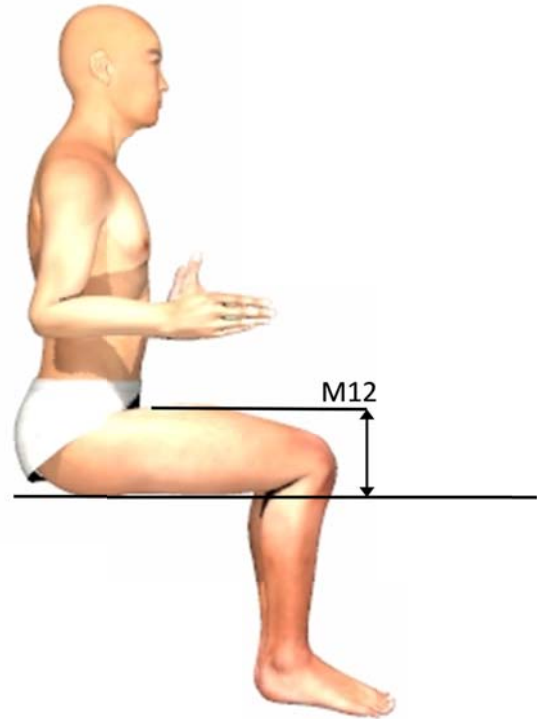


4.4.12 Thigh Clearance (M12)

Posture: Anthropometric Sitting, with the arms hanging relaxed.

Definition: Sitting surface to Thigh Point, Top.

FEMALES		MALES
277	n	1861
160	Mean	176
0.9	SE (mean)	0.3
14.4	SD	14.5
111	Minimum	119
202	Maximum	223
0.109	Skewness	0.007
-0.124	Kurtosis	0.138
9.1%	Coefficient of variation	8.2%
Percentiles		
129	1 st	142
133	2 nd	147
135	3 rd	149
137	5 th	153
141	10 th	158
145	15 th	161
147	20 th	164
149	25 th	166
152	30 th	169
153	35 th	171
155	40 th	173
157	45 th	175
159	50 th	176
161	55 th	178
164	60 th	180
165	65 th	182
167	70 th	184
169	75 th	186
172	80 th	188
175	85 th	191
180	90 th	195
184	95 th	201
187	97 th	204
190	98 th	207
194	99 th	211

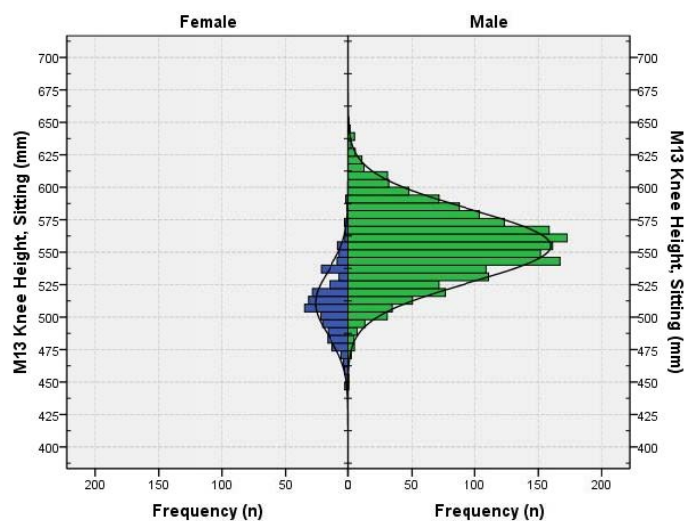
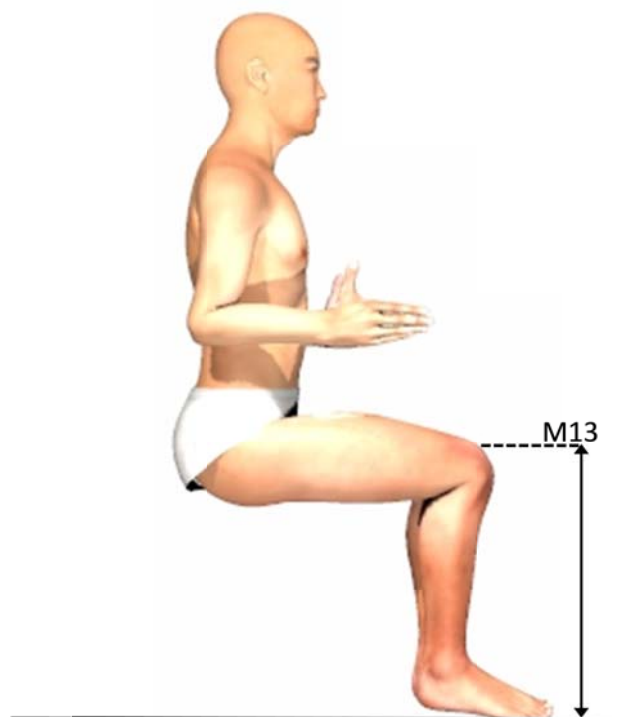


4.4.13 Knee Height, Sitting (M13)

Posture: Anthropometric Sitting, with the arms hanging relaxed.

Definition: Footrest surface to Suprapatella.

FEMALES		MALES
277	n	1861
511	Mean	555
1.5	SE (mean)	0.6
25.0	SD	27.9
446	Minimum	444
588	Maximum	650
0.256	Skewness	-0.002
0.301	Kurtosis	0.183
4.9%	Coefficient of variation	5.0%
Percentiles		
448	1 st	489
458	2 nd	499
466	3 rd	502
474	5 th	509
479	10 th	519
484	15 th	526
489	20 th	532
495	25 th	537
499	30 th	541
502	35 th	544
506	40 th	548
508	45 th	552
510	50 th	555
513	55 th	559
515	60 th	562
517	65 th	565
519	70 th	569
525	75 th	573
534	80 th	578
537	85 th	584
545	90 th	590
556	95 th	601
562	97 th	608
570	98 th	613
581	99 th	622

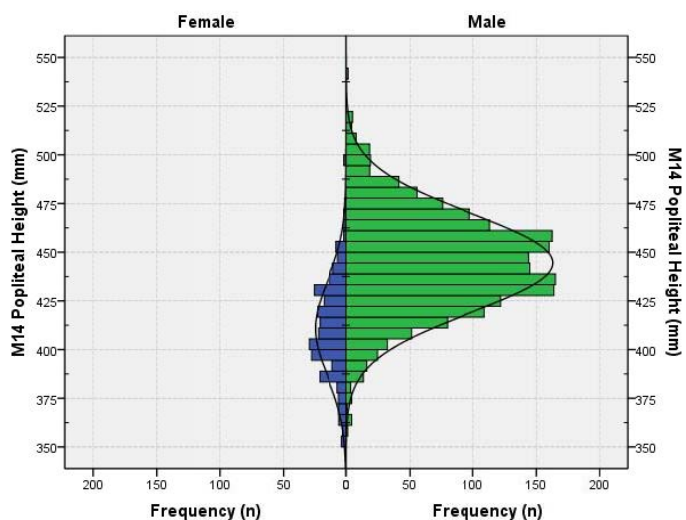
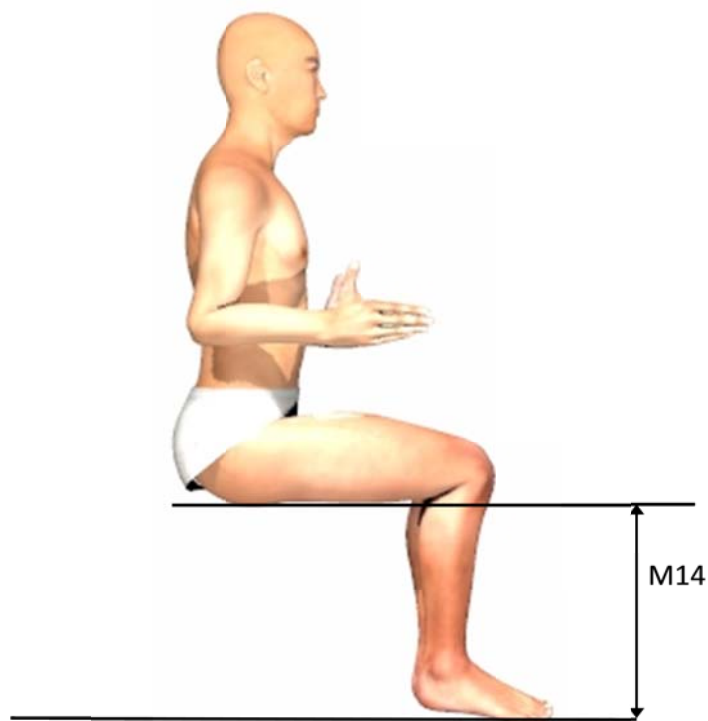


4.4.14 Popliteal Height (M14)

Posture: Anthropometric Sitting, with the arms hanging relaxed.

Definition: Footrest surface to the Dorsal Juncture of Calf and Thigh.

FEMALES		MALES
277	n	1861
411	Mean	445
1.5	SE (mean)	0.6
24.6	SD	25.3
352	Minimum	359
499	Maximum	544
0.172	Skewness	0.065
0.394	Kurtosis	0.281
6.0%	Coefficient of variation	5.7%
Percentiles		
353	1 st	385
361	2 nd	391
362	3 rd	397
367	5 th	404
381	10 th	414
385	15 th	419
389	20 th	424
396	25 th	428
398	30 th	431
401	35 th	434
404	40 th	437
406	45 th	441
410	50 th	444
414	55 th	447
417	60 th	451
421	65 th	455
425	70 th	458
428	75 th	461
431	80 th	465
436	85 th	471
441	90 th	476
450	95 th	486
456	97 th	495
465	98 th	500
475	99 th	506

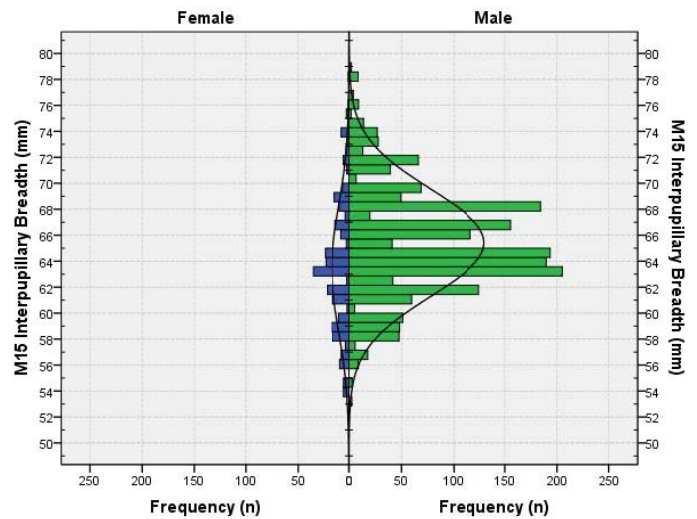
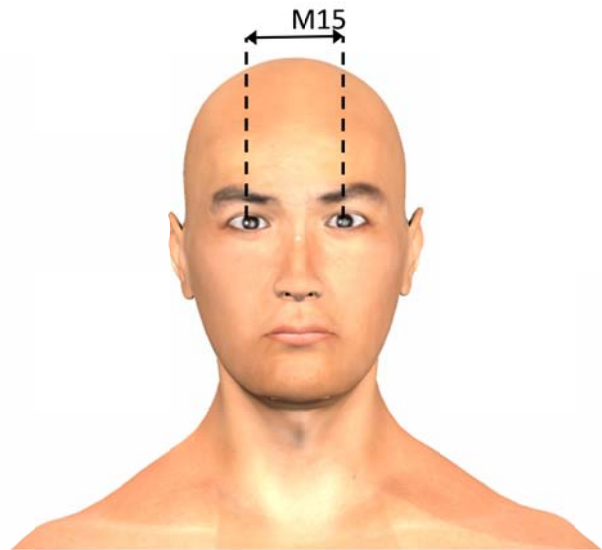


4.4.15 Interpupillary Breadth (M15)

Posture: Sitting.

Definition: Distance between the Centre of the Pupil (Right) and the Centre of the Pupil (Left).

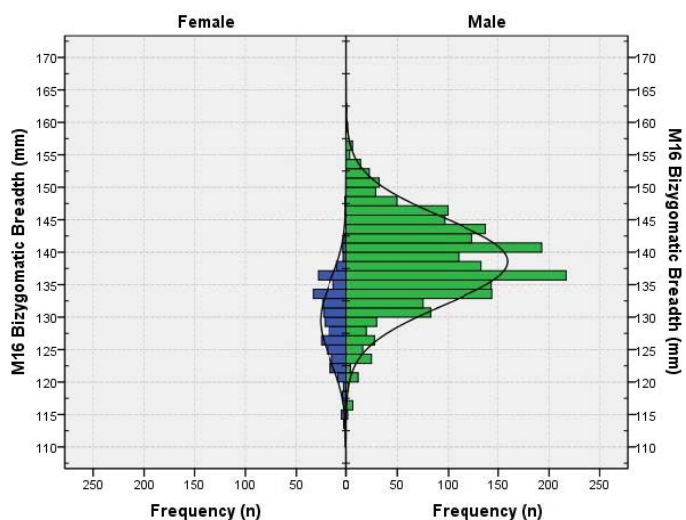
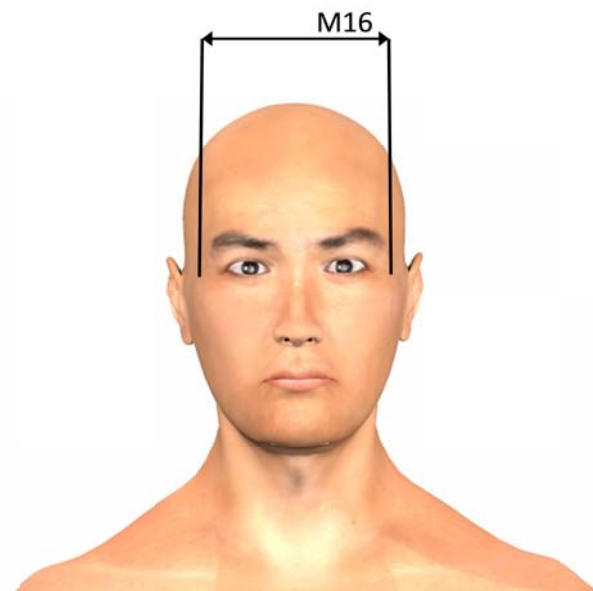
FEMALES		MALES
277	n	1861
63	Mean	65
0.3	SE (mean)	0.1
4.8	SD	4.1
54	Minimum	53
78	Maximum	79
0.374	Skewness	0.332
-0.080	Kurtosis	0.296
7.5%	Coefficient of variation	6.2%
Percentiles		
54	1 st	57
54	2 nd	58
55	3 rd	58
56	5 th	59
58	10 th	60
58	15 th	62
59	20 th	62
60	25 th	63
61	30 th	63
62	35 th	64
62	40 th	64
63	45 th	65
63	50 th	65
64	55 th	66
64	60 th	66
65	65 th	67
65	70 th	67
66	75 th	68
67	80 th	68
69	85 th	70
70	90 th	71
73	95 th	73
74	97 th	74
74	98 th	75
76	99 th	76



4.4.16 Bizygomatic Breadth (M16)

Posture: Sitting.**Definition:** The maximum horizontal breadth between Zygion (Right) and Zygion (Left).

FEMALES		MALES
277	n	1861
129	Mean	139
0.4	SE (mean)	0.2
6.1	SD	6.7
111	Minimum	115
148	Maximum	162
-0.316	Skewness	-0.200
0.134	Kurtosis	0.466
4.7%	Coefficient of variation	4.8%
Percentiles		
114	1 st	121
115	2 nd	123
116	3 rd	125
119	5 th	127
122	10 th	131
123	15 th	132
125	20 th	134
125	25 th	135
127	30 th	135
127	35 th	136
128	40 th	137
129	45 th	138
130	50 th	139
131	55 th	140
132	60 th	140
132	65 th	141
133	70 th	142
134	75 th	143
135	80 th	144
136	85 th	146
137	90 th	147
138	95 th	149
139	97 th	151
141	98 th	152
142	99 th	154

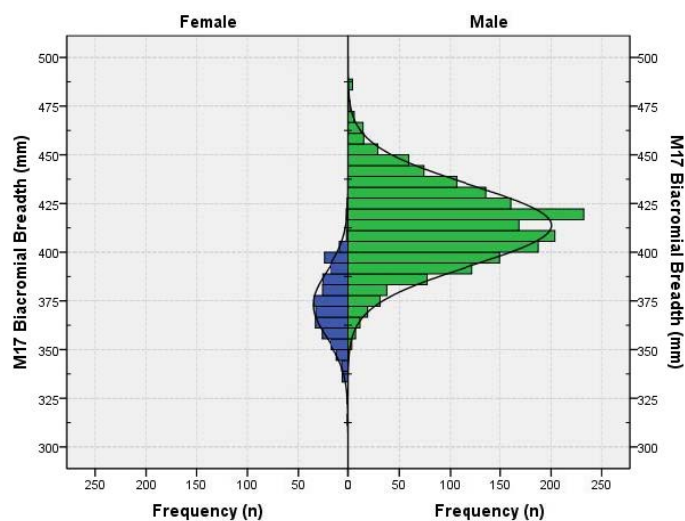
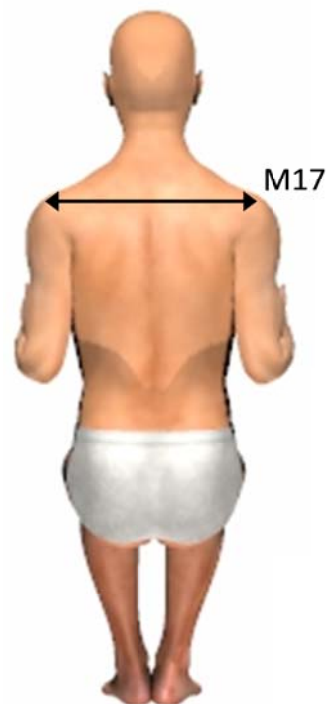


4.4.17 Biacromial Breadth (M17)

Posture: Anthropometric Sitting.

Definition: The distance between the Acromion (Right) and Acromion (Left).

FEMALES		MALES
277	n	1861
373	Mean	414
1.0	SE (mean)	0.5
17.4	SD	20.6
312	Minimum	348
424	Maximum	487
-0.077	Skewness	0.093
-0.079	Kurtosis	0.261
4.7%	Coefficient of variation	5.0%
Percentiles		
336	1 st	365
338	2 nd	370
340	3 rd	375
344	5 th	382
351	10 th	389
355	15 th	393
359	20 th	396
361	25 th	400
364	30 th	403
365	35 th	406
369	40 th	409
371	45 th	411
373	50 th	414
375	55 th	417
377	60 th	419
380	65 th	421
382	70 th	424
386	75 th	427
389	80 th	431
393	85 th	435
398	90 th	440
399	95 th	448
402	97 th	452
405	98 th	457
416	99 th	466

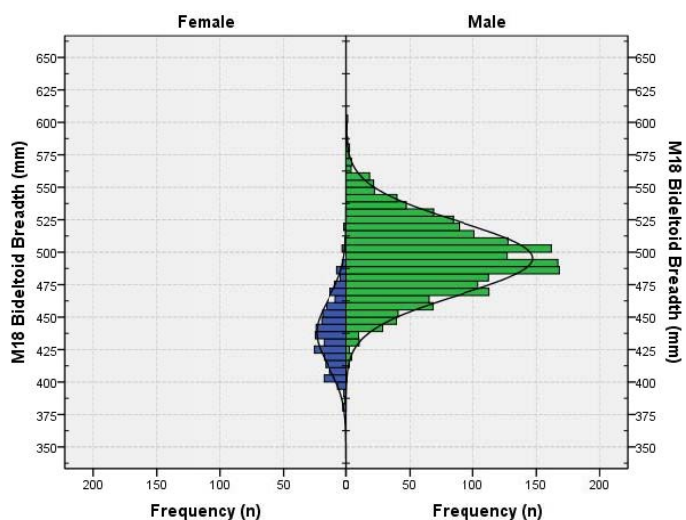
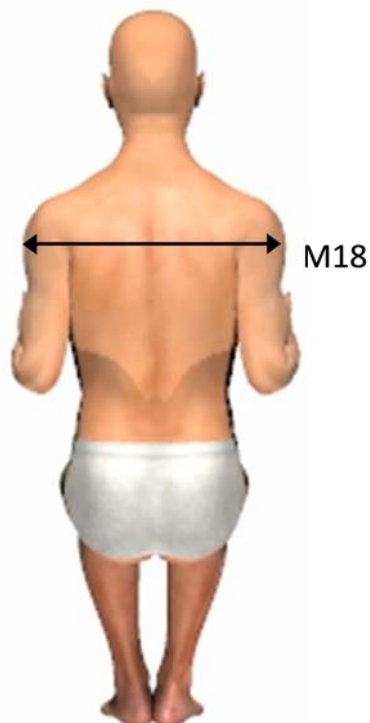


4.4.18 Bideltoid Breadth (M18)

Posture: Anthropometric Sitting.

Definition: The distance between the lateral margins of the upper arms on the deltoid muscle.

FEMALES		MALES
277	n	1861
438	Mean	495
1.6	SE (mean)	0.7
25.8	SD	28.0
380	Minimum	405
519	Maximum	605
0.404	Skewness	0.146
-0.050	Kurtosis	0.132
5.9%	Coefficient of variation	5.7%
Percentiles		
384	1 st	432
394	2 nd	440
395	3 rd	444
400	5 th	449
405	10 th	460
410	15 th	467
414	20 th	472
420	25 th	476
424	30 th	481
426	35 th	485
430	40 th	487
434	45 th	491
437	50 th	494
440	55 th	498
443	60 th	501
446	65 th	505
450	70 th	509
454	75 th	514
459	80 th	519
467	85 th	525
474	90 th	532
486	95 th	542
489	97 th	550
499	98 th	555
506	99 th	561



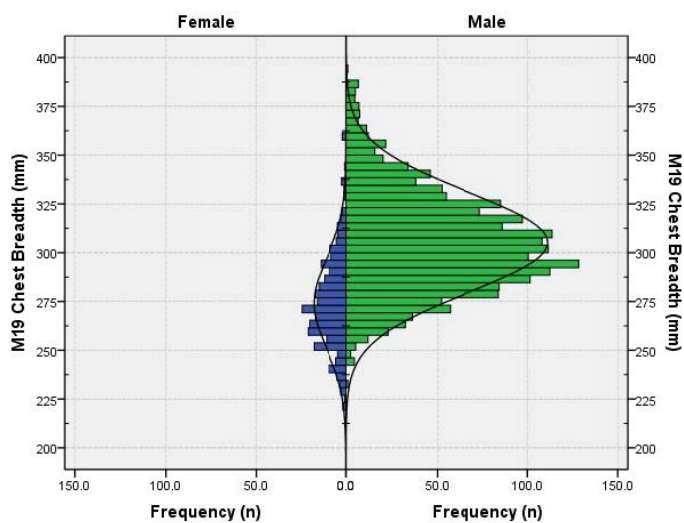
4.4.19 Chest Breadth (M19)

Posture: Anthropometric Standing, with the arms slightly abducted.

Definition: The maximum horizontal breadth at the height of Bustpoint, Right (females) or Thelion, Right (males).



FEMALES		MALES
277	n	1860
274	Mean	305
1.4	SE (mean)	0.6
23.3	SD	25.7
223	Minimum	234
359	Maximum	394
0.591	Skewness	0.481
0.805	Kurtosis	0.200
8.5%	Coefficient of variation	8.4%
Percentiles		
227	1 st	255
231	2 nd	260
234	3 rd	263
237	5 th	267
246	10 th	274
252	15 th	280
254	20 th	284
258	25 th	287
261	30 th	290
264	35 th	294
268	40 th	297
269	45 th	300
272	50 th	303
275	55 th	306
277	60 th	310
281	65 th	313
283	70 th	317
288	75 th	322
294	80 th	325
298	85 th	332
303	90 th	340
314	95 th	351
323	97 th	361
335	98 th	366
348	99 th	377



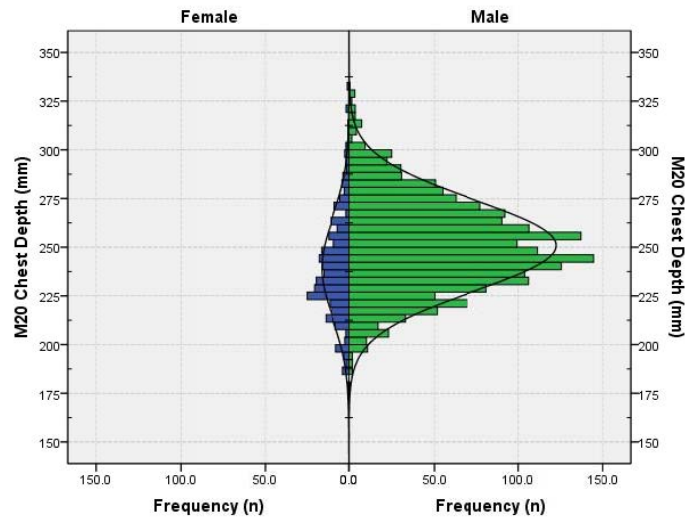
4.4.20 Chest Depth (M20)

Posture: Anthropometric Standing.

Definition: The horizontal distance between the Bustpoint, Right (females) or Thelion, Right (males), and point on the back at the same level.



FEMALES		MALES
277	n	1861
239	Mean	251
1.5	SE (mean)	0.5
25.5	SD	23.3
180	Minimum	178
334	Maximum	335
0.624	Skewness	0.258
0.827	Kurtosis	0.090
10.7%	Coefficient of variation	9.3%
Percentiles		
188	1 st	201
190	2 nd	205
196	3 rd	210
200	5 th	215
211	10 th	222
215	15 th	227
221	20 th	231
224	25 th	235
225	30 th	238
229	35 th	241
230	40 th	244
234	45 th	247
235	50 th	250
239	55 th	253
243	60 th	256
246	65 th	259
250	70 th	262
254	75 th	266
258	80 th	270
265	85 th	275
273	90 th	282
286	95 th	290
297	97 th	298
302	98 th	300
320	99 th	314

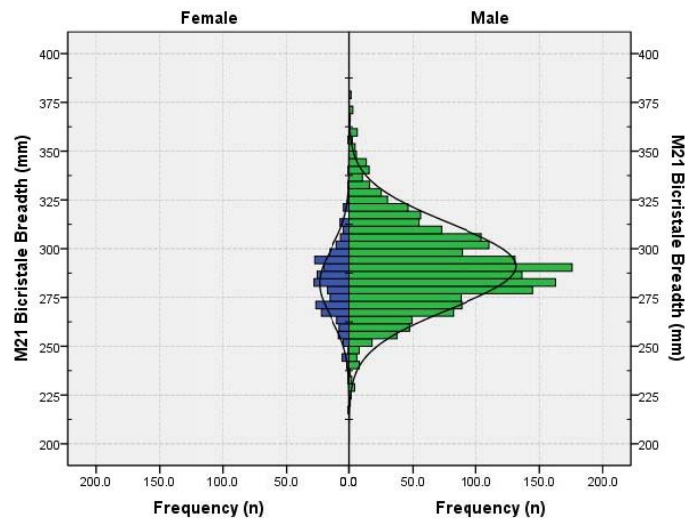


4.4.21 Bicristale Breadth (M21)

Posture: Anthropometric Standing, with the arms placed across the chest.

Definition: The distance between the most lateral points on the right and left iliac crests, immediately below the Iliocristale (Right) and Iliocristale (Left) landmarks.

FEMALES		MALES
277	n	1861
282	Mean	291
1.1	SE (mean)	0.5
17.7	SD	21.7
216	Minimum	221
357	Maximum	381
0.086	Skewness	0.425
1.118	Kurtosis	0.782
6.3%	Coefficient of variation	7.5%
Percentiles		
239	1 st	242
244	2 nd	251
246	3 rd	254
254	5 th	258
261	10 th	266
266	15 th	270
269	20 th	274
270	25 th	277
272	30 th	280
275	35 th	282
277	40 th	285
281	45 th	287
284	50 th	290
285	55 th	291
287	60 th	295
289	65 th	297
291	70 th	300
294	75 th	304
296	80 th	307
298	85 th	313
303	90 th	319
313	95 th	330
315	97 th	339
322	98 th	343
329	99 th	350

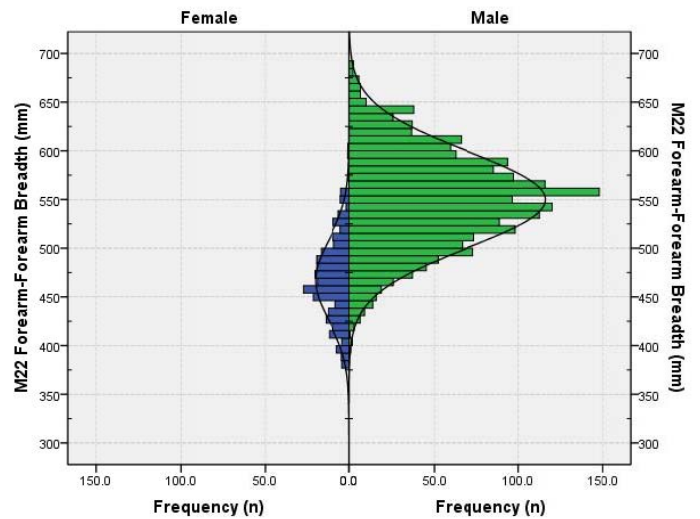
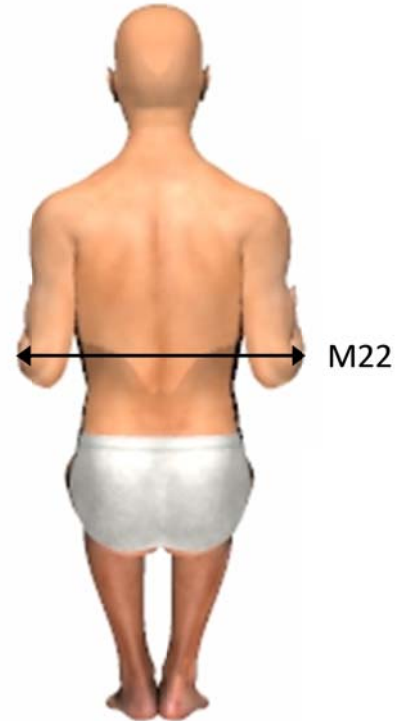


4.4.22 Forearm-Forearm Breadth (M22)

Posture: Anthropometric Sitting.

Definition: The maximum horizontal distance between the most lateral points on the right and lateral left forearms.

FEMALES		MALES
277	n	1861
467	Mean	550
2.5	SE (mean)	1.1
41.7	SD	49.2
361	Minimum	399
604	Maximum	692
0.180	Skewness	-0.055
-0.022	Kurtosis	-0.193
8.9%	Coefficient of variation	8.9%
Percentiles		
380	1 st	434
386	2 nd	447
389	3 rd	455
397	5 th	467
411	10 th	485
422	15 th	498
428	20 th	508
438	25 th	517
449	30 th	524
453	35 th	532
457	40 th	538
461	45 th	545
467	50 th	552
471	55 th	557
476	60 th	562
482	65 th	568
486	70 th	575
494	75 th	583
499	80 th	591
510	85 th	602
524	90 th	614
544	95 th	631
552	97 th	642
554	98 th	646
566	99 th	661

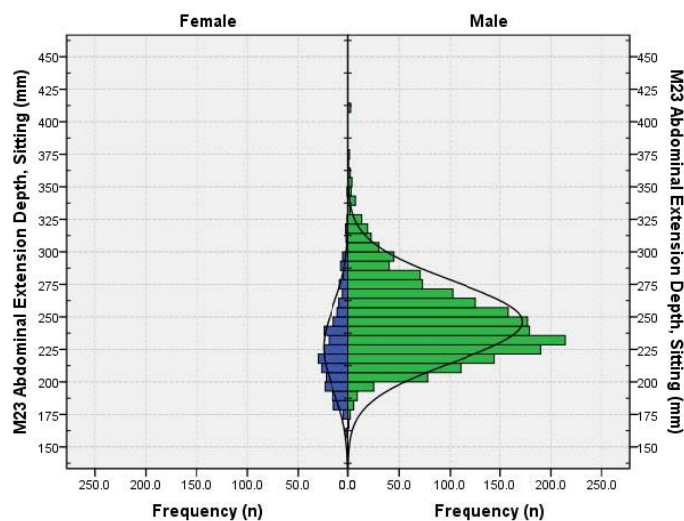


4.4.23 Abdominal Extension Depth, Sitting (M23)

Posture: Anthropometric Sitting with the right hand on the chest.

Definition: The horizontal distance between the Abdominal Point, Anterior, and point on the back at the same level.

FEMALES		MALES
277	n	1861
226	Mean	246
1.9	SE (mean)	0.7
31.8	SD	30.8
164	Minimum	168
345	Maximum	413
0.770	Skewness	0.969
0.448	Kurtosis	1.782
14.1%	Coefficient of variation	12.5%
Percentiles		
174	1 st	193
177	2 nd	198
180	3 rd	201
183	5 th	205
189	10 th	212
196	15 th	217
198	20 th	221
202	25 th	225
208	30 th	228
211	35 th	232
215	40 th	235
219	45 th	238
221	50 th	241
224	55 th	245
230	60 th	249
234	65 th	253
238	70 th	258
243	75 th	263
250	80 th	269
259	85 th	277
273	90 th	289
289	95 th	304
296	97 th	315
308	98 th	323
318	99 th	338

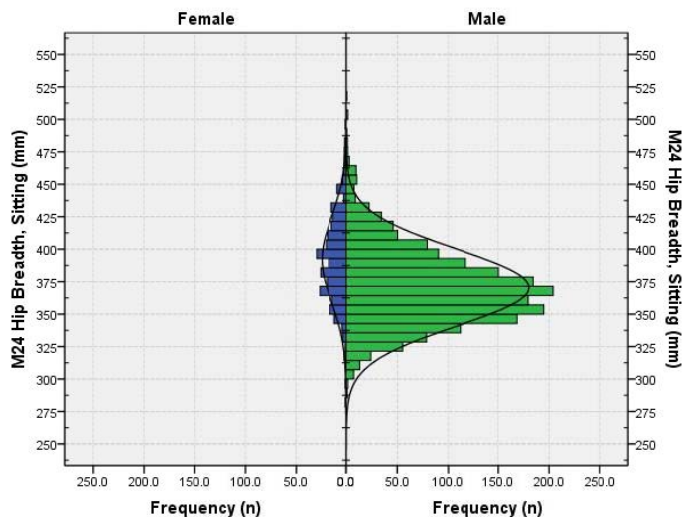
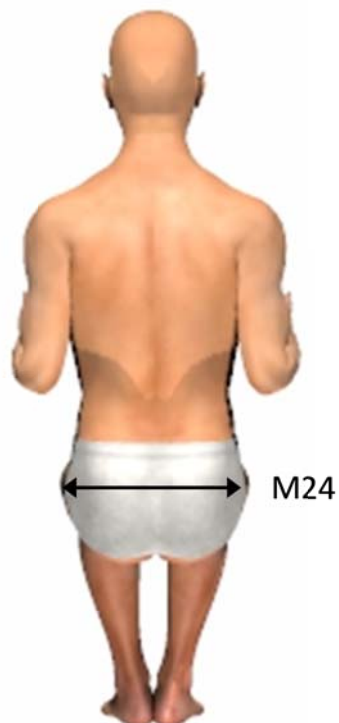


4.4.24 Hip Breadth, Sitting (M24)

Posture: Anthropometric Sitting, with knees together.

Definition: The maximum breadth of the seated subject at the hip or thigh, whichever is larger.

FEMALES		MALES
277	n	1861
392	Mean	370
1.9	SE (mean)	0.7
32.3	SD	29.4
284	Minimum	286
495	Maximum	520
0.224	Skewness	0.684
0.185	Kurtosis	1.028
8.2%	Coefficient of variation	7.9%
Percentiles		
320	1 st	312
333	2 nd	319
339	3 rd	323
344	5 th	327
354	10 th	336
358	15 th	342
365	20 th	346
369	25 th	351
373	30 th	354
378	35 th	357
380	40 th	361
385	45 th	365
391	50 th	368
396	55 th	371
399	60 th	375
403	65 th	378
409	70 th	382
414	75 th	387
420	80 th	393
425	85 th	400
435	90 th	409
446	95 th	422
457	97 th	433
466	98 th	443
479	99 th	458

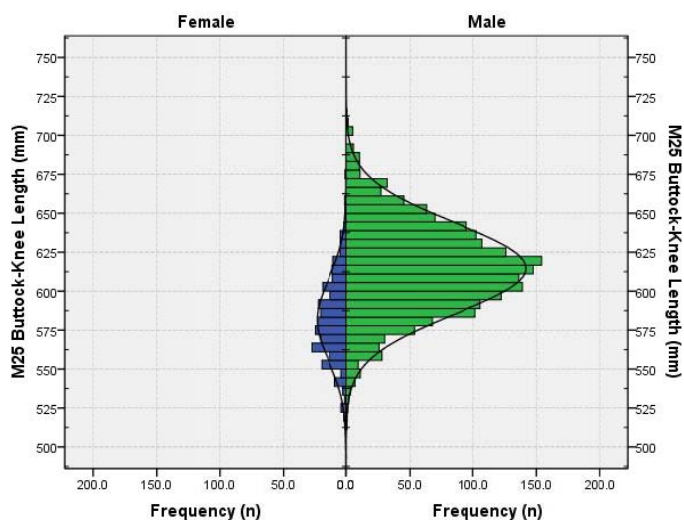
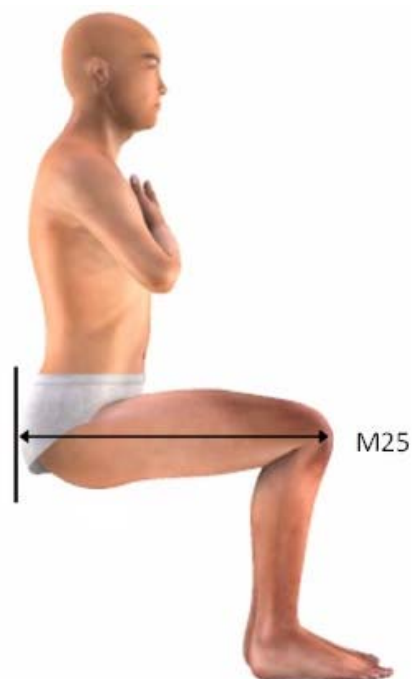


4.4.25 Buttock-Knee Length (M25)

Posture: Anthropometric Sitting.

Definition: The horizontal distance between Buttock Point, Posterior and the Knee Point, Anterior.

FEMALES		MALES
277	n	1861
582	Mean	615
1.6	SE (mean)	0.7
26.1	SD	29.1
512	Minimum	512
675	Maximum	713
0.242	Skewness	0.065
0.126	Kurtosis	0.128
4.5%	Coefficient of variation	4.7%
Percentiles		
521	1 st	546
527	2 nd	556
535	3 rd	559
540	5 th	567
550	10 th	579
555	15 th	586
561	20 th	590
564	25 th	595
567	30 th	599
570	35 th	603
575	40 th	607
577	45 th	611
579	50 th	614
584	55 th	618
586	60 th	621
591	65 th	625
593	70 th	629
599	75 th	634
604	80 th	639
610	85 th	645
617	90 th	652
627	95 th	664
634	97 th	670
637	98 th	677
650	99 th	685

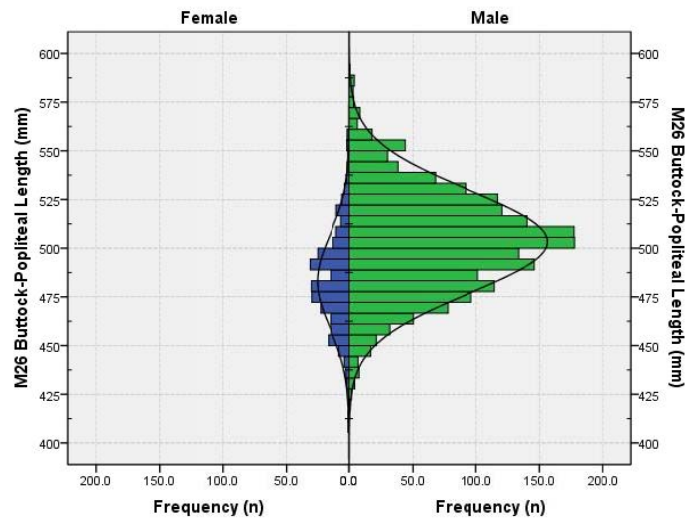
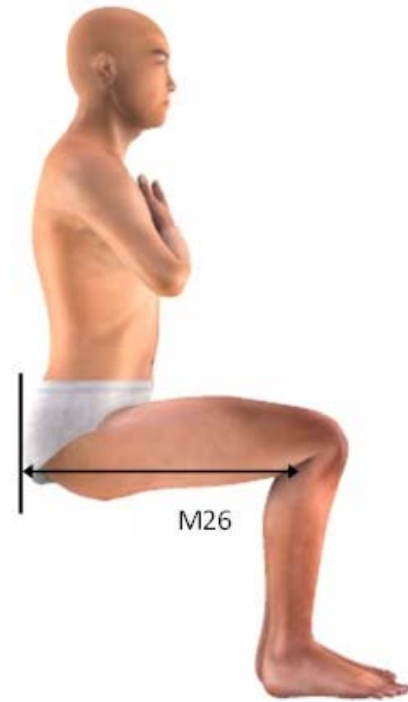


4.4.26 Buttock-Popliteal Length (M26)

Posture: Anthropometric Sitting.

Definition: The horizontal distance between Buttock Point, Posterior and the Dorsal Juncture of Calf and Thigh.

FEMALES		MALES
277	n	1860
483	Mean	503
1.4	SE (mean)	0.6
24.0	SD	26.4
407	Minimum	420
559	Maximum	589
0.283	Skewness	0.061
0.431	Kurtosis	0.084
5.0%	Coefficient of variation	5.2%
Percentiles		
429	1 st	441
435	2 nd	449
442	3 rd	455
447	5 th	462
452	10 th	470
458	15 th	476
464	20 th	481
467	25 th	485
470	30 th	490
474	35 th	493
477	40 th	497
479	45 th	500
481	50 th	504
485	55 th	507
489	60 th	510
490	65 th	513
494	70 th	517
497	75 th	521
500	80 th	525
507	85 th	530
516	90 th	536
526	95 th	549
533	97 th	554
541	98 th	557
551	99 th	569



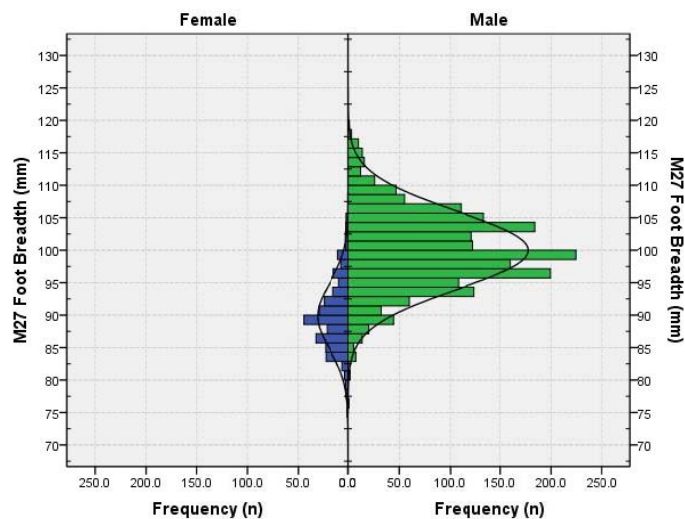
4.4.27 Foot Breadth, Horizontal (M27)

Posture: Anthropometric Standing.

Definition: The maximum horizontal distance between the First Metatarsophalangeal Protrusion and the Fifth Metatarsophalangeal Protrusion.



FEMALES		MALES
277	n	1861
90	Mean	100
0.3	SE (mean)	0.1
5.1	SD	6.0
75	Minimum	76
104	Maximum	120
0.431	Skewness	0.067
0.204	Kurtosis	0.294
5.7%	Coefficient of variation	6.0%
Percentiles		
78	1 st	86
81	2 nd	88
81	3 rd	89
83	5 th	90
84	10 th	93
85	15 th	94
85	20 th	95
86	25 th	96
87	30 th	97
88	35 th	98
89	40 th	98
89	45 th	99
90	50 th	100
90	55 th	101
91	60 th	101
91	65 th	102
92	70 th	103
92	75 th	104
94	80 th	105
96	85 th	106
97	90 th	107
100	95 th	110
101	97 th	112
102	98 th	113
104	99 th	115

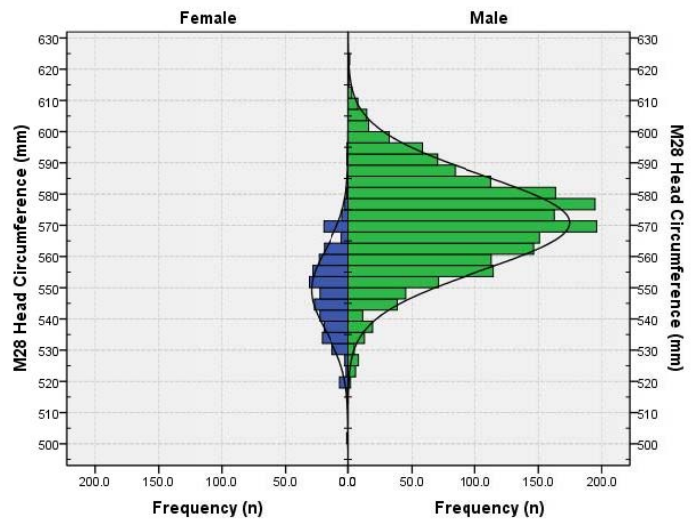
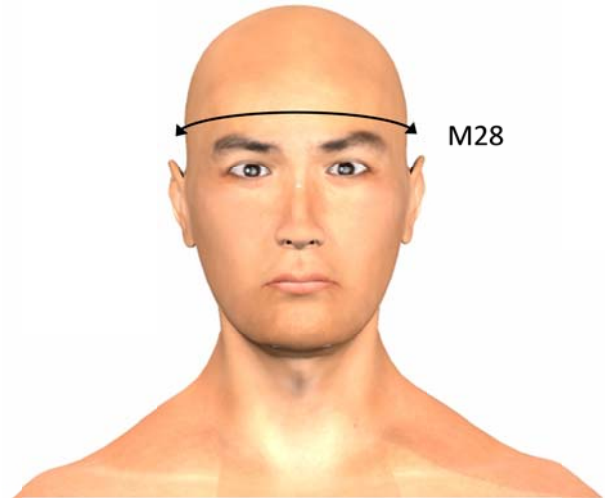


4.4.28 Head Circumference (M28)

Posture: Anthropometric Sitting with the head in the Frankfort place.

Definition: The maximum horizontal circumference of the head above the supraorbital ridges and ears, at the level of Glabella.

FEMALES		MALES
277	n	1860
549	Mean	571
0.8	SE (mean)	0.4
13.4	SD	15.2
503	Minimum	519
595	Maximum	624
-0.046	Skewness	-0.173
0.214	Kurtosis	0.307
2.4%	Coefficient of variation	2.7%
Percentiles		
519	1 st	531
520	2 nd	537
521	3 rd	540
530	5 th	545
533	10 th	552
535	15 th	556
537	20 th	559
540	25 th	561
542	30 th	563
544	35 th	566
545	40 th	568
548	45 th	569
550	50 th	571
551	55 th	573
553	60 th	575
555	65 th	577
557	70 th	579
558	75 th	581
561	80 th	583
563	85 th	586
568	90 th	590
570	95 th	595
573	97 th	598
574	98 th	601
578	99 th	606

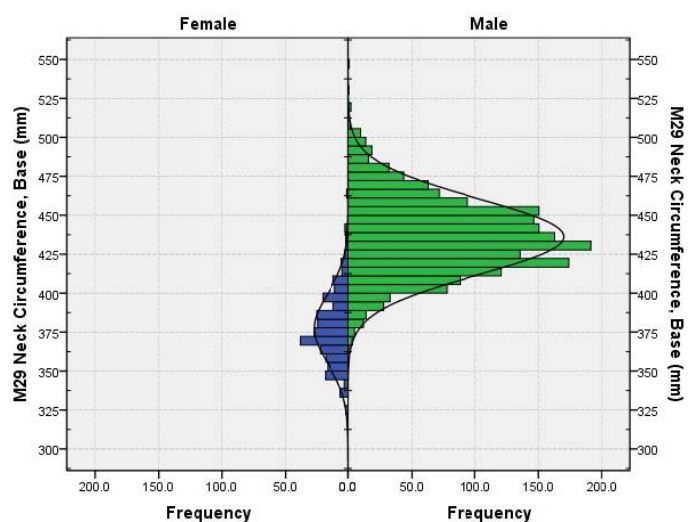
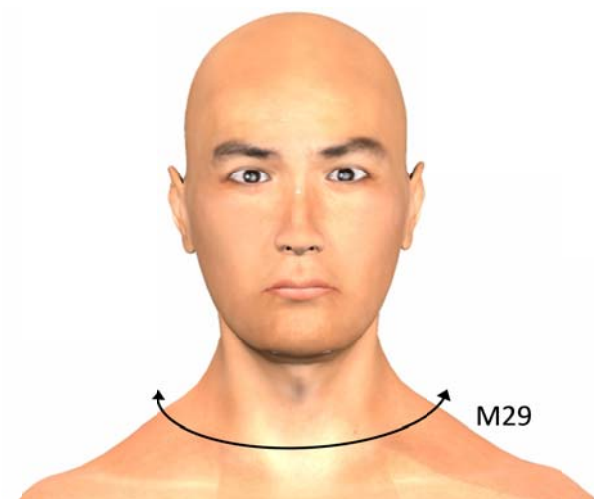


4.4.29 Neck Circumference, Base (M29)

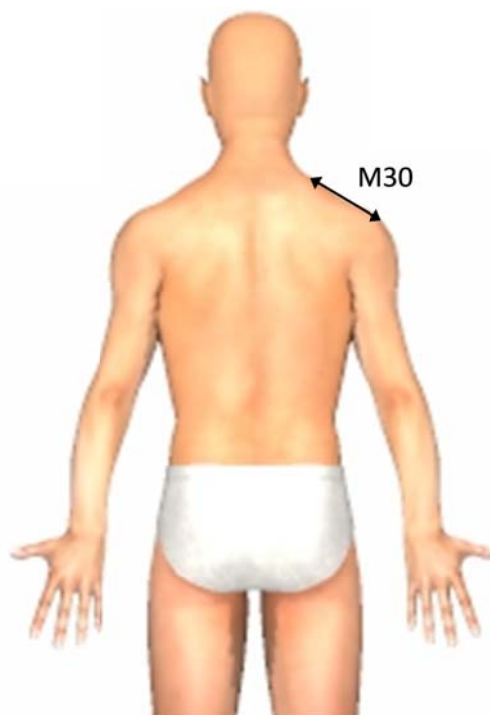
Posture: Anthropometric Standing with the head in the Frankfort plane.

Definition: The circumference at the base of the neck.

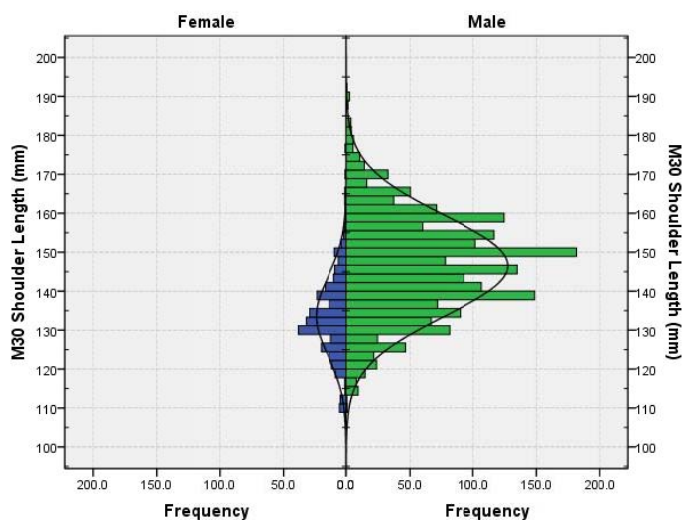
FEMALES		MALES
277	n	1861
377	Mean	436
1.3	SE (mean)	0.6
22.3	SD	24.3
323	Minimum	362
462	Maximum	546
0.600	Skewness	0.285
0.651	Kurtosis	0.322
5.9%	Coefficient of variation	5.6%
Percentiles		
334	1 st	382
338	2 nd	389
340	3 rd	393
346	5 th	399
350	10 th	407
355	15 th	412
359	20 th	416
362	25 th	420
366	30 th	423
368	35 th	426
370	40 th	430
372	45 th	432
375	50 th	434
377	55 th	438
381	60 th	442
384	65 th	445
386	70 th	448
391	75 th	451
396	80 th	455
400	85 th	461
408	90 th	468
420	95 th	478
425	97 th	485
435	98 th	492
441	99 th	497



4.4.30 Shoulder Length (M30)

Posture: Anthropometric Standing**Definition:** The surface distance between the Trapezium Point (Right) and the Acromion (Right).

FEMALES		MALES
277	n	1860
134	Mean	147
0.6	SE (mean)	0.3
10.2	SD	12.9
108	Minimum	110
176	Maximum	192
0.395	Skewness	.078
1.253	Kurtosis	-.061
7.6%	Coefficient of variation	8.8%
Percentiles		
110	1 st	117
110	2 nd	121
113	3 rd	122
118	5 th	125
122	10 th	130
124	15 th	133
126	20 th	135
128	25 th	138
129	30 th	140
130	35 th	142
131	40 th	143
132	45 th	145
133	50 th	146
134	55 th	149
135	60 th	150
136	65 th	152
138	70 th	153
140	75 th	155
141	80 th	158
143	85 th	160
146	90 th	162
151	95 th	167
154	97 th	170
157	98 th	173
165	99 th	178

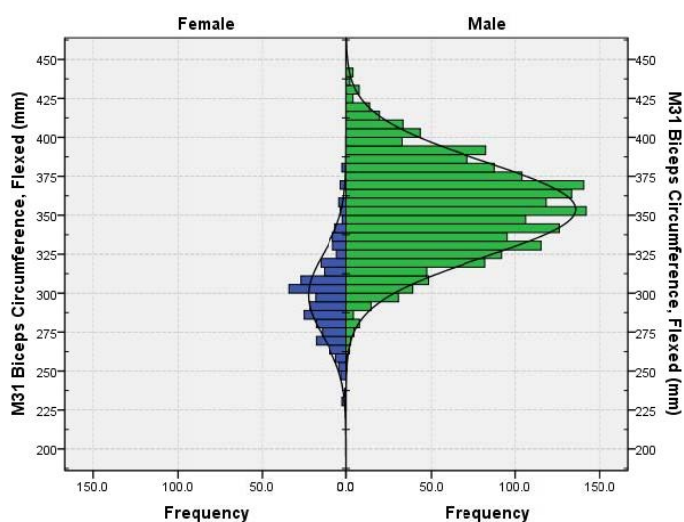
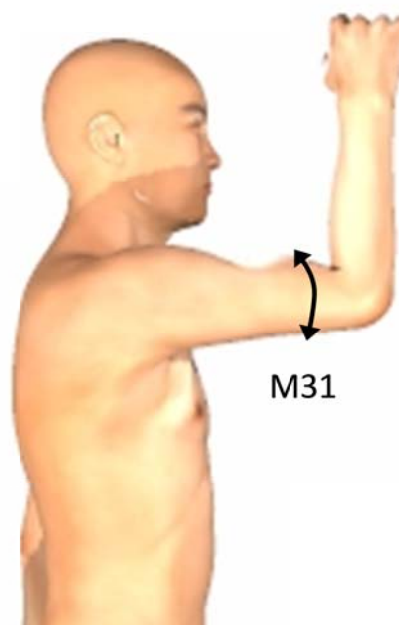


4.4.31 Biceps Circumference, Flexed (M31)

Posture: Anthropometric Standing with the right shoulder and elbow flexed at 90°.

Definition: The circumference of the upper arm at the height of the Biceps Point.

FEMALES		MALES
277	n	1861
299	Mean	354
1.6	SE (mean)	0.7
26.9	SD	30.4
230	Minimum	253
382	Maximum	442
0.449	Skewness	-0.023
0.465	Kurtosis	-0.190
9.0%	Coefficient of variation	8.6%
Percentiles		
234	1 st	282
249	2 nd	294
254	3 rd	297
257	5 th	303
267	10 th	315
271	15 th	322
276	20 th	327
280	25 th	332
285	30 th	337
286	35 th	342
290	40 th	346
294	45 th	350
299	50 th	355
302	55 th	359
304	60 th	363
306	65 th	366
309	70 th	370
312	75 th	374
319	80 th	380
323	85 th	386
335	90 th	392
349	95 th	405
356	97 th	410
369	98 th	414
377	99 th	423

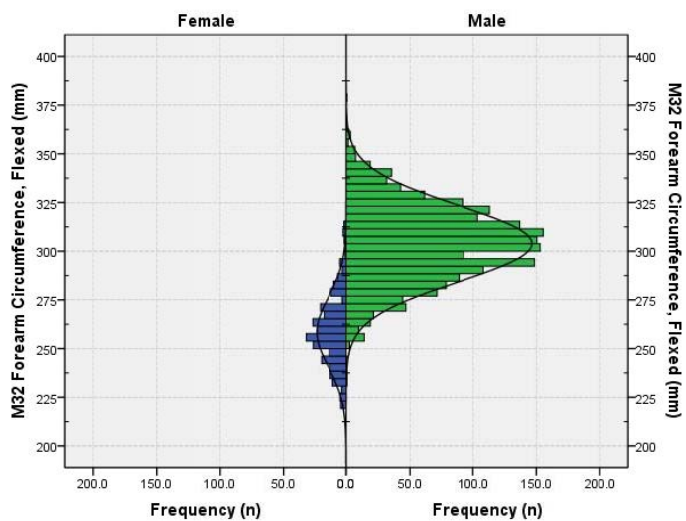


4.4.32 Forearm Circumference, Flexed (M32)

Posture: Anthropometric Standing with the right shoulder and elbow flexed at 90°.

Definition: The circumference of the forearm at the Elbow Crease.

FEMALES		MALES
277	n	1861
259	Mean	304
1.1	SE (mean)	0.5
18.0	SD	19.5
219	Minimum	231
315	Maximum	377
0.445	Skewness	-0.059
0.448	Kurtosis	-0.112
6.9%	Coefficient of variation	6.4%
Percentiles		
220	1 st	257
224	2 nd	264
225	3 rd	268
232	5 th	272
235	10 th	278
240	15 th	283
244	20 th	287
246	25 th	291
250	30 th	294
252	35 th	296
254	40 th	300
256	45 th	302
257	50 th	305
260	55 th	307
262	60 th	310
264	65 th	312
266	70 th	315
269	75 th	317
272	80 th	321
277	85 th	324
282	90 th	329
291	95 th	336
296	97 th	341
306	98 th	343
311	99 th	348

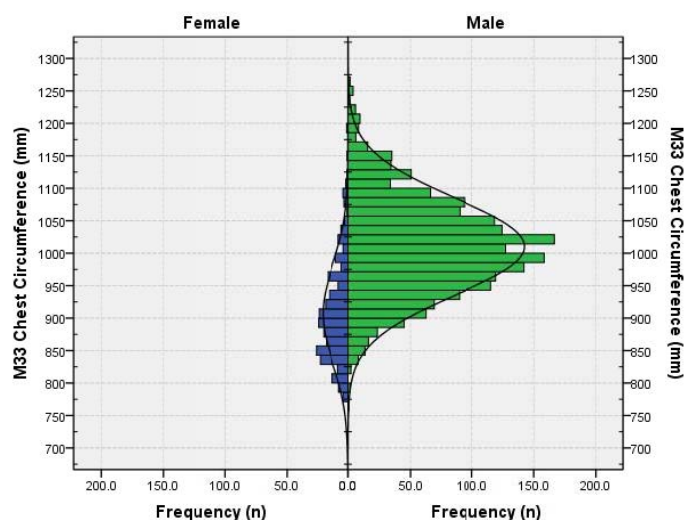


4.4.33 Chest Circumference (M33)

Posture: Anthropometric Standing.

Definition: The circumference of the chest at the height of the Bustpoint, Right (females) or Thelion, Right (males).

FEMALES		MALES
277	n	1860
907	Mean	1010
4.5	SE (mean)	1.7
75.1	SD	74.3
775	Minimum	761
1189	Maximum	1270
0.829	Skewness	0.274
0.680	Kurtosis	0.167
8.3%	Coefficient of variation	7.4%
Percentiles		
783	1 st	850
789	2 nd	869
791	3 rd	878
803	5 th	893
819	10 th	918
834	15 th	933
842	20 th	947
847	25 th	961
859	30 th	970
870	35 th	979
878	40 th	989
890	45 th	998
899	50 th	1009
907	55 th	1017
913	60 th	1025
926	65 th	1035
932	70 th	1045
945	75 th	1056
966	80 th	1070
990	85 th	1085
1016	90 th	1110
1048	95 th	1141
1088	97 th	1156
1098	98 th	1173
1121	99 th	1206

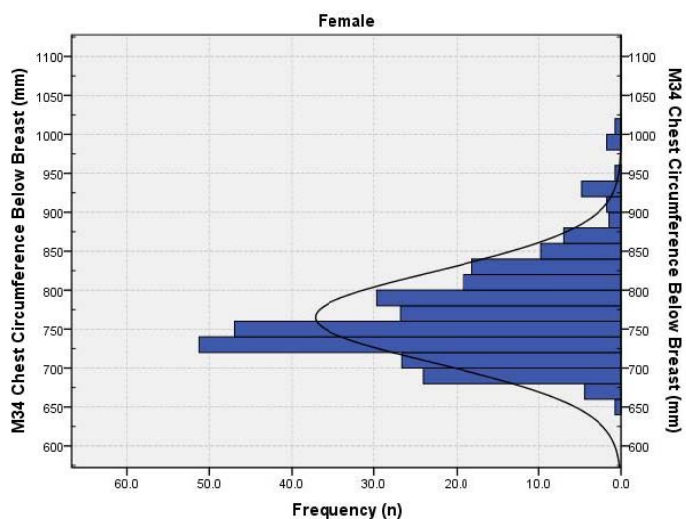
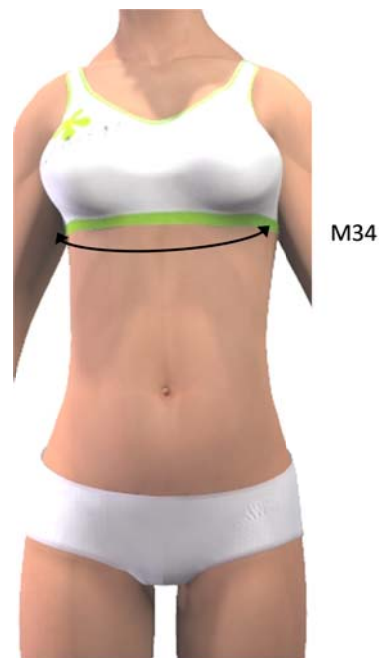


4.4.34 Chest Circumference Below Breast (M34)

Posture: Anthropometric Standing.

Definition: The circumference of the chest at the height of the Inferior Breastpoint (females only).

FEMALES		MALES
276	n	
765	Mean	
3.6	SE (mean)	
59.2	SD	
659	Minimum	
1011	Maximum	
1.102	Skewness	
1.722	Kurtosis	
7.7%	Coefficient of variation	
	Percentiles	
673	1 st	
679	2 nd	
682	3 rd	
686	5 th	
697	10 th	
711	15 th	
719	20 th	
723	25 th	
730	30 th	
733	35 th	
742	40 th	
749	45 th	
754	50 th	
758	55 th	
769	60 th	
779	65 th	
785	70 th	
796	75 th	
810	80 th	
827	85 th	
843	90 th	
874	95 th	
916	97 th	
928	98 th	
979	99 th	
		Not measured

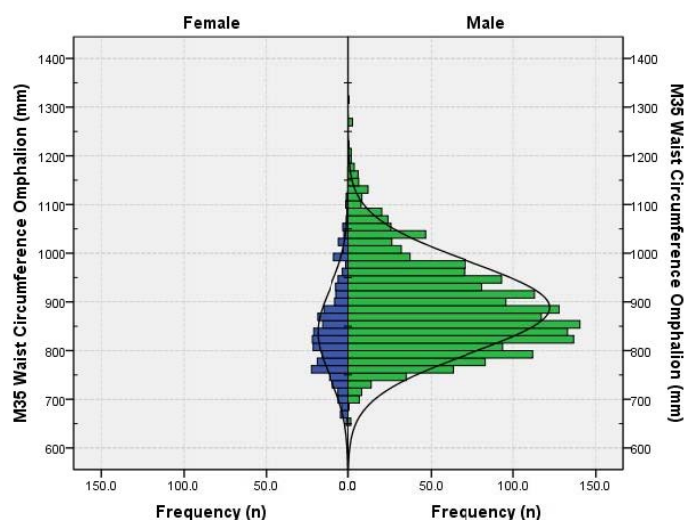
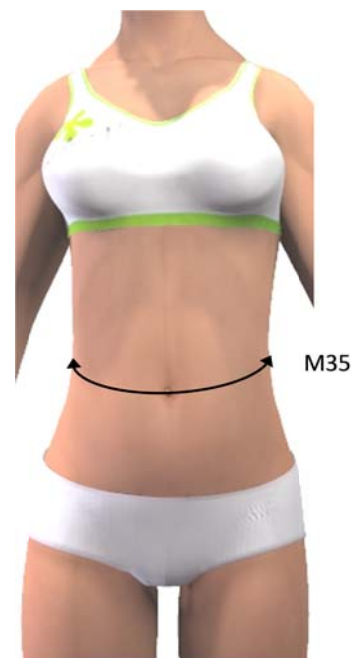


4.4.35 Waist Circumference (Omphalion) (M35)

Posture: Anthropometric Standing.

Definition: The horizontal circumference of the torso at the height of the Waist (Omphalion) Anterior.

FEMALES		MALES
277	n	1861
837	Mean	888
5.4	SE (mean)	2.2
90.4	SD	93.5
652	Minimum	656
1122	Maximum	1320
0.657	Skewness	0.749
0.277	Kurtosis	0.596
10.8%	Coefficient of variation	10.5%
Percentiles		
666	1 st	726
676	2 nd	742
689	3 rd	752
702	5 th	759
735	10 th	782
753	15 th	794
760	20 th	808
775	25 th	820
784	30 th	831
795	35 th	842
808	40 th	852
818	45 th	863
827	50 th	875
835	55 th	887
846	60 th	900
859	65 th	913
870	70 th	927
883	75 th	943
902	80 th	963
935	85 th	981
976	90 th	1022
1022	95 th	1064
1040	97 th	1092
1057	98 th	1122
1092	99 th	1153



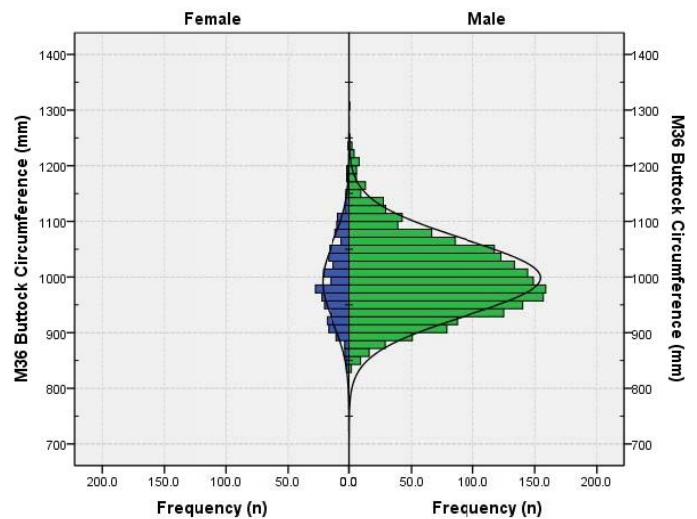
4.4.36 Buttock Circumference (M36)

Posture: Anthropometric Standing.

Definition: The horizontal circumference of the torso at height of the Buttock Point, Posterior.



FEMALES		MALES
277	n	1861
991	Mean	999
4.3	SE (mean)	1.6
71.7	SD	68.6
830	Minimum	785
1239	Maximum	1309
0.435	Skewness	0.491
0.027	Kurtosis	0.361
7.2%	Coefficient of variation	6.9%
Percentiles		
844	1 st	862
859	2 nd	876
872	3 rd	885
888	5 th	898
904	10 th	914
915	15 th	930
927	20 th	940
941	25 th	950
949	30 th	959
958	35 th	968
969	40 th	975
974	45 th	984
983	50 th	992
991	55 th	1003
1002	60 th	1012
1013	65 th	1022
1027	70 th	1031
1041	75 th	1042
1051	80 th	1053
1072	85 th	1067
1093	90 th	1086
1113	95 th	1124
1133	97 th	1140
1158	98 th	1164
1189	99 th	1190



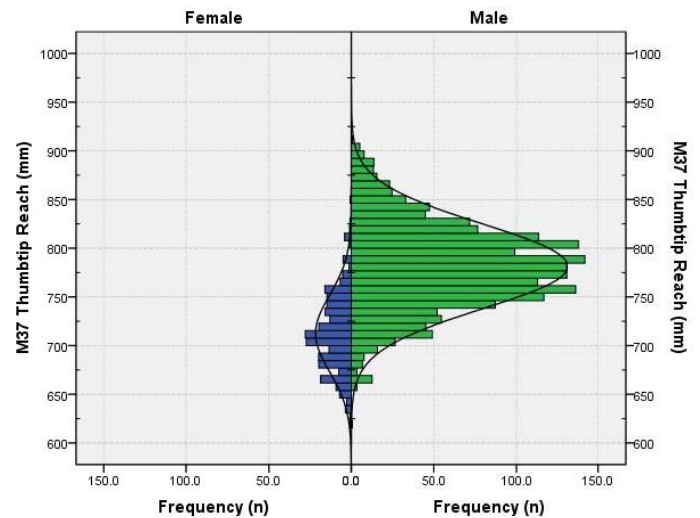
4.4.37 Thumbtip Reach (M37)

Posture: Anthropometric Standing.

Definition: The horizontal distance between the wall and the Thumbtip.



FEMALES		MALES
276	n	1861
713	Mean	781
2.4	SE (mean)	1.0
39.4	SD	43.6
623	Minimum	623
850	Maximum	912
0.365	Skewness	0.079
0.058	Kurtosis	0.083
5.5%	Coefficient of variation	5.6%
Percentiles		
634	1 st	673
639	2 nd	695
645	3 rd	701
651	5 th	710
664	10 th	726
669	15 th	739
678	20 th	747
684	25 th	753
690	30 th	759
697	35 th	764
702	40 th	770
705	45 th	775
710	50 th	780
713	55 th	785
720	60 th	791
727	65 th	798
733	70 th	803
741	75 th	810
747	80 th	816
755	85 th	825
760	90 th	838
779	95 th	855
795	97 th	870
808	98 th	878
820	99 th	890



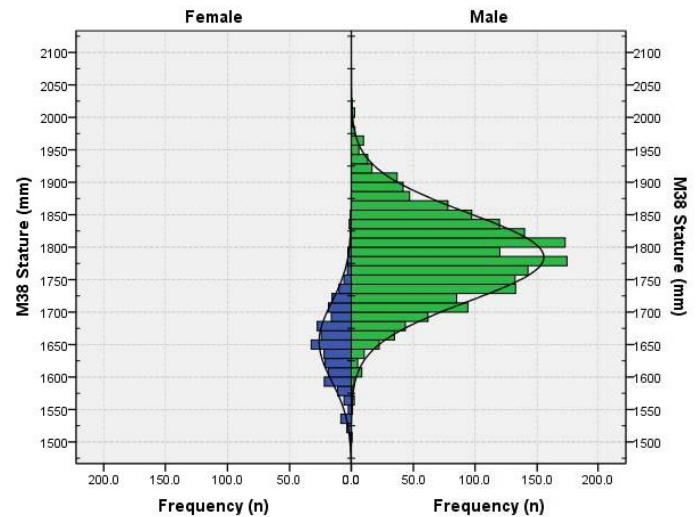
4.4.38 Stature (M38)

Posture: Anthropometric Standing with the head in the Frankfort plane.

Definition: The vertical distance between the standing surface and the Top of the Head landmark.



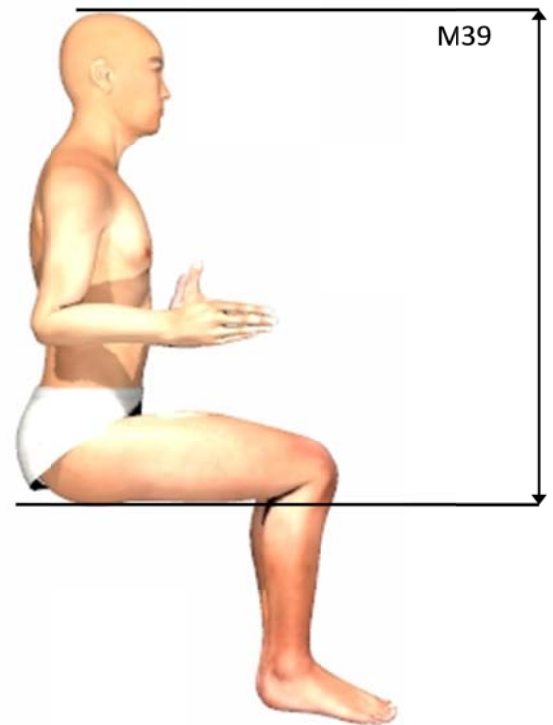
FEMALES		MALES
277	n	1861
1654	Mean	1785
3.7	SE (mean)	1.6
61.1	SD	68.3
1512	Minimum	1511
1852	Maximum	2025
0.188	Skewness	0.010
0.172	Kurtosis	0.171
3.7%	Coefficient of variation	3.8%
Percentiles		
1518	1 st	1623
1531	2 nd	1645
1536	3 rd	1660
1549	5 th	1672
1581	10 th	1698
1592	15 th	1713
1600	20 th	1729
1614	25 th	1738
1620	30 th	1747
1631	35 th	1759
1641	40 th	1767
1649	45 th	1777
1654	50 th	1784
1661	55 th	1794
1666	60 th	1803
1677	65 th	1812
1684	70 th	1820
1693	75 th	1830
1704	80 th	1840
1719	85 th	1853
1732	90 th	1869
1755	95 th	1899
1776	97 th	1913
1798	98 th	1929
1826	99 th	1953



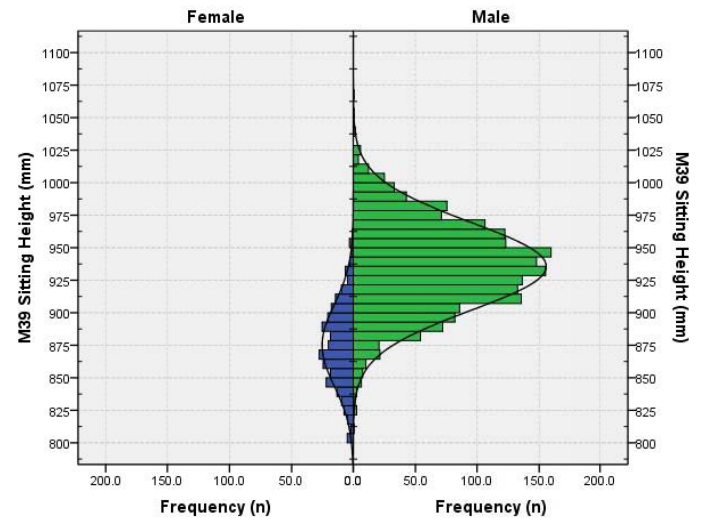
4.4.39 Sitting Height (M39)

Posture: Anthropometric Sitting, with the arms hanging relaxed and the head in the Frankfort plane.

Definition: The vertical distance between the sitting surface and Top of the Head.



FEMALES		MALES
277	n	1861
875	Mean	936
1.9	SE (mean)	0.8
31.5	SD	34.1
801	Minimum	808
962	Maximum	1069
0.118	Skewness	-0.045
-0.248	Kurtosis	0.002
3.6%	Coefficient of variation	3.6%
Percentiles		
804	1 st	854
810	2 nd	866
818	3 rd	874
824	5 th	881
835	10 th	892
843	15 th	899
847	20 th	908
852	25 th	912
858	30 th	918
862	35 th	922
865	40 th	927
869	45 th	931
873	50 th	936
879	55 th	940
884	60 th	944
890	65 th	949
892	70 th	954
896	75 th	960
901	80 th	965
907	85 th	971
915	90 th	980
929	95 th	991
936	97 th	998
945	98 th	1005
954	99 th	1012

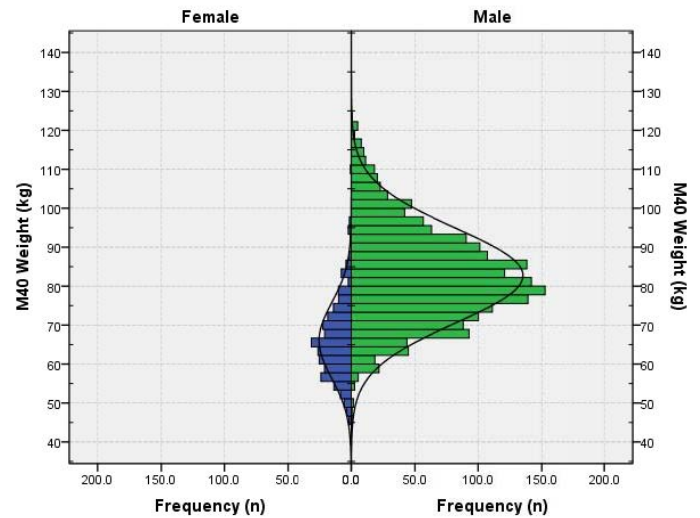


4.4.40 Weight (M40)

Posture: Anthropometric Standing.

Definition: The mass of the subject recorded to the nearest 0.1kg.

FEMALES		MALES
277	n	1861
66.0	Mean	82.7
0.6	SE (mean)	0.3
9.7	SD	12.2
45.4	Minimum	46.7
109.0	Maximum	123.5
0.705	Skewness	0.424
0.972	Kurtosis	0.071
14.7%	Coefficient of variation	14.7%
Percentiles		
47.2	1 st	58.9
49.2	2 nd	60.3
51.0	3 rd	62.5
51.7	5 th	64.2
54.2	10 th	67.7
56.7	15 th	70.0
57.6	20 th	72.3
59.1	25 th	74.1
60.3	30 th	76.0
61.5	35 th	77.6
62.9	40 th	78.7
63.9	45 th	80.2
65.0	50 th	81.7
66.0	55 th	83.3
67.4	60 th	84.9
68.8	65 th	86.5
70.1	70 th	88.3
72.2	75 th	90.2
73.3	80 th	92.5
75.6	85 th	95.1
78.9	90 th	99.4
83.6	95 th	104.9
86.4	97 th	108.9
91.8	98 th	111.4
94.7	99 th	115.1

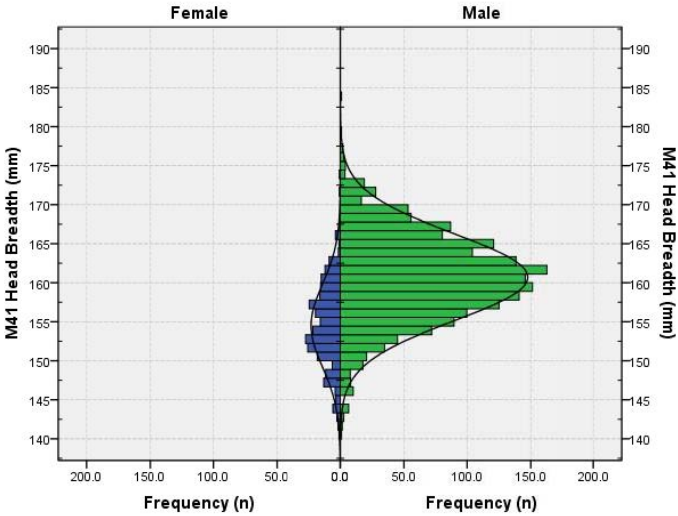
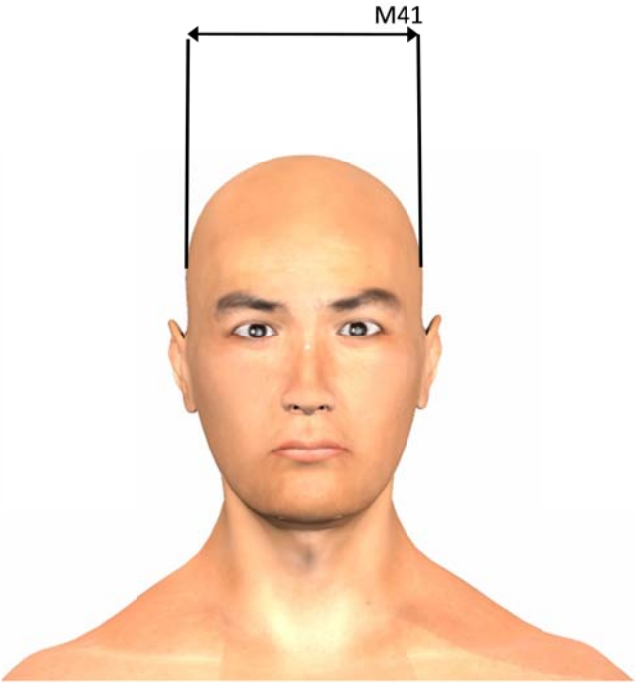


4.4.41 Head Breadth (M41)

Posture: Anthropometric Standing.

Definition: The point-to-point distance between the digitally-extracted Head Breadth Marker Left and Head Breadth Marker Right landmarks.

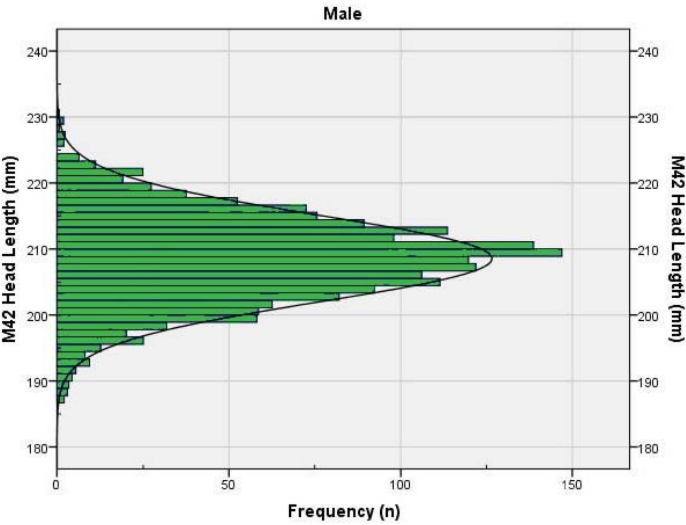
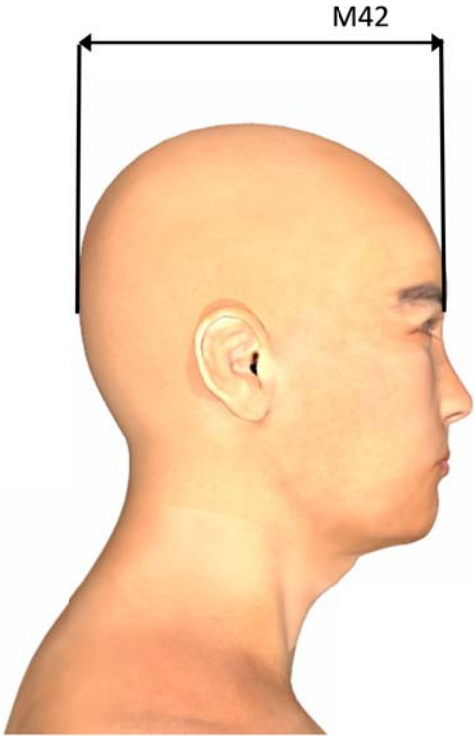
FEMALES		MALES
276	n	1861
155	Mean	161
0.3	SE (mean)	0.1
5.4	SD	5.6
141	Minimum	140
173	Maximum	184
0.022	Skewness	-0.097
0.114	Kurtosis	0.336
3.5%	Coefficient of variation	3.5%
Percentiles		
142	1 st	146
143	2 nd	149
144	3 rd	150
145	5 th	152
147	10 th	154
148	15 th	155
150	20 th	156
151	25 th	157
152	30 th	158
153	35 th	159
153	40 th	159
154	45 th	160
154	50 th	161
155	55 th	161
156	60 th	162
157	65 th	163
158	70 th	164
158	75 th	165
159	80 th	165
160	85 th	167
161	90 th	168
163	95 th	170
164	97 th	171
166	98 th	172
167	99 th	173



4.4.42 Head Length (M42)

Posture: Anthropometric Standing.
Definition: The point-to-point distance between the digitally-extracted Glabella and Opisthocranion.

FEMALES		MALES
Not measured	n	1860
	Mean	209
	SE (mean)	0.2
	SD	6.5
	Minimum	187
	Maximum	231
	Skewness	-0.121
	Kurtosis	0.119
	Coefficient of variation	3.1%
	Percentiles	
	1 st	192
	2 nd	195
	3 rd	196
	5 th	198
	10 th	200
	15 th	202
	20 th	203
	25 th	204
	30 th	205
	35 th	206
	40 th	207
	45 th	208
	50 th	209
	55 th	210
	60 th	210
	65 th	211
	70 th	212
	75 th	213
	80 th	214
	85 th	215
	90 th	217
	95 th	219
	97 th	221
	98 th	222
	99 th	223

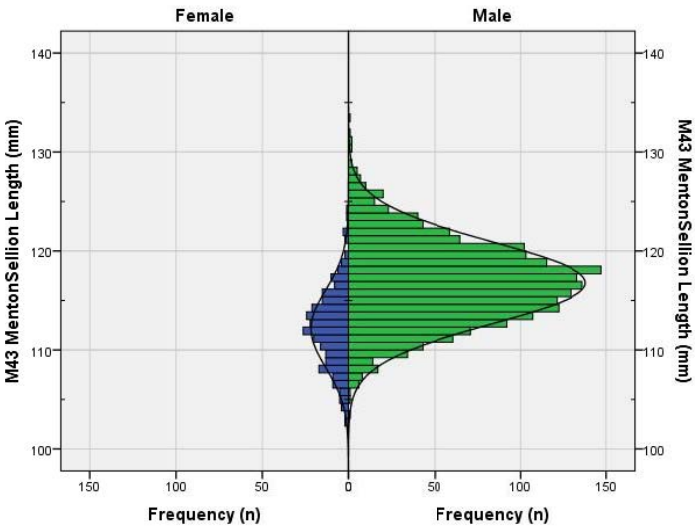
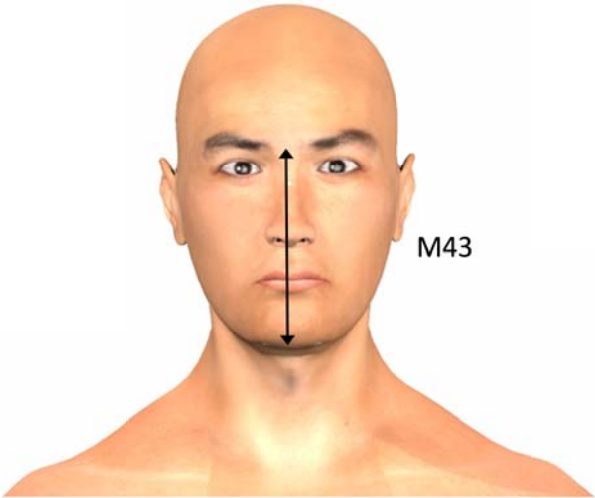


4.4.43 Menton-Sellion Length (M43)

Posture: Anthropometric Standing.

Definition: The point-to-point distance between the digitally-extracted Menton and Sellion landmarks.

FEMALES		MALES
276	n	1858
112	Mean	117
0.2	SE (mean)	0.1
3.9	SD	4.1
103	Minimum	104
124	Maximum	134
0.091	Skewness	0.197
0.102	Kurtosis	0.197
3.4%	Coefficient of variation	3.5%
Percentiles		
103	1 st	108
104	2 nd	108
104	3 rd	109
105	5 th	110
107	10 th	112
108	15 th	113
109	20 th	113
109	25 th	114
110	30 th	115
111	35 th	115
111	40 th	116
112	45 th	116
112	50 th	117
113	55 th	117
113	60 th	118
114	65 th	118
114	70 th	119
115	75 th	120
115	80 th	120
116	85 th	121
117	90 th	122
118	95 th	124
119	97 th	125
121	98 th	126
122	99 th	127

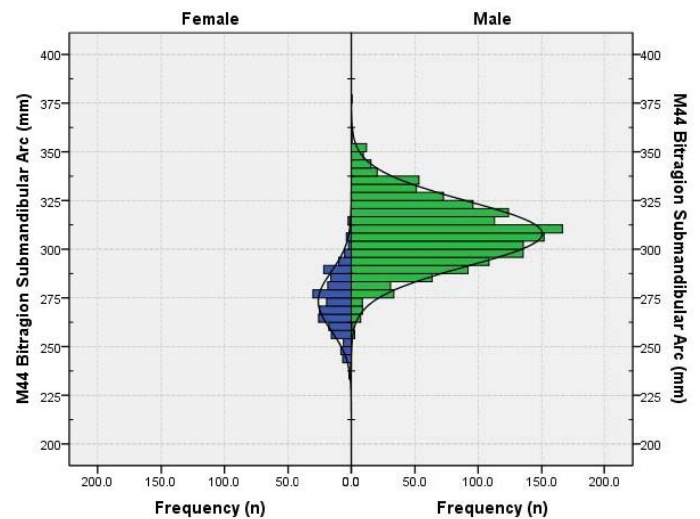
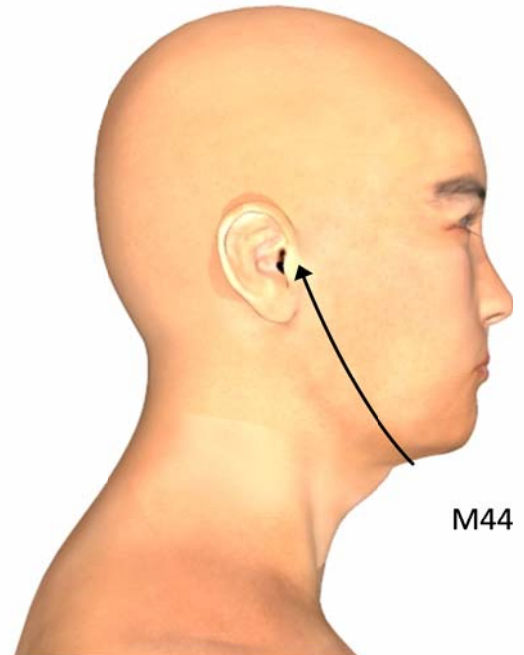


4.4.44 Bitragion Submandibular Arc (M44)

Posture: Anthropometric Standing with head in the Frankfort plane

Definition: The surface distance from the Tragon, Right landmark, through the Submandibular landmark, to the Tragon, Left landmark.

FEMALES		MALES
236	n	1516
273	Mean	308
1.0	SE (mean)	0.4
15.2	SD	16.7
234	Minimum	257
316	Maximum	377
0.112	Skewness	0.090
-0.057	Kurtosis	0.038
5.5%	Coefficient of variation	5.4%
Percentiles		
240	1 st	267
245	2 nd	275
245	3 rd	278
247	5 th	281
254	10 th	287
257	15 th	290
261	20 th	294
263	25 th	296
265	30 th	299
267	35 th	301
268	40 th	304
271	45 th	306
272	50 th	308
276	55 th	310
277	60 th	312
279	65 th	314
281	70 th	317
284	75 th	319
287	80 th	322
290	85 th	325
292	90 th	330
298	95 th	336
305	97 th	339
307	98 th	344
314	99 th	349

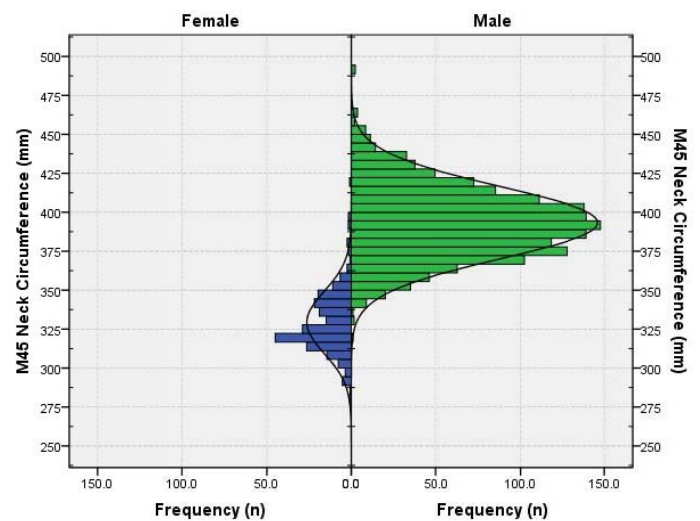
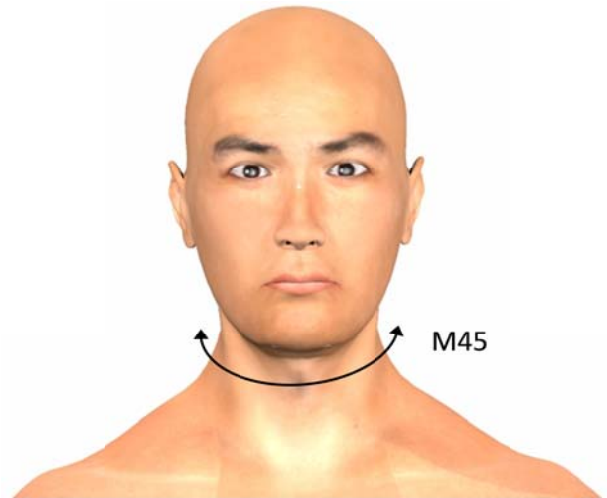


4.4.45 Neck Circumference, Mid (M45)

Posture: Anthropometric Standing with the head in the Frankfort plane.

Definition: The circumference of the neck at the height of the Infrathyroid landmark. The plane of the measurement is perpendicular to the long axis of the neck.

FEMALES		MALES
236	n	1519
329	Mean	393
1.3	SE (mean)	0.6
20.0	SD	23.0
282	Minimum	317
419	Maximum	493
0.900	Skewness	0.290
2.097	Kurtosis	0.253
6.1%	Coefficient of variation	5.9%
Percentiles		
289	1 st	347
291	2 nd	349
295	3 rd	352
301	5 th	356
307	10 th	365
312	15 th	370
314	20 th	373
317	25 th	377
319	30 th	380
320	35 th	384
321	40 th	387
324	45 th	390
326	50 th	393
328	55 th	396
331	60 th	398
336	65 th	401
339	70 th	405
342	75 th	408
345	80 th	412
347	85 th	417
353	90 th	424
362	95 th	433
377	97 th	438
388	98 th	444
395	99 th	453

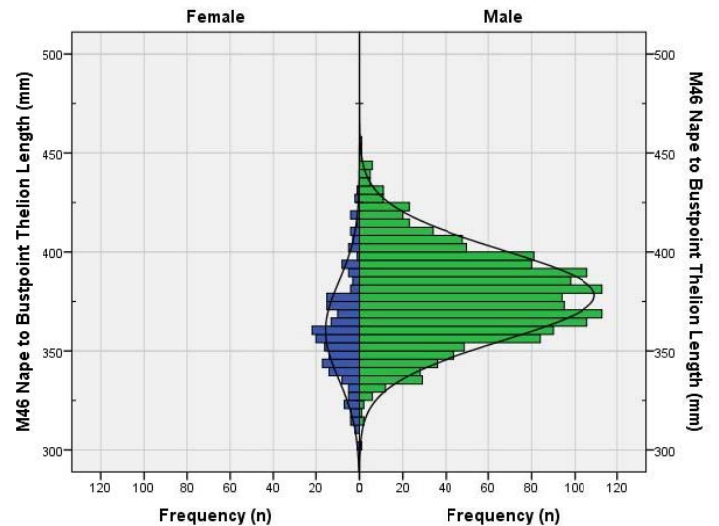


4.4.46 Nape to Bustpoint Thelion Length (M46)

Posture: Anthropometric Standing.

Definition: The surface distance from the Cervicale landmark, across the Trapezius Point, Right landmark, to the Thelion (males) or Bustpoint (females) landmarks.

FEMALES		MALES
236	n	1519
360	Mean	378
1.6	SE (mean)	0.6
24.4	SD	22.9
303	Minimum	304
432	Maximum	456
0.396	Skewness	0.200
0.286	Kurtosis	-0.026
6.8%	Coefficient of variation	6.1%
Percentiles		
309	1 st	330
314	2 nd	335
315	3 rd	337
321	5 th	341
330	10 th	348
338	15 th	355
341	20 th	359
344	25 th	362
348	30 th	365
351	35 th	368
354	40 th	371
356	45 th	374
358	50 th	378
360	55 th	381
364	60 th	384
367	65 th	387
372	70 th	390
375	75 th	393
377	80 th	397
384	85 th	401
394	90 th	408
407	95 th	418
417	97 th	424
420	98 th	429
427	99 th	438

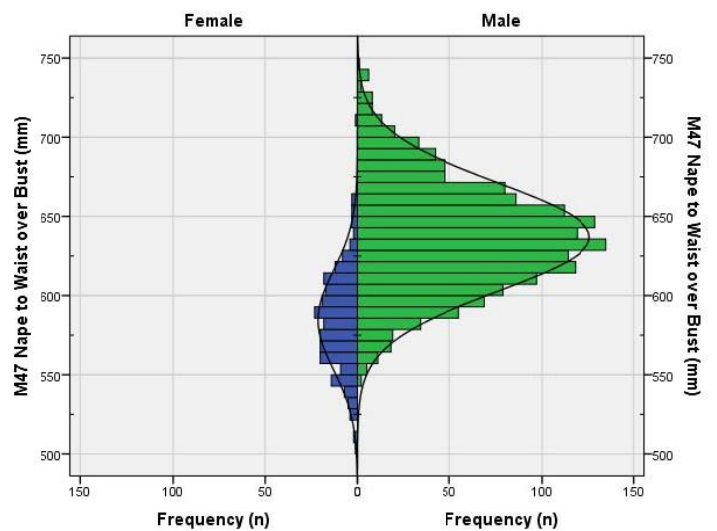
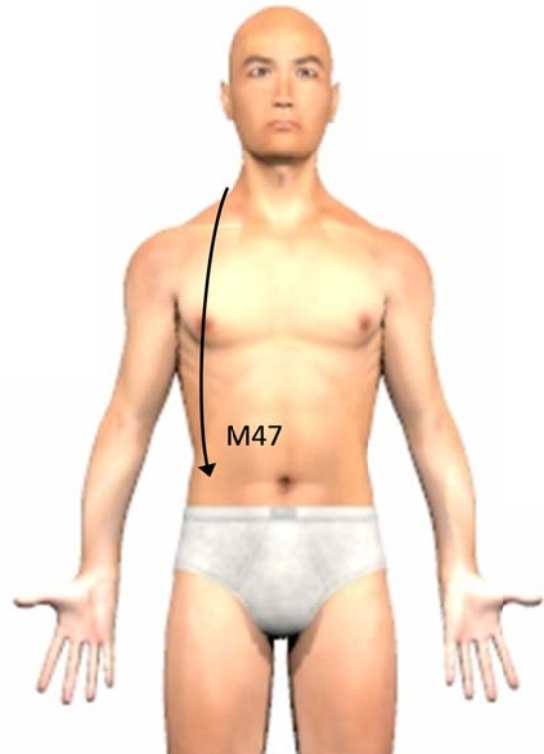


4.4.47 Nape to Waist Over Bust (M47)

Posture: Anthropometric Standing.

Definition: The surface distance from the Cervicale landmark, across the Trapezius Point, Right landmark, across the Thelion (males) or Bustpoint (females) landmarks, to the Waist Preferred Posterior, Projected landmark.

FEMALES		MALES
236	n	1519
584	Mean	637
2.1	SE (mean)	0.9
31.9	SD	33.8
500	Minimum	546
710	Maximum	747
0.246	Skewness	0.254
0.375	Kurtosis	-0.025
5.5%	Coefficient of variation	5.3%
Percentiles		
511	1 st	563
521	2 nd	570
527	3 rd	575
532	5 th	585
545	10 th	594
549	15 th	601
558	20 th	608
562	25 th	613
567	30 th	619
569	35 th	623
576	40 th	627
578	45 th	630
582	50 th	635
588	55 th	640
592	60 th	644
596	65 th	647
601	70 th	652
605	75 th	658
609	80 th	664
615	85 th	671
622	90 th	681
637	95 th	696
650	97 th	707
656	98 th	714
663	99 th	722



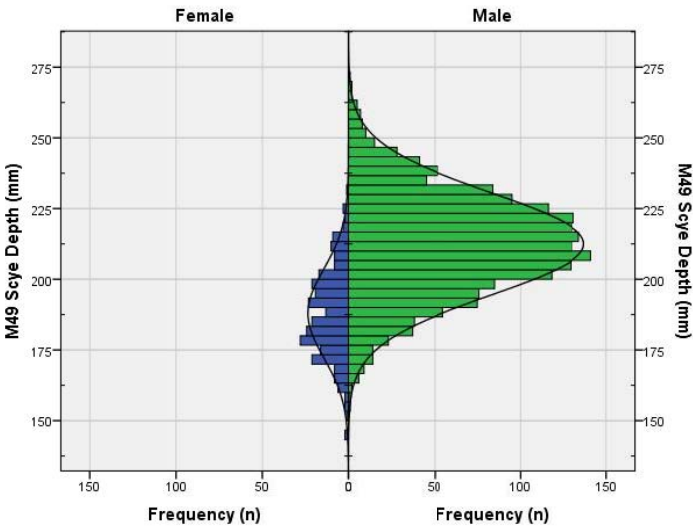
4.4.48 Scye Depth (M49)

Posture: Anthropometric Standing.

Definition: The contour distance between the digitally-extracted Cervicale and Scye Level at Midspine landmarks.



FEMALES		MALES
276	n	1860
188	Mean	213
0.9	SE (mean)	0.4
15.4	SD	18.2
145	Minimum	153
233	Maximum	271
0.180	Skewness	-0.019
-0.223	Kurtosis	0.013
8.2%	Coefficient of variation	8.6%
Percentiles		
153	1 st	170
158	2 nd	174
162	3 rd	177
164	5 th	182
170	10 th	189
173	15 th	193
175	20 th	198
178	25 th	201
179	30 th	204
181	35 th	206
183	40 th	208
185	45 th	211
187	50 th	213
190	55 th	215
193	60 th	217
194	65 th	220
196	70 th	222
199	75 th	225
201	80 th	228
205	85 th	231
212	90 th	236
215	95 th	243
218	97 th	247
221	98 th	250
225	99 th	257



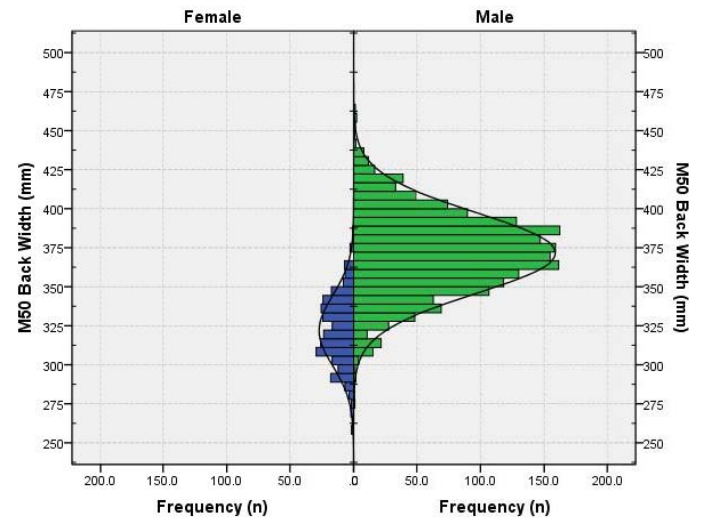
4.4.49 Back Width (M50)

Posture: Anthropometric Standing.

Definition: The point-to-point distance between the digitally-extracted Posterior Horizontal Scye, Left and Posterior Horizontal Scye, Right landmarks.



FEMALES		MALES
276	n	1861
322	Mean	372
1.4	SE (mean)	0.6
22.6	SD	25.9
259	Minimum	276
388	Maximum	463
-0.043	Skewness	-0.043
-0.153	Kurtosis	0.190
7.0%	Coefficient of variation	7.0%
Percentiles		
265	1 st	310
274	2 nd	313
280	3 rd	322
287	5 th	330
292	10 th	338
298	15 th	345
303	20 th	350
306	25 th	354
310	30 th	359
312	35 th	362
315	40 th	366
318	45 th	369
321	50 th	372
324	55 th	375
329	60 th	379
332	65 th	382
336	70 th	385
339	75 th	388
342	80 th	393
345	85 th	398
349	90 th	404
359	95 th	415
363	97 th	421
366	98 th	425
376	99 th	431

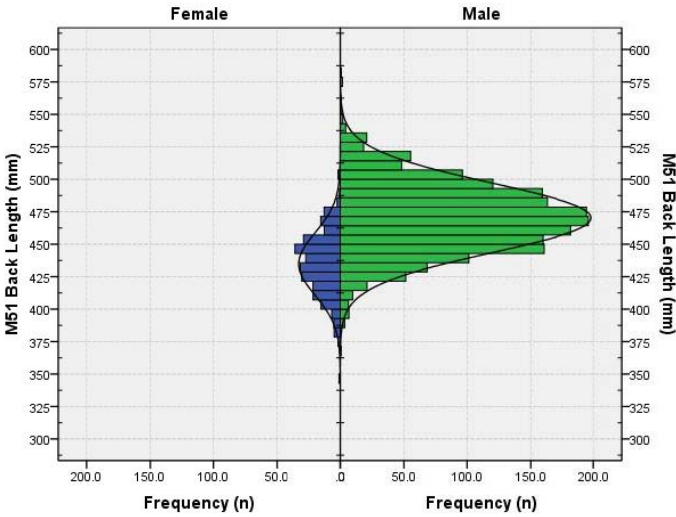


4.4.50 Back Length (M51)

Posture: Anthropometric Standing.

Definition: The contour distance between the digitally-extracted Cervicale and Back Length Marker landmarks.

FEMALES		MALES
276	n	1854
435	Mean	470
1.5	SE (mean)	0.6
24.1	SD	26.7
348	Minimum	371
506	Maximum	580
-0.173	Skewness	0.088
0.222	Kurtosis	0.170
5.5%	Coefficient of variation	5.7%
Percentiles		
377	1 st	409
383	2 nd	416
387	3 rd	423
394	5 th	428
404	10 th	437
410	15 th	443
413	20 th	448
419	25 th	452
423	30 th	455
425	35 th	459
429	40 th	463
432	45 th	467
435	50 th	470
439	55 th	474
443	60 th	477
446	65 th	481
448	70 th	484
452	75 th	489
455	80 th	493
458	85 th	498
467	90 th	504
475	95 th	515
477	97 th	520
478	98 th	525
488	99 th	532

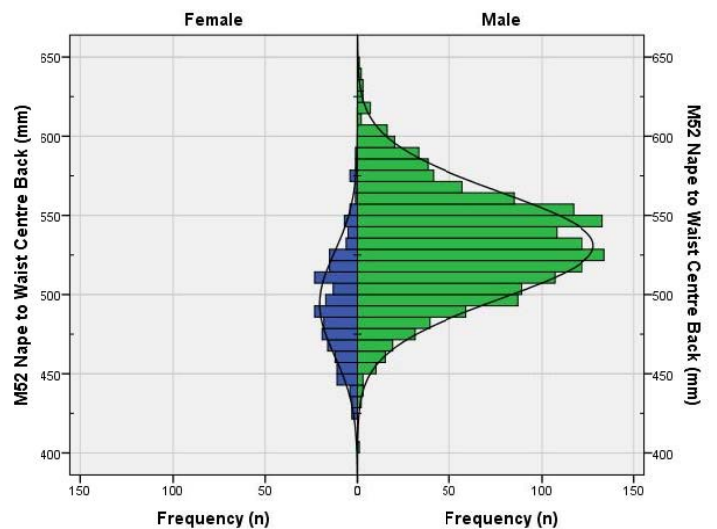
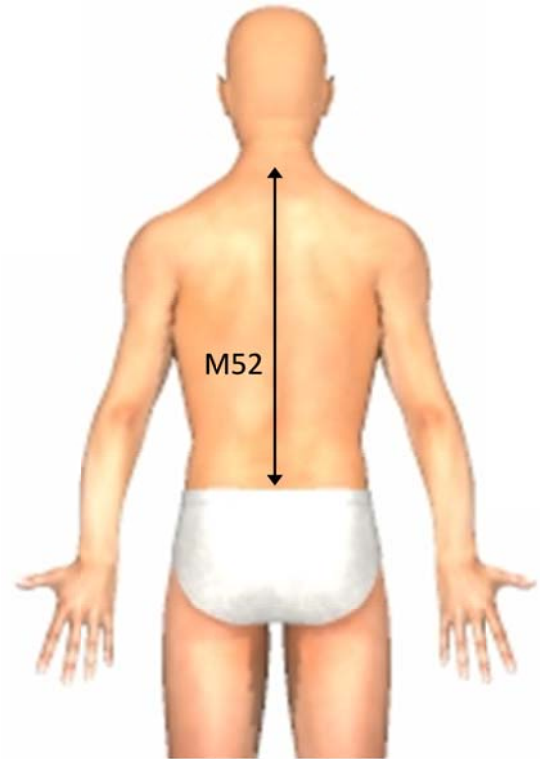


4.4.51 Nape to Waist Centre Back (M52)

Posture: Anthropometric Standing.

Definition: The surface distance from the digitally extracted Cervicale landmark to the Waist Preferred, Posterior landmark

FEMALES		MALES
236	n	1519
493	Mean	531
2.2	SE (mean)	0.9
33.3	SD	33.9
423	Minimum	402
590	Maximum	647
0.317	Skewness	0.068
-0.069	Kurtosis	0.192
6.8%	Coefficient of variation	6.4%
Percentiles		
427	1 st	450
430	2 nd	460
436	3 rd	468
442	5 th	475
449	10 th	489
457	15 th	497
464	20 th	502
470	25 th	509
475	30 th	513
478	35 th	518
484	40 th	522
488	45 th	527
492	50 th	531
498	55 th	535
502	60 th	540
506	65 th	545
509	70 th	549
514	75 th	554
519	80 th	558
525	85 th	565
540	90 th	573
551	95 th	587
571	97 th	595
576	98 th	602
580	99 th	619



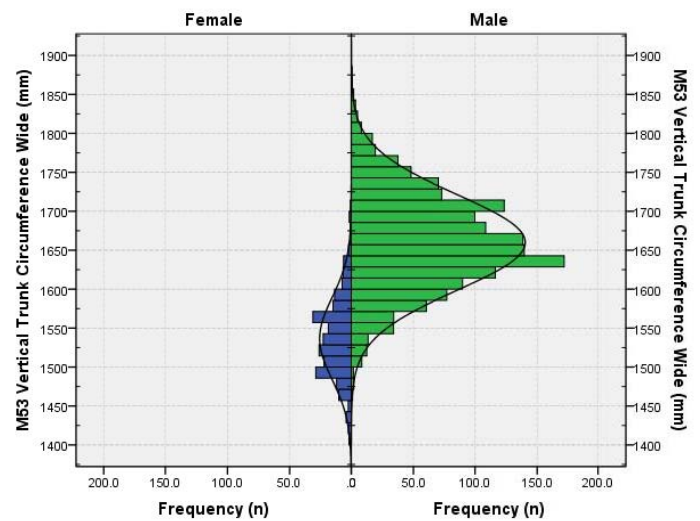
4.4.52 Vertical Trunk Circumference (M53)

Posture: Anthropometric Standing.

Definition: The circumference of the trunk on a line passing through the Crotch landmark and over Bustpoint (females)/Thelion (males), Midshoulder, and Buttock Point, Posterior landmarks.



FEMALES		MALES
235	n	1519
1537	Mean	1660
3.4	SE (mean)	1.6
52.6	SD	61.7
1407	Minimum	1469
1707	Maximum	1881
0.276	Skewness	0.104
0.205	Kurtosis	-0.005
3.4%	Coefficient of variation	3.7%
Percentiles		
1413	1 st	1517
1429	2 nd	1532
1442	3 rd	1547
1458	5 th	1558
1472	10 th	1582
1487	15 th	1597
1493	20 th	1610
1500	25 th	1619
1505	30 th	1629
1513	35 th	1635
1519	40 th	1641
1526	45 th	1649
1535	50 th	1657
1542	55 th	1666
1549	60 th	1673
1558	65 th	1682
1564	70 th	1693
1570	75 th	1703
1579	80 th	1712
1590	85 th	1725
1606	90 th	1741
1632	95 th	1763
1641	97 th	1780
1655	98 th	1789
1690	99 th	1808

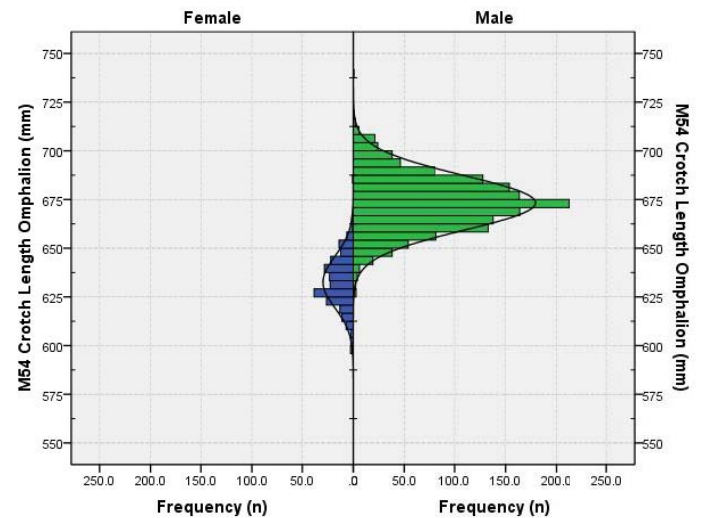


4.4.53 Crotch Length Omphalion (M54)

Posture: Anthropometric Standing.

Definition: The surface distance between the Waist Omphalion, Anterior and the Waist Omphalion, Posterior landmarks, passing through the Crotch landmark.

FEMALES		MALES
236	n	1519
633	Mean	673
0.9	SE (mean)	0.4
13.2	SD	14.1
597	Minimum	626
686	Maximum	741
0.063	Skewness	0.086
0.384	Kurtosis	0.233
2.1%	Coefficient of variation	2.1%
Percentiles		
599	1 st	642
601	2 nd	645
608	3 rd	647
611	5 th	650
616	10 th	655
620	15 th	659
622	20 th	662
624	25 th	664
626	30 th	666
627	35 th	668
629	40 th	670
630	45 th	672
631	50 th	674
634	55 th	675
636	60 th	676
638	65 th	678
640	70 th	680
642	75 th	682
644	80 th	685
647	85 th	687
651	90 th	691
653	95 th	697
656	97 th	701
657	98 th	704
663	99 th	708

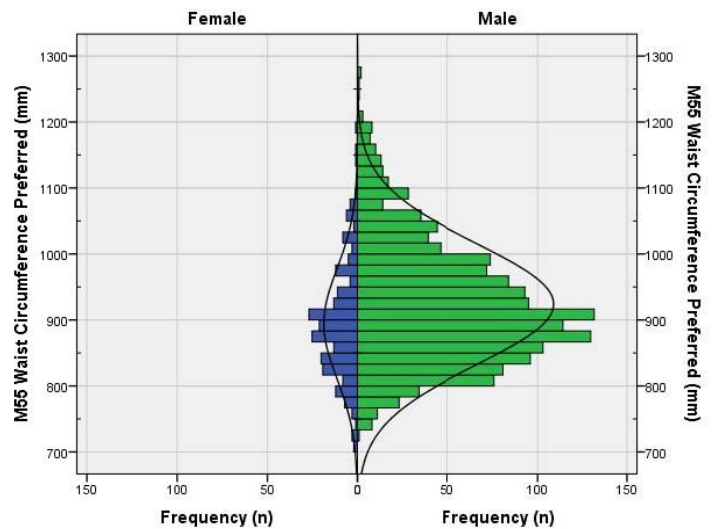
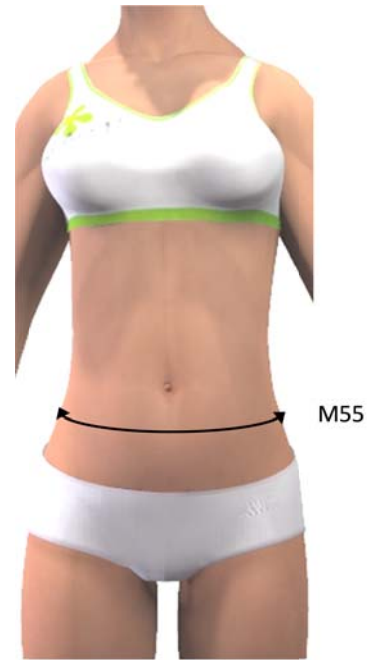


4.4.54 Waist Circumference (Preferred) (M55)

Posture: Anthropometric Standing.

Definition: The horizontal circumference of the torso at the height of the Waist Preferred, Posterior landmark.

FEMALES		MALES
236	n	1519
894	Mean	924
5.5	SE (mean)	2.3
85.0	SD	91.2
711	Minimum	730
1189	Maximum	1282
0.489	Skewness	0.757
0.441	Kurtosis	0.582
9.5%	Coefficient of variation	9.9%
Percentiles		
715	1 st	763
722	2 nd	779
732	3 rd	786
768	5 th	799
794	10 th	818
808	15 th	833
825	20 th	845
836	25 th	858
849	30 th	870
862	35 th	880
874	40 th	890
881	45 th	901
889	50 th	910
898	55 th	920
908	60 th	934
913	65 th	947
920	70 th	963
938	75 th	977
963	80 th	993
980	85 th	1017
1020	90 th	1049
1056	95 th	1098
1066	97 th	1131
1080	98 th	1157
1150	99 th	1186



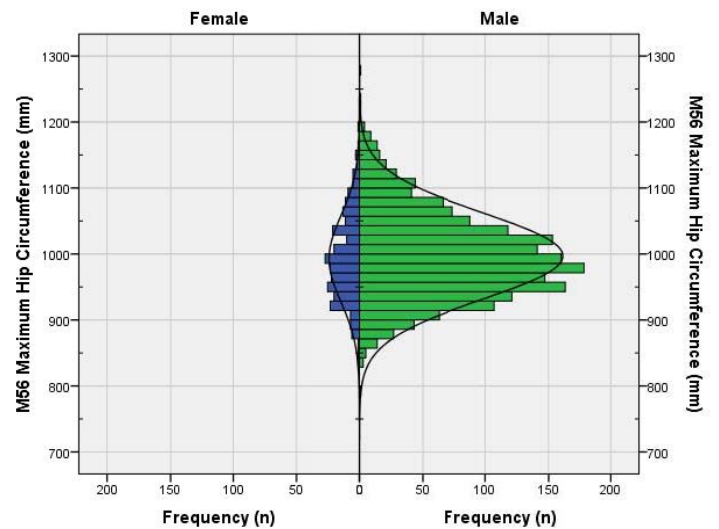
4.4.55 Maximum Hip Circumference (M56)

Posture: Anthropometric Standing.

Definition: The maximum circumference of the body (excluding the appendages) at or about the height of the hip. This measure must be taken below the height of the iliac crest.



FEMALES		MALES
275	n	1856
992	Mean	997
3.9	SE (mean)	1.5
65.4	SD	65.2
838	Minimum	786
1194	Maximum	1281
0.334	Skewness	0.453
-0.298	Kurtosis	0.241
6.6%	Coefficient of variation	6.5%
Percentiles		
867	1 st	865
877	2 nd	880
879	3 rd	888
891	5 th	899
917	10 th	919
923	15 th	931
936	20 th	942
944	25 th	952
953	30 th	960
964	35 th	968
971	40 th	977
978	45 th	984
987	50 th	991
992	55 th	1000
1001	60 th	1010
1011	65 th	1017
1028	70 th	1026
1037	75 th	1035
1051	80 th	1049
1070	85 th	1066
1081	90 th	1085
1109	95 th	1116
1122	97 th	1137
1144	98 th	1149
1153	99 th	1169



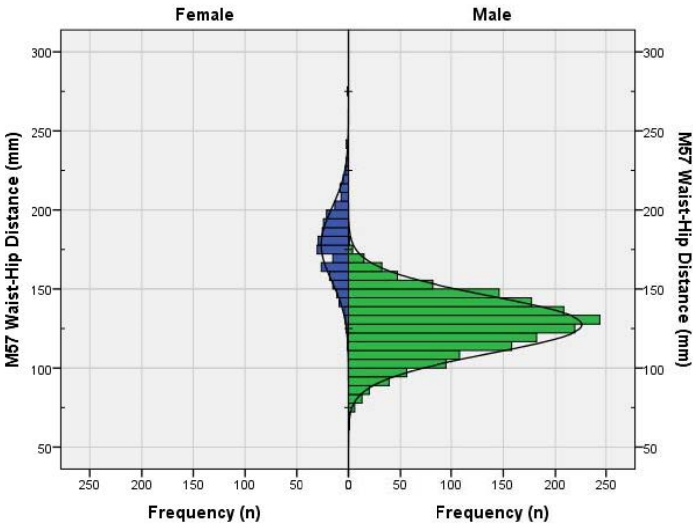
4.4.56 Waist-Hip Distance (M57)

Posture: Anthropometric Standing.

Definition: The contoured distance between the digitally-extracted Waist Preferred, Anterior and Hip Marker landmarks, vertically aligned with the Iliocristale, Right landmark.



FEMALES		MALES
275	n	1855
178	Mean	127
1.4	SE (mean)	0.4
23.9	SD	18.2
114	Minimum	63
275	Maximum	180
0.292	Skewness	-0.242
1.192	Kurtosis	-0.005
13.4%	Coefficient of variation	14.3%
Percentiles		
122	1 st	82
129	2 nd	87
134	3 rd	91
140	5 th	95
148	10 th	104
156	15 th	109
158	20 th	112
163	25 th	115
166	30 th	119
170	35 th	121
173	40 th	123
177	45 th	126
179	50 th	128
181	55 th	131
184	60 th	133
187	65 th	135
191	70 th	138
193	75 th	140
196	80 th	143
200	85 th	146
206	90 th	150
218	95 th	156
224	97 th	161
230	98 th	163
244	99 th	168



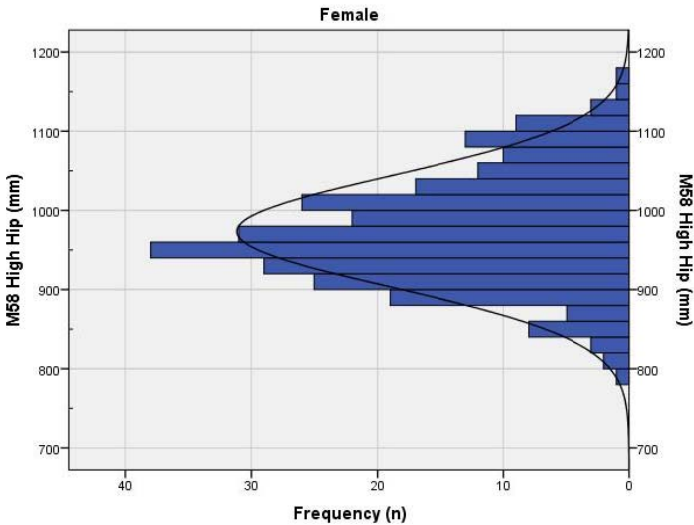
4.4.57 High Hip Circumference (M58)

Posture: Anthropometric Standing.

Definition: The horizontal circumference measured at the height of the digitally-extracted High Hip Marker (females only).

FEMALES		MALES
275	n	
973	Mean	
4.3	SE (mean)	
71.1	SD	
800	Minimum	
1163	Maximum	
.190	Skewness	
-.304	Kurtosis	
7.3%	Coefficient of variation	
	Percentiles	
817	1 st	
826	2 nd	
840	3 rd	
857	5 th	
889	10 th	
900	15 th	
914	20 th	
923	25 th	
936	30 th	
945	35 th	
951	40 th	
957	45 th	
961	50 th	
973	55 th	
983	60 th	
995	65 th	
1010	70 th	
1018	75 th	
1033	80 th	
1055	85 th	
1079	90 th	
1101	95 th	
1111	97 th	
1115	98 th	
1139	99 th	

Not measured

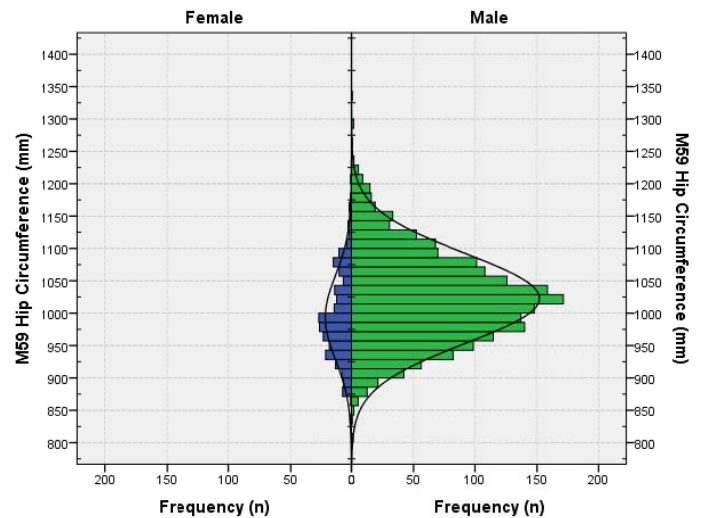


4.4.58 Hip Circumference (M59)

Posture: Anthropometric Standing.

Definition: The horizontal circumference of the torso at the height of the digitally-extracted Hip Marker landmark.

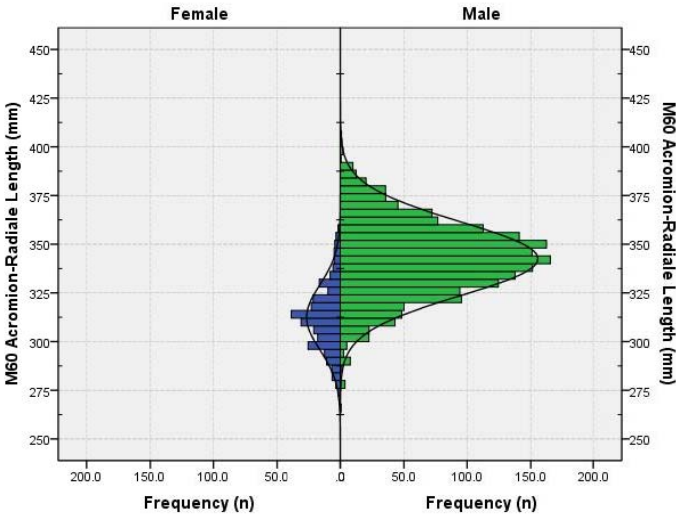
FEMALES		MALES
243	n	1850
993	Mean	1023
4.2	SE (mean)	1.6
65.6	SD	69.4
841	Minimum	809
1200	Maximum	1340
0.424	Skewness	0.384
-0.142	Kurtosis	0.224
6.6%	Coefficient of variation	6.8%
Percentiles		
870	1 st	881
875	2 nd	897
884	3 rd	906
892	5 th	916
916	10 th	938
929	15 th	952
937	20 th	964
945	25 th	974
954	30 th	984
965	35 th	993
972	40 th	1003
980	45 th	1011
985	50 th	1020
994	55 th	1027
998	60 th	1036
1009	65 th	1044
1024	70 th	1055
1036	75 th	1066
1057	80 th	1078
1075	85 th	1094
1085	90 th	1115
1105	95 th	1147
1130	97 th	1168
1145	98 th	1185
1161	99 th	1205



4.4.59 Acromion-Radiale Length (M60)

Posture: Anthropometric Standing.
Definition: The point-to-point distance between the digitally-extracted Acromion, Right and Radiale Digital landmarks.

FEMALES		MALES
276	n	1857
312	Mean	343
1.0	SE (mean)	0.4
16.7	SD	19.0
274	Minimum	267
358	Maximum	405
0.311	Skewness	-0.052
0.041	Kurtosis	0.157
5.3%	Coefficient of variation	5.6%
Percentiles		
278	1 st	299
280	2 nd	303
283	3 rd	306
286	5 th	310
291	10 th	318
296	15 th	323
299	20 th	327
300	25 th	330
303	30 th	333
307	35 th	336
309	40 th	338
310	45 th	340
312	50 th	343
313	55 th	345
315	60 th	348
317	65 th	350
319	70 th	352
322	75 th	355
325	80 th	358
331	85 th	362
334	90 th	367
345	95 th	375
351	97 th	379
352	98 th	383
354	99 th	387

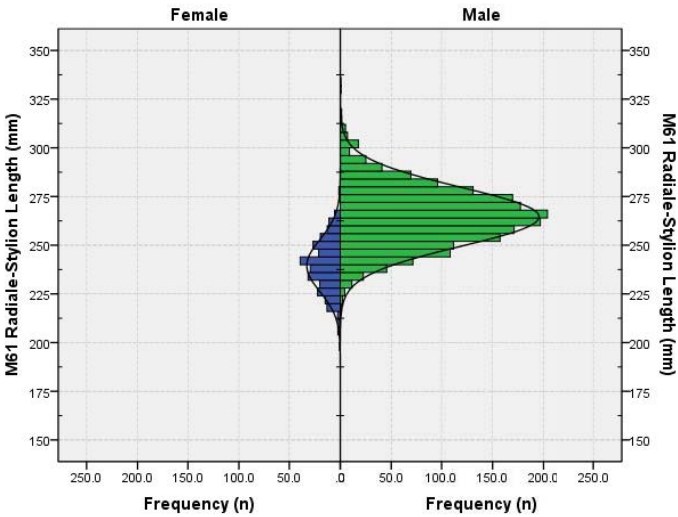


4.4.60 Radiale-Stylian Length (M61)

Posture: Anthropometric Standing.

Definition: The point-to-point distance between the digitally-extracted Radiale and the Stylian landmarks.

FEMALES		MALES
276	n	1861
240	Mean	265
0.8	SE (mean)	0.4
13.4	SD	15.2
196	Minimum	220
277	Maximum	334
-0.059	Skewness	0.219
-0.140	Kurtosis	0.273
5.6%	Coefficient of variation	5.7%
Percentiles		
207	1 st	231
213	2 nd	235
216	3 rd	238
218	5 th	240
221	10 th	245
225	15 th	248
228	20 th	252
231	25 th	254
232	30 th	257
234	35 th	259
236	40 th	261
238	45 th	263
240	50 th	264
242	55 th	266
243	60 th	268
244	65 th	270
247	70 th	272
249	75 th	275
251	80 th	277
255	85 th	280
257	90 th	283
262	95 th	289
264	97 th	294
265	98 th	299
271	99 th	304



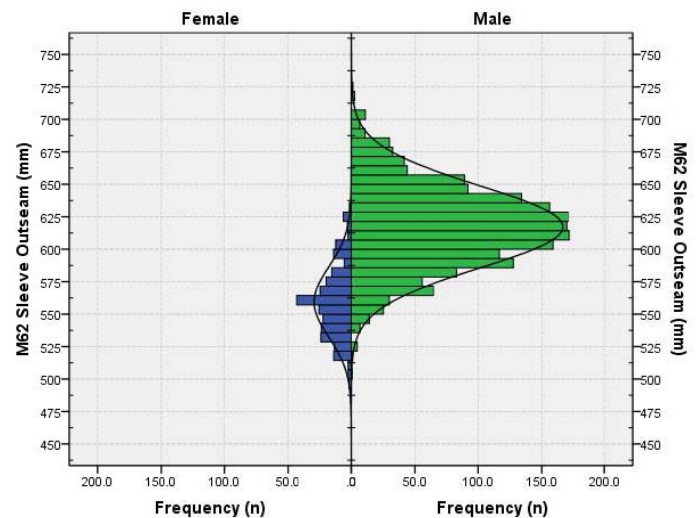
4.4.61 Sleeve Outseam (M62)

Posture: Anthropometric Standing.

Definition: The contour distance between the digitally-extracted Acromion, Right and Centre Wrist Marker landmarks, passing over the Radiale landmark.



FEMALES		MALES
276	n	1855
559	Mean	617
1.6	SE (mean)	0.7
27.0	SD	31.7
487	Minimum	506
634	Maximum	727
0.324	Skewness	0.087
-0.077	Kurtosis	0.113
4.8%	Coefficient of variation	5.1%
Percentiles		
500	1 st	546
511	2 nd	552
515	3 rd	558
519	5 th	566
526	10 th	576
531	15 th	585
535	20 th	591
540	25 th	596
544	30 th	601
548	35 th	605
554	40 th	609
557	45 th	613
558	50 th	617
561	55 th	621
563	60 th	625
566	65 th	629
570	70 th	633
575	75 th	637
580	80 th	642
589	85 th	650
598	90 th	657
605	95 th	672
620	97 th	679
623	98 th	684
627	99 th	696

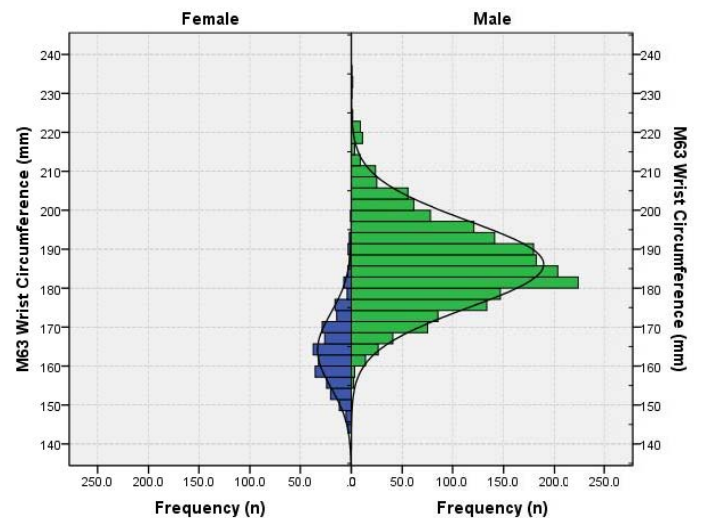
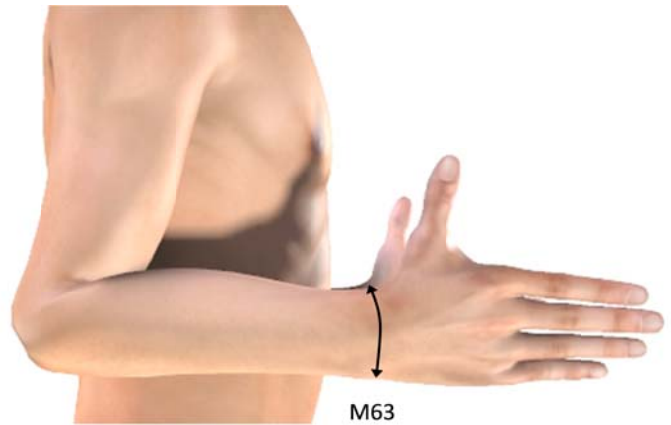


4.4.62 Wrist Circumference (M63)

Posture: Anthropometric Standing.

Definition: The circumference around the wrist at the height of the Stylium landmark, perpendicular to the long axis of the forearm.

FEMALES		MALES
276	n	1859
164	Mean	186
0.6	SE (mean)	0.3
9.5	SD	11.2
143	Minimum	155
199	Maximum	237
0.625	Skewness	0.439
0.660	Kurtosis	0.595
5.8%	Coefficient of variation	6.0%
Percentiles		
145	1 st	163
147	2 nd	165
148	3 rd	167
151	5 th	169
153	10 th	172
155	15 th	175
156	20 th	177
157	25 th	179
158	30 th	180
160	35 th	181
161	40 th	183
162	45 th	184
163	50 th	185
164	55 th	187
165	60 th	188
167	65 th	189
168	70 th	191
170	75 th	193
171	80 th	195
173	85 th	197
176	90 th	201
182	95 th	205
186	97 th	209
189	98 th	211
193	99 th	219

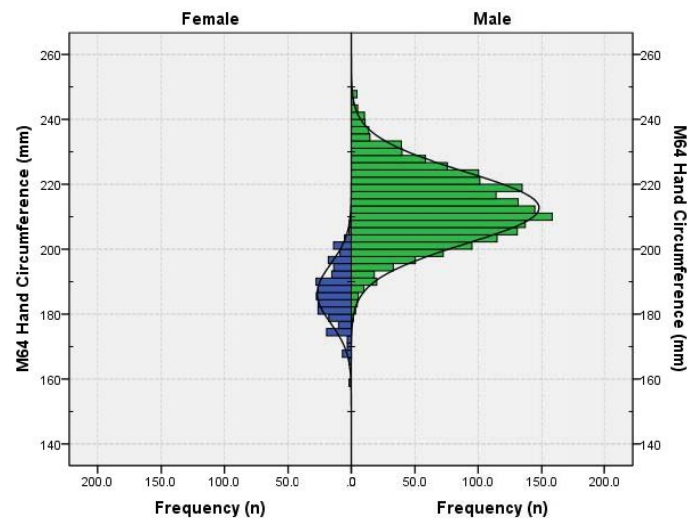
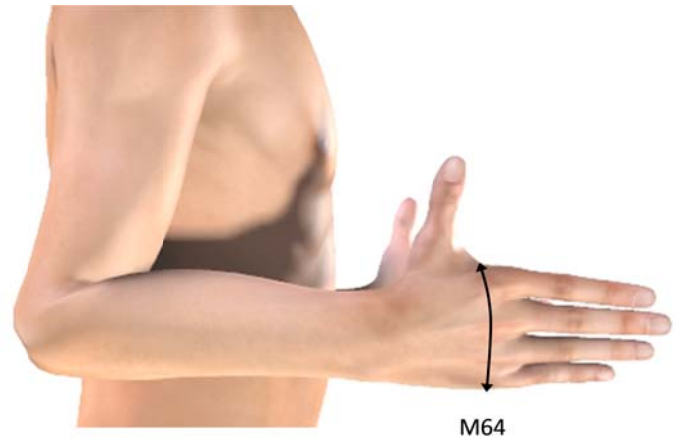


4.4.63 Hand Circumference (M64)

Posture: Anthropometric Standing.

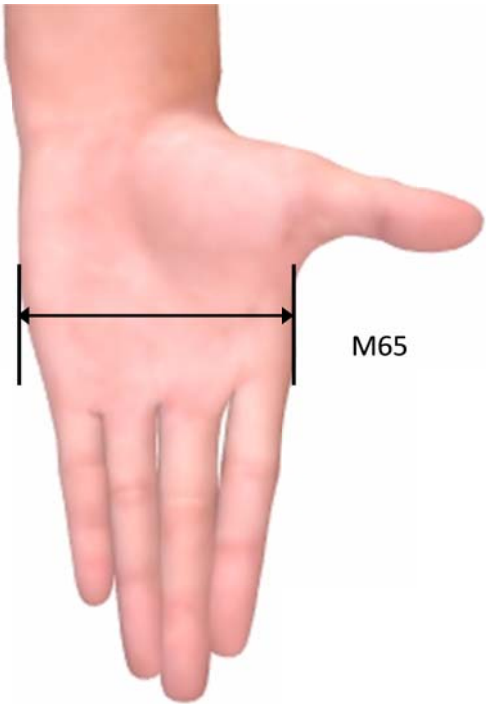
Definition: The circumference around the hand that passes over the digitally-extracted Metacarpale II and Metacarpale V landmarks.

FEMALES		MALES
275	n	1855
186	Mean	213
0.5	SE (mean)	0.3
9.1	SD	11.1
159	Minimum	178
209	Maximum	249
-0.086	Skewness	0.138
-0.243	Kurtosis	0.032
4.9%	Coefficient of variation	5.2%
Percentiles		
166	1 st	187
168	2 nd	191
168	3 rd	192
171	5 th	195
174	10 th	199
177	15 th	201
179	20 th	203
180	25 th	205
181	30 th	207
183	35 th	208
184	40 th	209
185	45 th	211
186	50 th	212
188	55 th	214
189	60 th	215
189	65 th	217
190	70 th	219
193	75 th	220
195	80 th	222
197	85 th	224
199	90 th	227
201	95 th	231
202	97 th	234
204	98 th	237
206	99 th	240

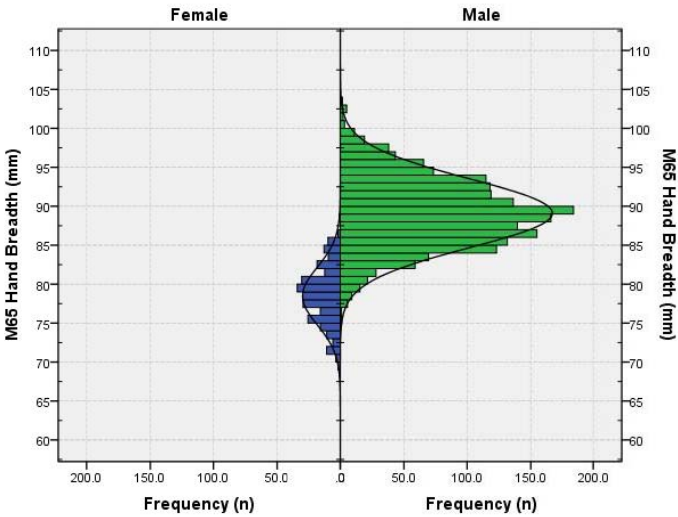


4.4.64 Hand Breadth (M65)

Posture: Anthropometric Standing.
Definition: The point-to-point distance between the digitally-extracted Metacarpale II and Metacarpale V landmarks.



FEMALES		MALES
276	n	1860
78	Mean	89
0.2	SE (mean)	0.1
3.7	SD	4.4
70	Minimum	75
87	Maximum	104
-0.051	Skewness	0.121
-0.383	Kurtosis	-0.140
4.7%	Coefficient of variation	5.0%
Percentiles		
70	1 st	79
71	2 nd	80
71	3 rd	81
72	5 th	82
74	10 th	84
74	15 th	85
75	20 th	85
76	25 th	86
77	30 th	87
77	35 th	87
78	40 th	88
78	45 th	89
79	50 th	89
79	55 th	90
79	60 th	90
80	65 th	91
80	70 th	92
81	75 th	92
82	80 th	93
83	85 th	94
84	90 th	95
85	95 th	97
85	97 th	98
86	98 th	98
86	99 th	99

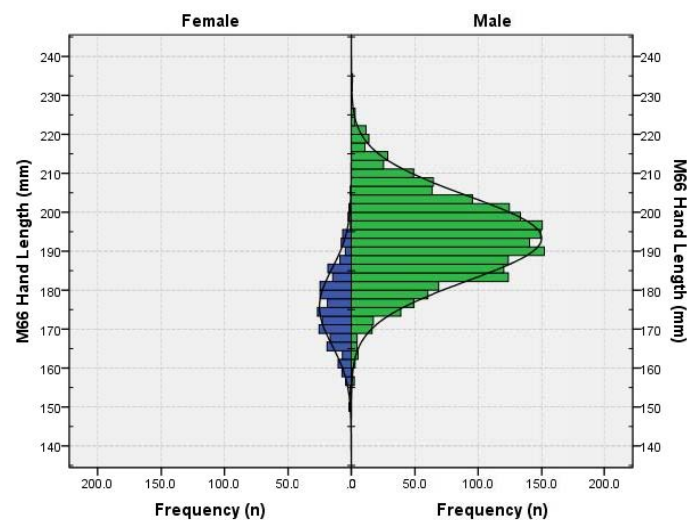
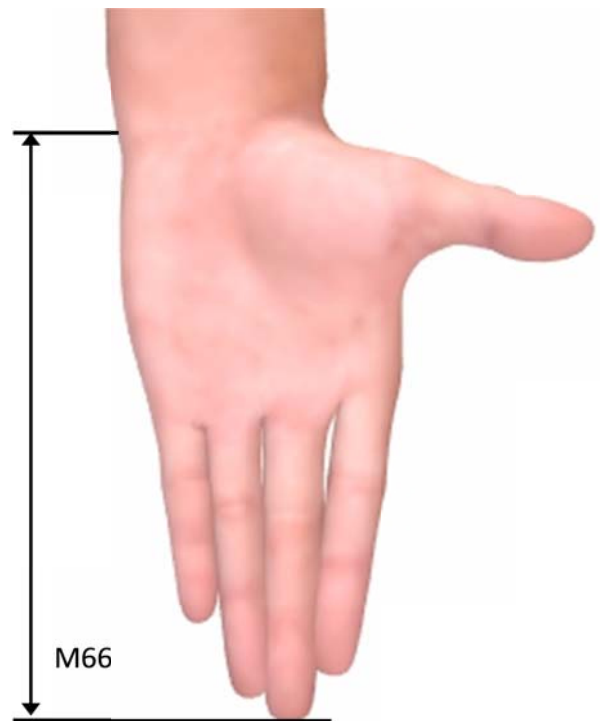


4.4.65 Hand Length (M66)

Posture: Anthropometric Standing.

Definition: The point-to-point distance between the digitally-extracted Centre Wrist Marker and Dactylion III landmarks.

FEMALES		MALES
276	n	1859
176	Mean	193
0.6	SE (mean)	0.3
9.8	SD	11.0
151	Minimum	157
206	Maximum	234
0.157	Skewness	0.051
-0.098	Kurtosis	0.148
5.6%	Coefficient of variation	5.7%
Percentiles		
153	1 st	168
156	2 nd	171
158	3 rd	173
159	5 th	176
163	10 th	179
166	15 th	182
167	20 th	184
169	25 th	186
170	30 th	187
171	35 th	189
173	40 th	190
174	45 th	192
175	50 th	193
177	55 th	195
178	60 th	196
179	65 th	197
181	70 th	199
182	75 th	201
184	80 th	202
186	85 th	204
189	90 th	208
193	95 th	212
195	97 th	214
197	98 th	217
201	99 th	221



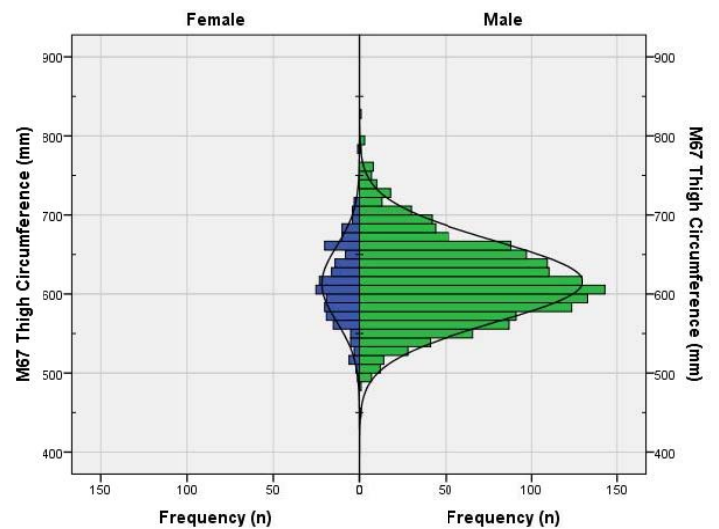
4.4.66 Thigh Circumference (M67)

Posture: Anthropometric Standing.

Definition: The maximum circumference of the thigh (measured perpendicular to the long axis of the leg) between the Trochanterion landmark and the Lateral Femoral Epicondyle, Standing landmark.



FEMALES		MALES
236	n	1519
612	Mean	615
3.1	SE (mean)	1.3
47.7	SD	51.2
490	Minimum	452
785	Maximum	827
0.094	Skewness	0.348
-0.113	Kurtosis	0.308
7.8%	Coefficient of variation	8.3%
Percentiles		
509	1 st	507
515	2 nd	520
519	3 rd	526
532	5 th	536
555	10 th	553
564	15 th	562
573	20 th	572
580	25 th	581
587	30 th	587
593	35 th	593
600	40 th	601
606	45 th	607
610	50 th	614
615	55 th	619
620	60 th	626
629	65 th	633
635	70 th	640
650	75 th	648
658	80 th	656
666	85 th	666
676	90 th	684
695	95 th	707
702	97 th	724
704	98 th	732
715	99 th	750

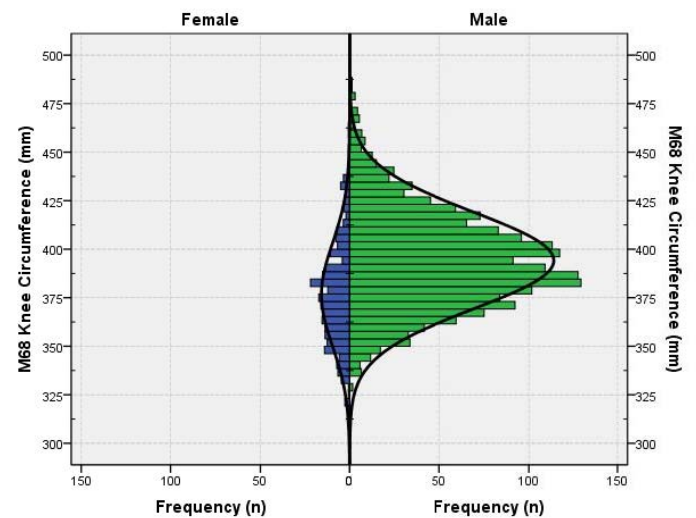
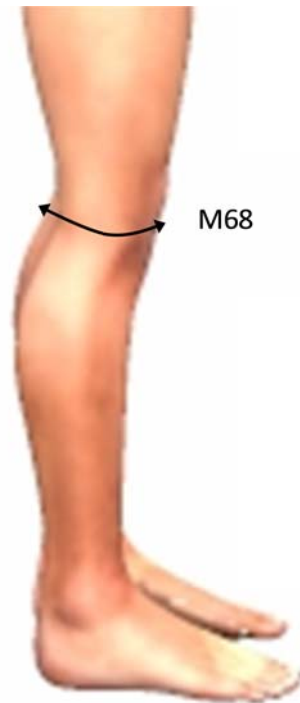


4.4.67 Knee Circumference (M68)

Posture: Anthropometric Standing.

Definition: The circumference of the knee at the height of the digitally-extracted Midpatella landmark.

FEMALES		MALES
273	n	1852
377	Mean	394
1.6	SE (mean)	0.6
26.7	SD	25.0
316	Minimum	318
462	Maximum	487
0.493	Skewness	0.418
0.130	Kurtosis	0.262
7.1%	Coefficient of variation	6.3%
Percentiles		
322	1 st	343
330	2 nd	348
333	3 rd	351
337	5 th	356
346	10 th	364
349	15 th	368
354	20 th	373
357	25 th	377
361	30 th	380
364	35 th	383
367	40 th	386
371	45 th	389
374	50 th	392
378	55 th	396
381	60 th	399
384	65 th	402
387	70 th	406
392	75 th	410
397	80 th	414
405	85 th	420
412	90 th	426
429	95 th	438
434	97 th	446
438	98 th	452
449	99 th	462

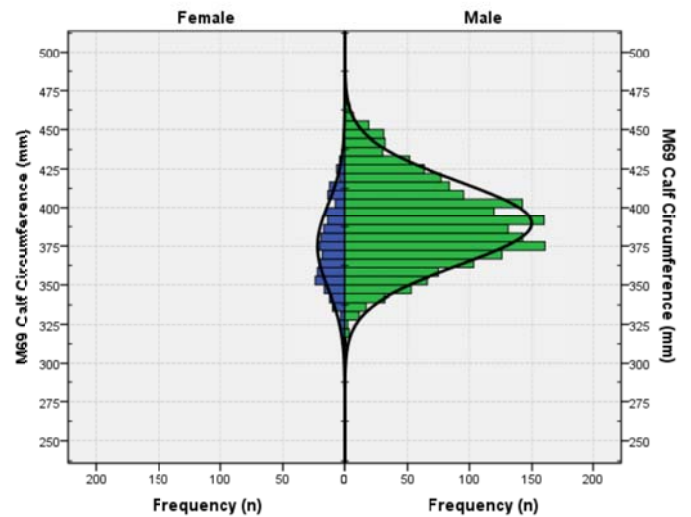


4.4.68 Calf Circumference (M69)

Posture: Anthropometric Standing.

Definition: The maximum horizontal circumference of the lower leg segment.

FEMALES		MALES
271	n	1844
375	Mean	390
1.7	SE (mean)	0.6
27.6	SD	27.3
309	Minimum	299
463	Maximum	479
0.346	Skewness	0.210
-0.237	Kurtosis	-0.226
7.4%	Coefficient of variation	7.0%
Percentiles		
320	1 st	333
324	2 nd	339
328	3 rd	342
336	5 th	347
341	10 th	355
346	15 th	362
351	20 th	367
355	25 th	371
357	30 th	375
361	35 th	378
365	40 th	381
369	45 th	385
373	50 th	389
376	55 th	392
380	60 th	395
384	65 th	400
389	70 th	403
394	75 th	407
399	80 th	413
409	85 th	419
413	90 th	427
423	95 th	439
427	97 th	445
430	98 th	447
449	99 th	454

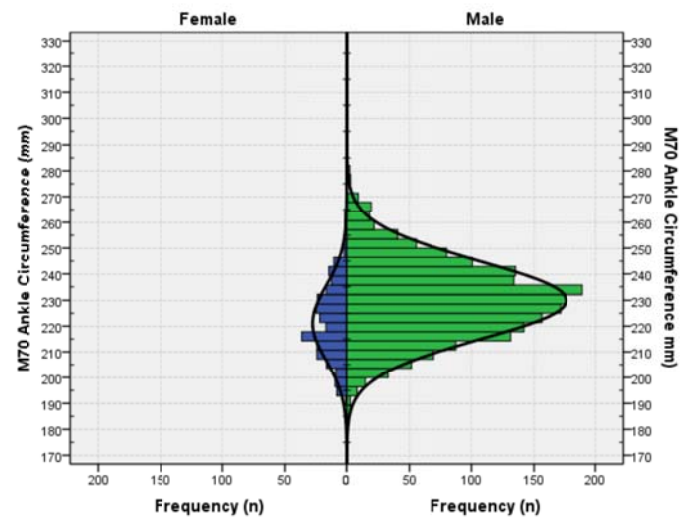


4.4.69 Ankle Circumference (M70)

Posture: Anthropometric Standing.

Definition: The minimum horizontal circumference above the digitally-extracted Lateral Malleolus landmark and below the level of the Maximum Calf Circumference.

FEMALES		MALES
276	n	1858
221	Mean	230
0.9	SE (mean)	0.3
14.4	SD	15.0
185	Minimum	175
265	Maximum	301
0.250	Skewness	0.216
-0.225	Kurtosis	0.235
6.5%	Coefficient of variation	6.5%
Percentiles		
193	1 st	198
195	2 nd	201
196	3 rd	203
198	5 th	206
203	10 th	211
206	15 th	215
209	20 th	217
211	25 th	219
213	30 th	222
215	35 th	224
216	40 th	226
218	45 th	228
219	50 th	230
222	55 th	232
225	60 th	233
227	65 th	235
229	70 th	237
231	75 th	240
233	80 th	242
237	85 th	246
241	90 th	249
246	95 th	255
248	97 th	260
251	98 th	264
261	99 th	267



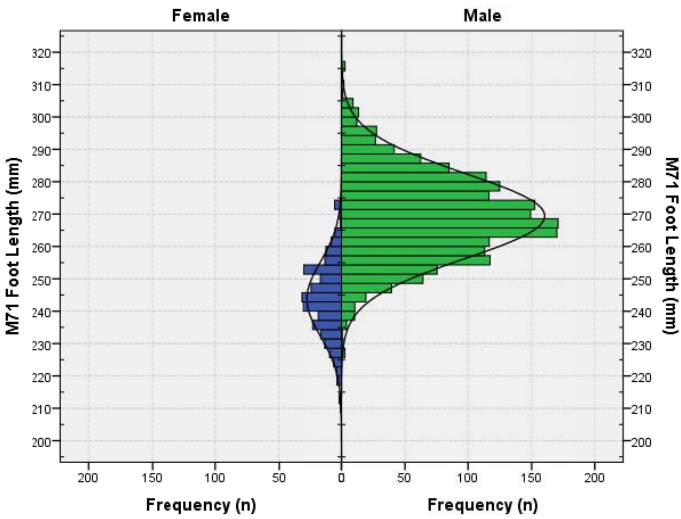
4.4.70 Foot Length (M71)

Posture: Anthropometric Standing.

Definition: The point-to-point distance between the digitally-extracted Acropodion and Pternion landmarks.



FEMALES		MALES
275	n	1857
244	Mean	269
0.7	SE (mean)	0.3
11.5	SD	13.2
210	Minimum	227
274	Maximum	316
0.023	Skewness	0.177
0.077	Kurtosis	0.078
4.7%	Coefficient of variation	4.9%
Percentiles		
215	1 st	240
220	2 nd	244
221	3 rd	246
224	5 th	249
229	10 th	253
232	15 th	255
234	20 th	258
236	25 th	260
238	30 th	263
240	35 th	264
241	40 th	266
242	45 th	267
244	50 th	269
245	55 th	271
246	60 th	272
248	65 th	274
250	70 th	276
252	75 th	279
253	80 th	281
255	85 th	283
258	90 th	286
263	95 th	292
266	97 th	296
272	98 th	298
273	99 th	302

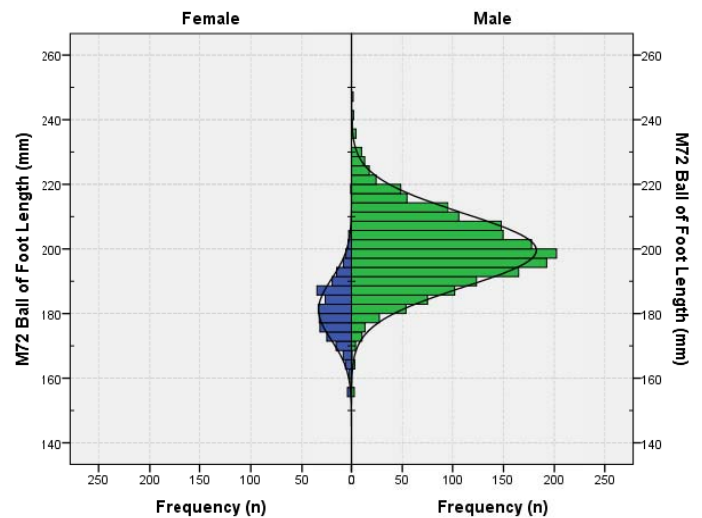
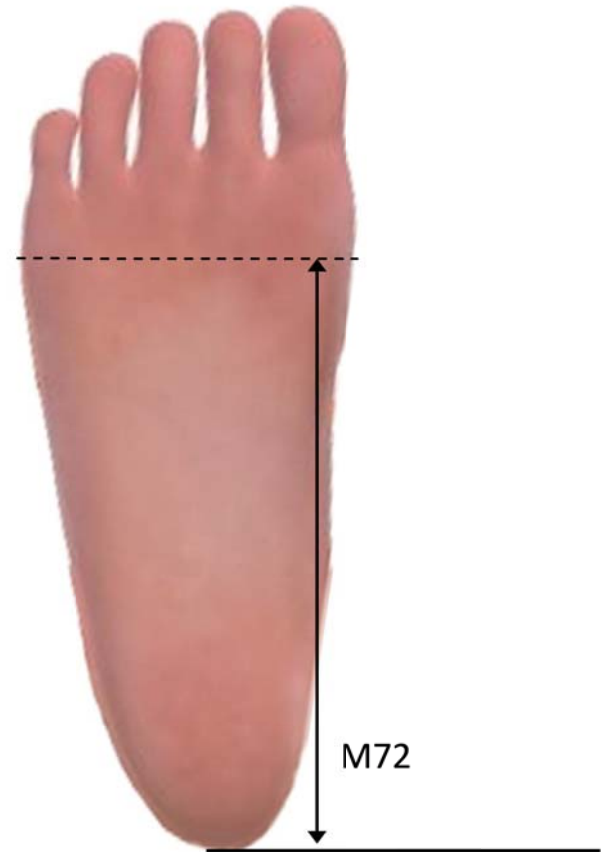


4.4.71 Ball of Foot Length (M72)

Posture: Anthropometric Standing.

Definition: The distance along a line between Acropodion and Pternion, between the Pternion and intersection of a line drawn through the First Metatarsophalangeal Joint Protrusion Landmark perpendicular to the line between Acropodion and Pternion.

FEMALES		MALES
269	n	1828
181	Mean	200
0.6	SE (mean)	0.3
9.5	SD	11.4
154	Minimum	156
218	Maximum	247
0.083	Skewness	0.171
0.469	Kurtosis	0.624
5.3%	Coefficient of variation	5.7%
Percentiles		
157	1 st	173
160	2 nd	178
164	3 rd	179
166	5 th	182
170	10 th	185
172	15 th	188
173	20 th	190
175	25 th	192
176	30 th	194
177	35 th	195
178	40 th	197
180	45 th	198
181	50 th	199
182	55 th	200
184	60 th	202
185	65 th	203
187	70 th	205
188	75 th	207
189	80 th	209
191	85 th	211
193	90 th	214
197	95 th	219
199	97 th	222
202	98 th	224
205	99 th	230

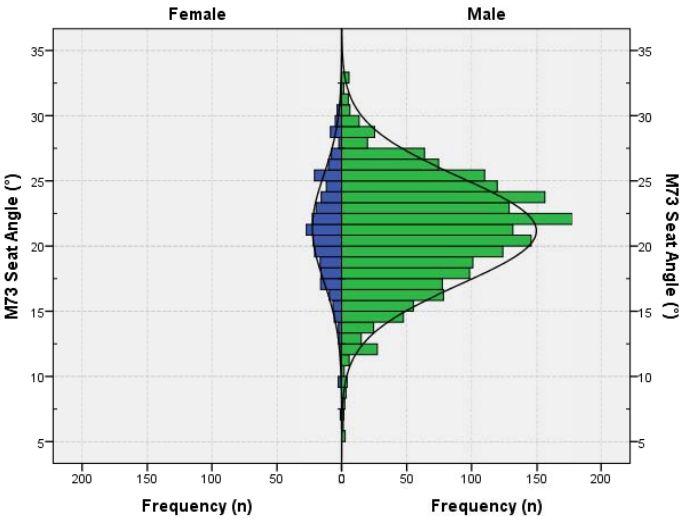


4.4.72 Seat Angle (M73)

Posture: Anthropometric Standing.
Definition: A two dimensional angle in the anterior-posterior plane, defined by a vertical line and a line between the Buttock Point, Posterior landmark and the Waist Preferred, Posterior landmark.



FEMALES		MALES
276	n	1858
21	Mean	21
0.2	SE (mean)	0.1
4.1	SD	4.1
7	Minimum	6
31	Maximum	33
-0.160	Skewness	-0.334
0.275	Kurtosis	0.318
19.2%	Coefficient of variation	19.5%
Percentiles		
10	1 st	11
13	2 nd	12
14	3 rd	13
15	5 th	14
17	10 th	16
17	15 th	17
18	20 th	18
19	25 th	19
19	30 th	19
20	35 th	20
20	40 th	20
21	45 th	21
21	50 th	22
22	55 th	22
22	60 th	22
23	65 th	23
23	70 th	24
24	75 th	24
25	80 th	25
26	85 th	25
27	90 th	26
29	95 th	27
29	97 th	28
30	98 th	29
30	99 th	30

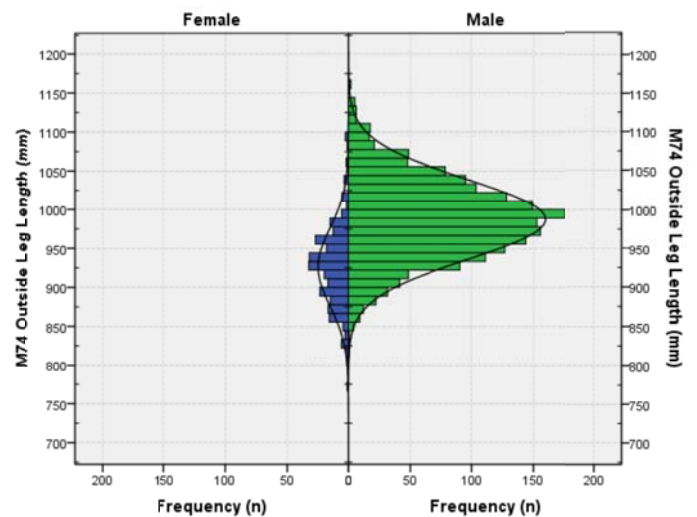
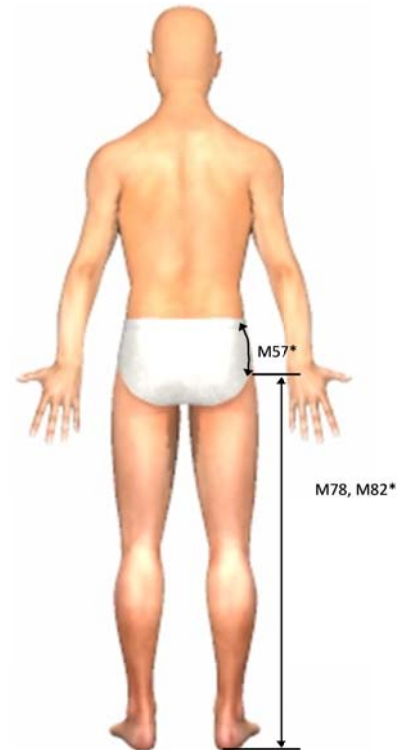


4.4.73 Outside Leg Length (M74)

Posture: Anthropometric Standing.

Definition: The sum of the Waist-Hip Distance (M57) and Hip Level (M78, M82).

FEMALES		MALES
276	n	1854
926	Mean	987
3.0	SE (mean)	1.2
50.2	SD	51.4
774	Minimum	816
1098	Maximum	1164
0.321	Skewness	0.122
0.959	Kurtosis	0.075
5.4%	Coefficient of variation	5.2%
Percentiles		
812	1 st	869
825	2 nd	881
831	3 rd	893
846	5 th	903
863	10 th	925
874	15 th	936
885	20 th	944
892	25 th	952
897	30 th	959
907	35 th	967
914	40 th	974
923	45 th	980
929	50 th	986
933	55 th	993
937	60 th	999
943	65 th	1005
950	70 th	1013
957	75 th	1022
963	80 th	1030
970	85 th	1041
982	90 th	1053
1012	95 th	1074
1034	97 th	1088
1051	98 th	1101
1093	99 th	1117

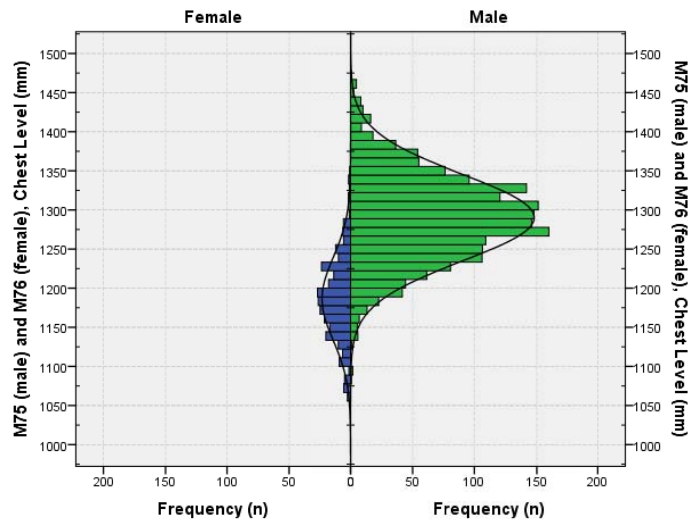


4.4.74 Chest and Bust Level (M75, M76)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Thelion, Right landmark (males) or the digitally-extracted Bustpoint, Right landmark (females).

FEMALES		MALES
276	n	1860
1186	Mean	1290
3.2	SE (mean)	1.3
53.3	SD	55.8
1057	Minimum	1082
1351	Maximum	1477
0.168	Skewness	0.059
0.183	Kurtosis	0.166
4.5%	Coefficient of variation	4.3%
Percentiles		
1067	1 st	1163
1070	2 nd	1179
1080	3 rd	1187
1096	5 th	1199
1120	10 th	1219
1134	15 th	1232
1143	20 th	1242
1153	25 th	1253
1157	30 th	1261
1166	35 th	1269
1172	40 th	1276
1180	45 th	1283
1185	50 th	1290
1190	55 th	1297
1197	60 th	1304
1203	65 th	1311
1212	70 th	1320
1223	75 th	1327
1230	80 th	1335
1241	85 th	1346
1253	90 th	1361
1277	95 th	1381
1291	97 th	1397
1310	98 th	1414
1333	99 th	1429

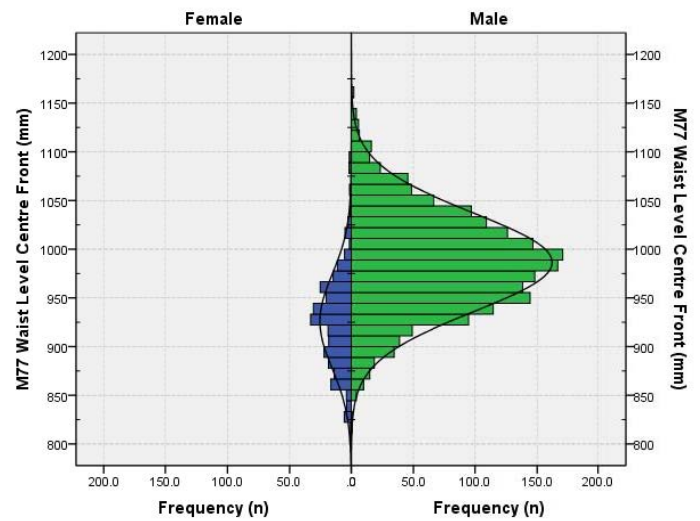
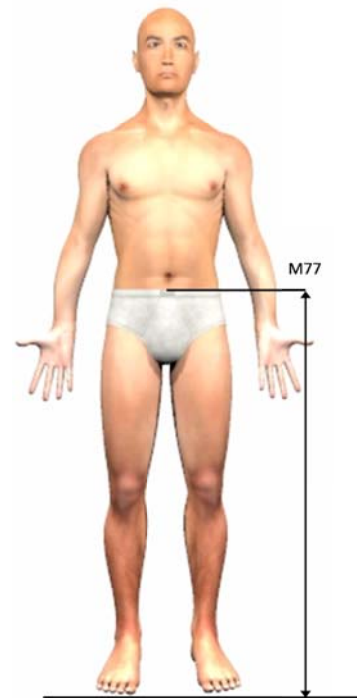


4.4.75 Waist Level Centre Front (M77)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Waist Preferred, Anterior landmark.

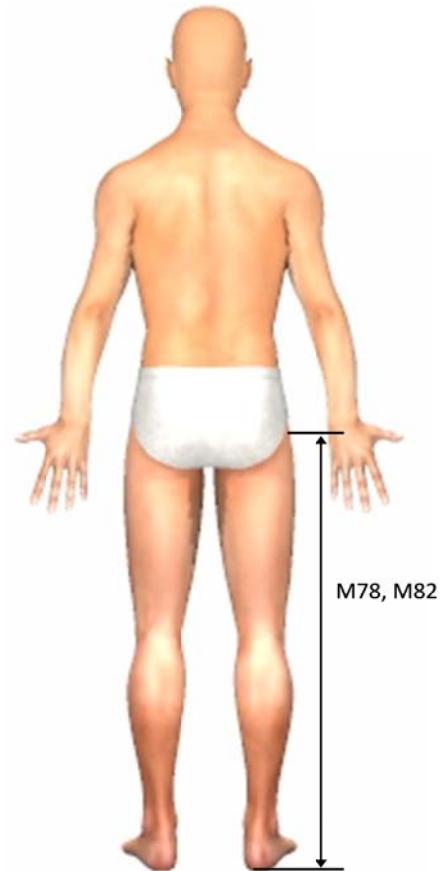
FEMALES		MALES
276	n	1861
926	Mean	987
2.9	SE (mean)	1.2
48.6	SD	50.9
807	Minimum	815
1097	Maximum	1163
0.422	Skewness	0.133
0.838	Kurtosis	0.091
5.3%	Coefficient of variation	5.2%
Percentiles		
823	1 st	869
828	2 nd	881
839	3 rd	894
851	5 th	903
864	10 th	925
874	15 th	935
884	20 th	944
891	25 th	951
896	30 th	958
907	35 th	966
914	40 th	973
923	45 th	980
928	50 th	985
933	55 th	992
937	60 th	998
943	65 th	1004
950	70 th	1012
957	75 th	1020
962	80 th	1029
969	85 th	1040
981	90 th	1050
1013	95 th	1073
1032	97 th	1087
1042	98 th	1099
1087	99 th	1115



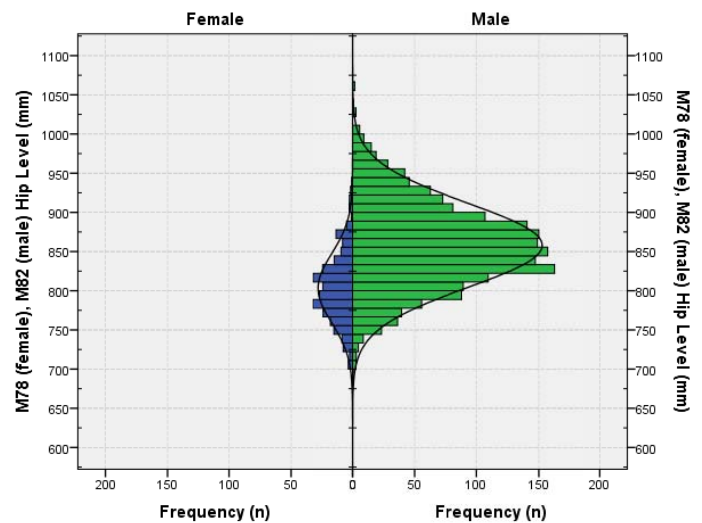
4.4.76 Hip Level, Male and Female (M78, M82)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Hip Marker landmark (male) and the vertical distance between the standing surface and the level at which the Maximum Hip Circumference measurement is established (female).



FEMALES		MALES
276	n	1861
803	Mean	858
2.7	SE (mean)	1.3
44.1	SD	54.0
704	Minimum	697
934	Maximum	1059
0.373	Skewness	0.221
0.138	Kurtosis	0.037
5.5%	Coefficient of variation	6.3%
Percentiles		
707	1 st	743
717	2 nd	755
726	3 rd	759
734	5 th	772
748	10 th	791
757	15 th	802
767	20 th	813
773	25 th	822
779	30 th	829
784	35 th	835
788	40 th	842
797	45 th	849
801	50 th	856
806	55 th	863
813	60 th	870
818	65 th	876
823	70 th	883
829	75 th	892
837	80 th	901
846	85 th	916
865	90 th	930
880	95 th	951
895	97 th	966
914	98 th	975
926	99 th	990

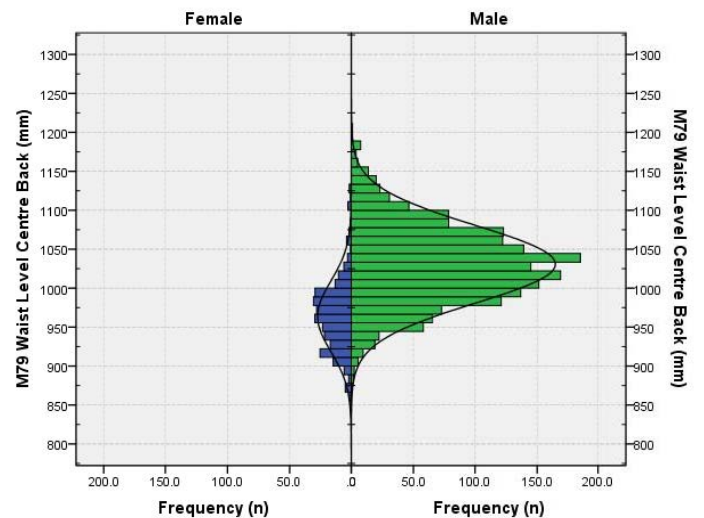
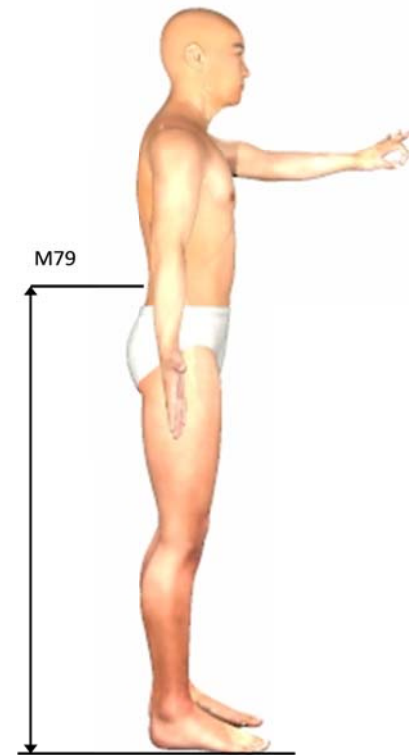


4.4.77 Waist Level Centre Back (M79)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Waist Preferred, Posterior landmark.

FEMALES		MALES
276	n	1861
964	Mean	1031
2.7	SE (mean)	1.2
45.2	SD	50.1
852	Minimum	874
1129	Maximum	1210
0.637	Skewness	0.196
1.439	Kurtosis	0.094
4.7%	Coefficient of variation	4.9%
Percentiles		
868	1 st	918
872	2 nd	931
882	3 rd	942
899	5 th	949
908	10 th	967
917	15 th	980
924	20 th	988
933	25 th	996
939	30 th	1003
946	35 th	1010
953	40 th	1017
959	45 th	1022
964	50 th	1029
968	55 th	1036
974	60 th	1042
979	65 th	1047
983	70 th	1056
990	75 th	1064
996	80 th	1073
1001	85 th	1082
1012	90 th	1095
1040	95 th	1115
1067	97 th	1130
1098	98 th	1142
1118	99 th	1157

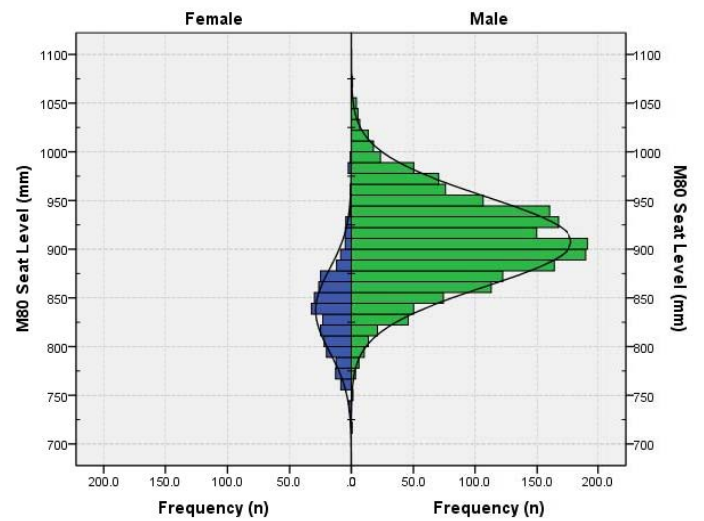
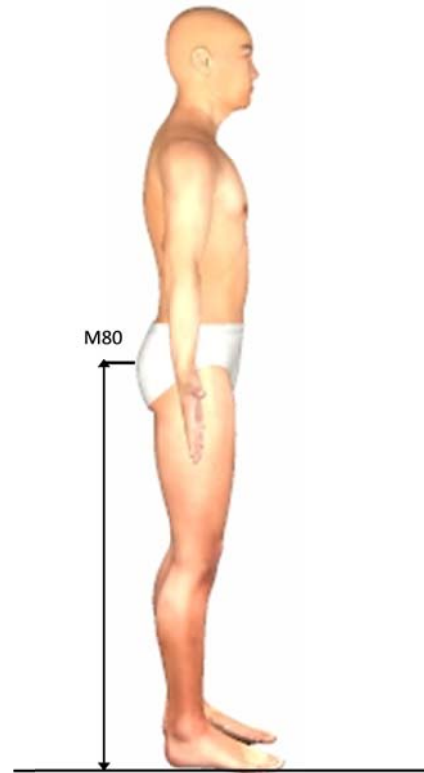


4.4.78 Seat Level (M80)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Buttock Point, Posterior landmark.

FEMALES		MALES
276	n	1861
837	Mean	908
2.6	SE (mean)	1.1
42.8	SD	46.4
731	Minimum	720
998	Maximum	1077
0.421	Skewness	0.040
0.740	Kurtosis	0.267
5.1%	Coefficient of variation	5.1%
Percentiles		
744	1 st	796
760	2 nd	812
762	3 rd	822
770	5 th	831
783	10 th	850
793	15 th	861
800	20 th	870
805	25 th	878
813	30 th	885
820	35 th	890
827	40 th	896
833	45 th	901
838	50 th	907
842	55 th	913
847	60 th	920
852	65 th	926
857	70 th	932
865	75 th	938
871	80 th	945
876	85 th	954
889	90 th	968
913	95 th	984
923	97 th	995
933	98 th	1009
980	99 th	1022

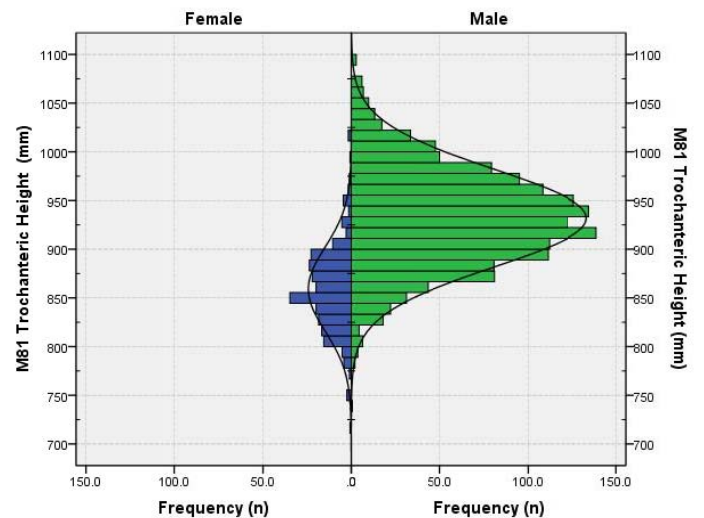
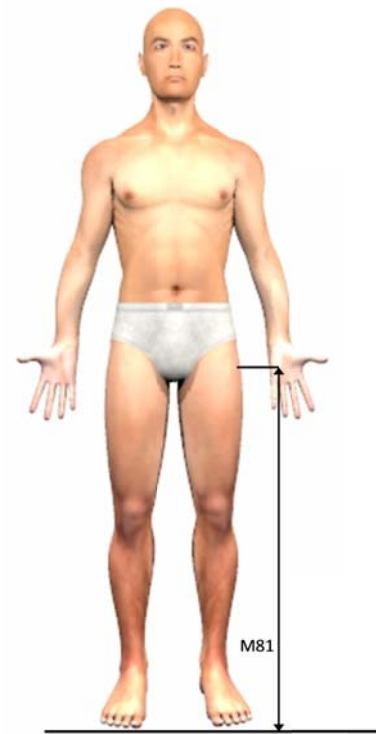


4.4.79 Trochanteric Height (M81)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally extracted Trochanterion landmark.

FEMALES		MALES
236	n	1508
859	Mean	932
2.8	SE (mean)	1.3
43.4	SD	50.1
722	Minimum	743
1021	Maximum	1096
0.387	Skewness	0.093
1.259	Kurtosis	0.092
5.0%	Coefficient of variation	5.4%
Percentiles		
745	1 st	817
775	2 nd	828
780	3 rd	840
798	5 th	852
808	10 th	869
814	15 th	881
823	20 th	890
829	25 th	897
838	30 th	905
844	35 th	912
849	40 th	919
852	45 th	925
855	50 th	931
861	55 th	938
871	60 th	944
876	65 th	951
879	70 th	958
885	75 th	965
891	80 th	973
898	85 th	983
910	90 th	997
934	95 th	1016
951	97 th	1032
960	98 th	1041
1005	99 th	1056

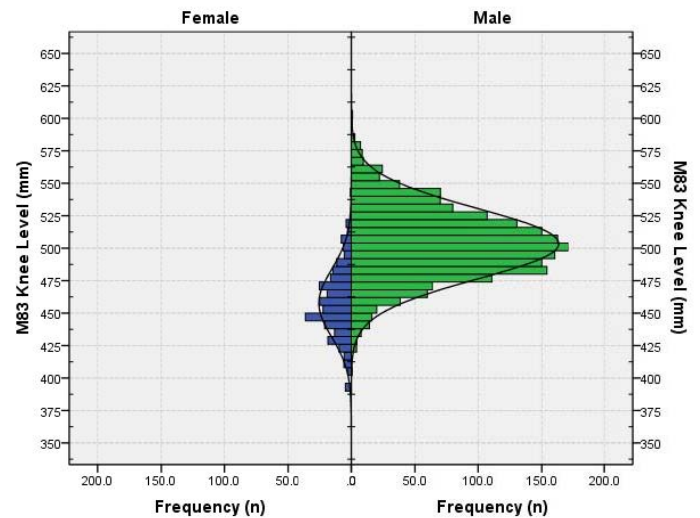
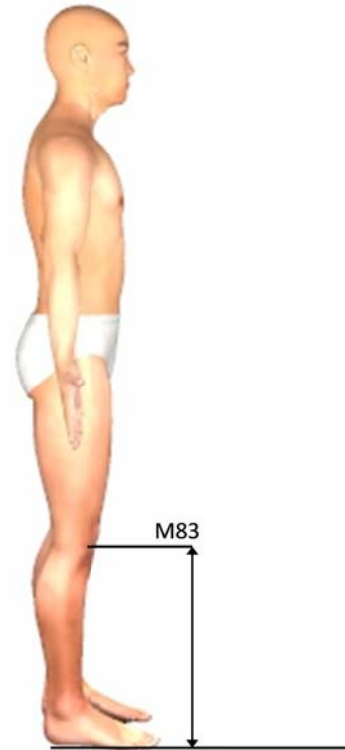


4.4.80 Knee Level (M83)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Midpatella landmark.

FEMALES		MALES
276	n	1861
458	Mean	503
1.6	SE (mean)	0.6
26.0	SD	27.3
392	Minimum	404
540	Maximum	601
0.161	Skewness	0.123
0.054	Kurtosis	0.181
5.7%	Coefficient of variation	5.4%
Percentiles		
394	1 st	439
405	2 nd	446
410	3 rd	454
415	5 th	461
426	10 th	470
430	15 th	477
437	20 th	481
442	25 th	485
444	30 th	489
447	35 th	492
450	40 th	496
452	45 th	499
456	50 th	503
459	55 th	506
462	60 th	509
467	65 th	513
472	70 th	517
474	75 th	521
478	80 th	526
483	85 th	532
492	90 th	540
506	95 th	549
510	97 th	558
515	98 th	563
520	99 th	574

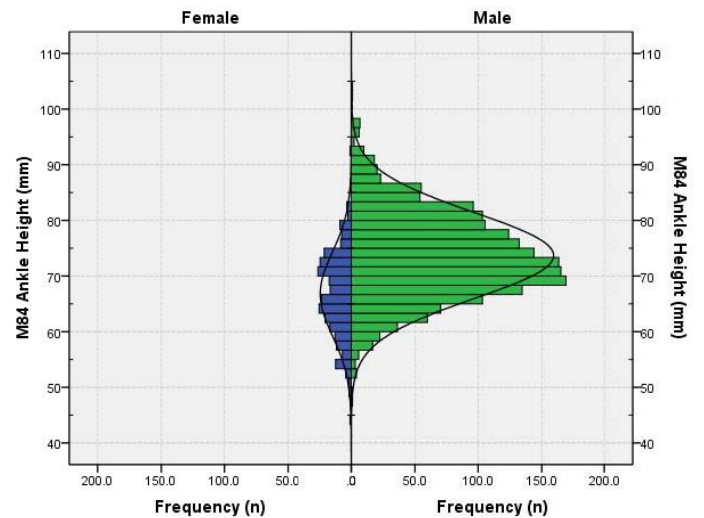


4.4.81 Ankle Height (M84)

Posture: Anthropometric Standing.

Definition: The vertical distance between the standing surface and the digitally-extracted Lateral Malleolus landmark.

FEMALES		MALES
276	n	1859
67	Mean	74
0.5	SE (mean)	0.2
7.5	SD	7.8
45	Minimum	48
92	Maximum	104
-0.017	Skewness	0.282
-0.058	Kurtosis	0.177
11.3%	Coefficient of variation	10.5%
Percentiles		
50	1 st	57
52	2 nd	59
53	3 rd	60
54	5 th	62
57	10 th	64
59	15 th	66
60	20 th	67
62	25 th	68
63	30 th	69
64	35 th	70
65	40 th	71
66	45 th	72
67	50 th	73
68	55 th	74
69	60 th	75
70	65 th	76
71	70 th	78
72	75 th	79
73	80 th	81
75	85 th	82
76	90 th	84
79	95 th	87
81	97 th	89
82	98 th	91
83	99 th	93

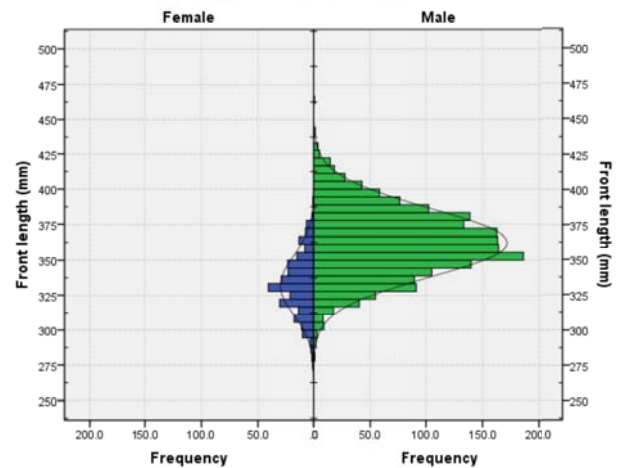
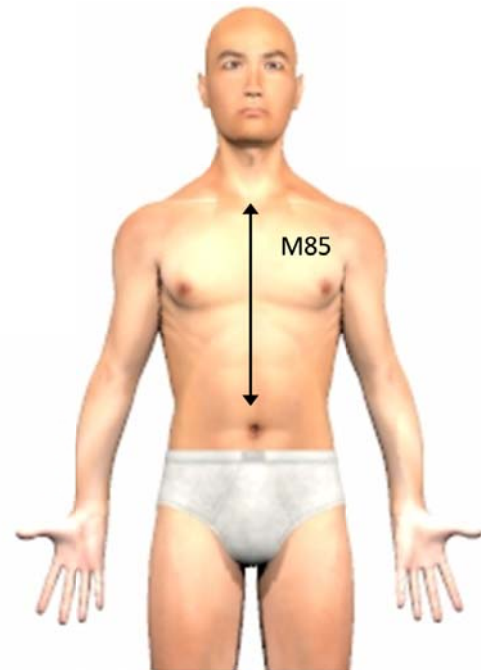


4.4.82 Front Length (M85)

Posture: Anthropometric Standing.

Definition: M04 Suprasternale Height minus
M07 Iliocristale Height.

FEMALES		MALES
277	n	1861
362	Mean	332
0.6	SE (mean)	1.2
24.0	SD	20.8
281	Minimum	277
467	Maximum	393
0.091	Skewness	0.041
-0.011	Kurtosis	-0.161
	Coefficient of variation	
	Percentiles	
282	1 st	309
289	2 nd	315
294	3 rd	319
297	5 th	323
305	10 th	331
310	15 th	337
315	20 th	342
319	25 th	346
322	30 th	350
325	35 th	353
328	40 th	356
330	45 th	359
332	50 th	362
334	55 th	365
336	60 th	368
339	65 th	371
342	70 th	375
346	75 th	379
349	80 th	383
354	85 th	387
362	90 th	393
368	95 th	403
374	97 th	409
375	98 th	413
377	99 th	419



5. Multivariate Statistics

5.1 Introduction

Boundary manikins have been produced through factor analysis of the univariate data provided at Section 4. The factor analyses performed used the dimensions considered critical to land vehicle design and the design of vehicles in which Army personnel may be transported. These dimensions were used to define the underlying critical human body size factors. Manikins that demonstrate the extremes of these factors can then be used to validate a design in terms of the central 90% of the population, as defined by MIL-STD 1472G [2012].

The boundary manikins provided within this standard are based on measurements considered critical for land vehicle design/assessment and the majority level of accommodation (central 90%). As such, these boundary manikins may be inappropriate for other applications and different levels of required accommodation, for example dismounted equipment design/assessment and the requirement for the full level of accommodation. Should boundary manikins be required for other applications or levels of accommodation then DSTO Land Division, Land Human Systems Branch should be contacted for advice.

The boundary manikins presented in this standard represent the majority level of accommodation for the AWAS dataset. The following boundary manikins are provided:

- Manikin A:* Overall smallest female
- Manikin B:* Widest male
- Manikin C:* Largest upper body size:lower body size male
- Manikin D:* Smallest upper body size:lower body size male
- Manikin E:* Overall largest male
- Manikin F:* Overall smallest male
- Manikin G:* Average male

5.2 Multivariate Assessment Procedure

The multivariate assessment procedure, shown in Figure 8, is intended to be used in combination with univariate assessments to support military land vehicle design and evaluation. As the univariate assessment procedure is quicker to apply than the multivariate assessment procedure, univariate assessments should be performed first to provide initial assessments of the vehicle in terms of single anthropometric dimensions, for example to identify any occupant fit issues. The multivariate assessment procedure should then be applied to assess aspects that are related to multiple anthropometric dimensions, for example reach to controls.

The multivariate assessment procedure is intended to be used for assessment where more than one anthropometric dimension is considered key and the dimensions are related to each other in the assessment. For example, multiple anthropometric variables will need to be considered when assessing reach in military land vehicles, given that both the height of the shoulder and the length of the arm will be influential on the reach envelope. It should be noted that there are some instances where more than one dimension is considered key, however, if these are not key for the same assessment aspects then each can be assessed separately using the univariate assessment procedure. For example when assessing fit through a doorway, stature and bideltoid width might be considered key dimensions. However, given that they are not dependent on each other these might be assessed more efficiently using two univariate assessments rather than one multivariate assessment.

Given the nature of land vehicle design and evaluation, it is intended that the multivariate assessment procedure is used in combination with univariate assessments. For example when assessing a vehicle driving position, initial univariate assessments might include fit in terms of bideltoid width and seated height to check that the driver would fit in the vehicle. This would allow relatively quick assessment of fit to be made and issues identified. Assuming that no issues are identified by the univariate assessments, this would then be followed with multivariate assessments to provide a more detailed assessment of the driving position.

The multivariate procedure requires three inputs:

- The boundary manikins; as defined in Section 5.3.
- The relevant PECCFs; using the tables provided at Section 6.
- Any miscellaneous adjustments (if required); any other adjustments that should be added, for example a comfort clearance.

The assessment procedure consists of four phases intended to be performed using a Digital Human Modelling (DHM) package; i) manikin construction, ii) the application of PECCFs, iii) placing the boundary manikin in the CAD model and then iv) assessing the risks identified. This is conducted for each boundary manikin in turn. It is outside the scope of this document to detail this process within a DHM package, in part due to the differences between DHM packages.

In the multivariate assessment procedure shown in Figure 8, Stage 3.3 “Place boundary manikin in CAD model” will require tailoring against the required task. A suggested method for placing a boundary manikin at the driving position in a military land vehicle is provided in Figure 9. It is recommended that this be used as a basis for all vehicle postures and modified to reflect the task performed.

Test methods, pass-fail criteria and reporting requirements for each assessment aspect are shown in Table 8. It is noted that whilst fit, clearance, reach and vision can be assessed using visual methods, posture assessment is more complex. Posture assessment requires consideration of aspects such as task frequency, task duration, forces applied to/by the body, support of the limbs and joint angles. As such, it should be assessed against the risks of user injury and task performance impairment by a suitably qualified Human Factors Subject Matter Expert (SME).

Reporting from these assessment types should provide sufficient information to permit the assessment to be repeated, including:

- Descriptions of the task assessed, key task points, perceived risk and assessment type.
- The anthropometric dimensions considered key to the assessment.
- A summary of the inputs used.
- An image of the assessment that shows how all assessments were performed, the measurements taken and body landmarks used for each boundary.
- The outputs listed for each assessment type in Table 8 for each boundary manikin.
- A risk statement for any assessment failures which states the likelihood and consequence associated with the risk.

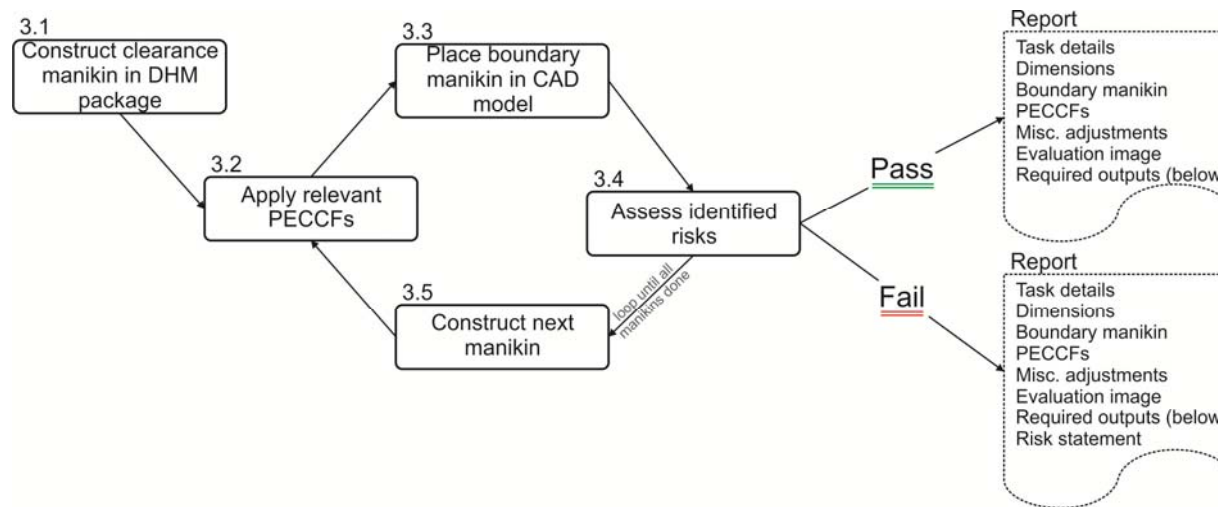


Figure 8 Multivariate assessment procedure

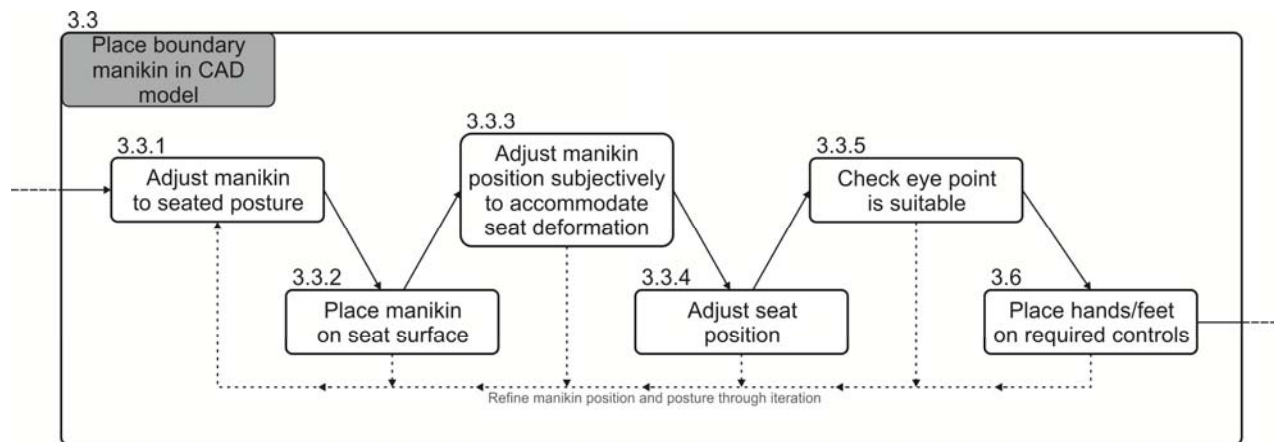


Figure 9 Multivariate assessment procedure – expansion on “Place boundary manikin in CAD model” for driving positions

Table 8 Assessment type and method including pass-fail criteria and reporting requirements

Aspect	Test method	Pass-fail criteria	Reporting requirements	
			Pass	Fail
Fit	Visually check for surface interactions between manikin and surrounding surfaces	Any surface interactions = fail	Report clearances distances	Report interaction distances
Clearance	Measure distance from body to hazard surfaces	<0mm = fail	Report clearances distances	Report interaction distances
Reach	1) Plot reach curves 2) Visually inspect layout for possible obstructions to reach. Adjust manikin to reach for any potentially obstructed controls	Any control outside of reach curves, and not possible to adjust manikin posture to reach control = fail	Report reach distance(s) and any required postural adjustment	Report reach distance(s) and measurement delta
Vision	1) Plot vision cones 2) View mannequins eye camera. Adjust posture to view any obstructed items	Any item outside of vision cone and not possible to adjust manikin posture to view item = fail	Report items within view and any required postural adjustment	Report items outside of vision cones, distance from cone
Posture	Measure key joint angles; ankle flex/ext, knee flex/ext, hip flex/ext, shoulder flex/ext, shoulder ab/adduction, shoulder int/ext rotation, neck flex/ext, neck rotation, elbow flex/ext, wrist flex/ext and wrist radial/ulnar flexion	Posture assessment by Human Factors SME taking into account task frequency, task duration, forces applied to/by the body, support of the limbs and joint angles	Report all angles. Provide reasons for pass	Report all angles. Provide reasons for failure

5.3 Boundary Manikin Data

The critical measurements of the boundary manikins are shown in Table 9. These dimensions are considered critical in the design of military land vehicles. Comprehensive dimensions for these mannequins can be found at Annex B to aid the production of manikins in DHM software.

Table 9 Boundary manikin critical measurements

Dimension	Applicable PECCF	Manikin						
		A	B	C	D	E	F	G
		Overall smallest female	Widest male	Largest upper body:lower body male	Smallest upper body:lower body male	Overall largest male	Overall smallest male	Average male
M09 Eye Height Sitting (mm)	-	750	841	858	750	831	770	820
M10 Acromion Height Sitting (mm)	EM22	559	606.5	644	562	636	595	609
M11 Elbow Rest Height (mm)	-	231.4	218.5	271	192	230	247	248
M12 Thigh Clearance (mm)	EM27	153	172	162	179	196	153	187
M13 Knee Height Sitting (mm)	EM28	484	571	564	561	581	534	566
M14 Popliteal Height (mm)	EM29	381	473	455	454	471	438	454
M17 Biacromial Breadth (mm)	-	345	440	443	420	421	390	392
M18 Bideloid Breadth (mm)	EM23	404	517	516	495	504	462	469.5
M19 Chest Breadth (mm)	EM08	259	331	292	320	326.9	280	323.5
M20 Chest Depth (mm)	EM09	226	237	260	244	290	236	221
M21 Bicristale Breadth (mm)	-	254	297	297	281	315	267	308.5
M22 Forearm-Forearm Breadth (mm)	EM24	411	614	542	545	528	545.5	525
M23 Abdominal Extension Depth Sitting (mm)	EM25	198	236	235	240	301	216	258.5
M24 Hip Breadth Sitting (mm)	EM26	369	386	394	345	415	341	377.5
M25 Buttock-Knee Length (mm)	EM30	543.5	645	608	610	669	571	622
M26 Buttock-Popliteal Length (mm)	EM31	452.5	524	509	495	568	464	503
M37 Thumbtip Reach (mm)	-	684	898	760	750	847.5	747	809
M38 Stature (mm)	EM01	1593	1884.2	1808	1760	1843	1684.5	1800
M39 Sitting Height (mm)	EM21	864	982.7	976	913	956	896.6	940
M40 Weight (kg)	EM02	58	85.1	83.5	80.4	95.1	69.4	83.8
M50 Back Width (mm)	-	289.3	410.6	373.1	379.4	370.2	354	384.6
M51 Back Length (mm)	-	427.6	490.3	466.5	430.2	495.4	448.3	432.7

Dimension	Applicable PECCF	Manikin						
		A	B	C	D	E	F	G
		Overall smallest female	Widest male	Largest upper body:lower body male	Smallest upper body:lower body male	Overall largest male	Overall smallest male	Average male
M52 Nape to Waist Centre Back (mm)	-	472.2	569.8	523.1	485.2	591	493.3	550.5
M60 Acromion-Radiale Length (mm)	-	290	364.4	338.6	349.6	350.3	318.9	342.6
M61 Radiale-Stylian Length (mm)	-	232.2	289.1	270.2	250.8	297.7	241.3	266.2

6. Personal Equipment and Clothing Correction Factors

6.1 Introduction

Anthropometric data are taken in a semi-nude state in order to accurately measure body dimensions. Statistical correction factors are therefore required to be added to the semi-nude data in order to represent the additional dimensions and volume of a soldier's encumbered state. This can include items such as boots, body armour and helmet. Collectively these statistical corrections are termed Personal Equipment and Clothing Correction Factors (PECCF).

When conducting either a univariate or multivariate assessment, relevant PECCFs should be added to the percentile data to represent an ADF Soldier wearing Soldier Combat Ensemble (SCE). Note that although anthropometric data is presented as two datasets; male and female, there is only one PECCF dataset which is applied to both the male and female data.

6.2 PECCF Data

PECCFs based on measurements collected of two ADF Soldier Combat Ensembles are summarised in Table 10. This table shows PECCF data for driver and dismounted close combatant Soldier Combat Ensembles wearing warm weather and cold weather clothing. These ensembles worn with warm weather clothing can be seen in Figure 10 and Figure 11.

Table 10 PECCF data

Dimension		PECCF (mm)			
		Driver/Crew		Dismounted Close Combatant	
		Warm Weather Clothing	Cold Weather Clothing	Warm Weather Clothing	Cold Weather Clothing
EM01	Stature (mm)	69	71	71	71
EM02	Weight (kg)	14	15	26	28
EM03	Head/Helmet Circumference (mm)	327	327	246	246
EM04	Head/Helmet Breadth (mm)	126	126	82	82
EM05	Head/Helmet Length (mm)	65	65	54	54
EM06	Acromion Height (mm)	57	57	57	57
EM07	Chest Circumference (mm)	186	186	471	471
EM08	Chest Breadth (mm)	18	18	24	25
EM09	Chest Depth (mm)	79	80	251	251
EM10	Waist Circumference (omphalion) (mm)	379	389	665	676
EM11	Buttock Circumference (mm)	61	101	61	101
EM12	Crotch Height (mm)	-36	-102	-36	-94
EM13	Hand Circumference (mm)	27	27	27	27
EM14	Hand Breadth (mm)	6	6	6	6
EM15	Hand Length (mm)	10	10	10	10
EM16	Hand Thickness (mm)	6	6	6	6
EM17	Ankle Height (mm)	46	46	46	46
EM18	Foot Breadth, Horizontal (mm)	9	9	9	9
EM19	Foot Length (mm)	45	45	45	45
EM20	Ball of Foot Length (mm)	17	17	17	17
EM21	Sitting Height (mm)	35	36	31	31
EM22	Acromion Height, Sitting (mm)	20	20	20	20
EM23	Bideltoid Breadth (mm)	67	79	77	95
EM24	Forearm-Forearm Breadth (mm)	125	156	183	196
EM25	Abdominal Extension Depth, Sitting (mm)	86	91	266	272
EM26	Hip breadth, Sitting (mm)	27	47	27	39
EM27	Thigh Clearance (mm)	17	20	17	20
EM28	Knee Height, Sitting (mm)	73	73	73	73
EM29	Popliteal Height (mm)	43	43	43	43
EM30	Buttock-Knee Length (mm)	21	44	21	44
EM31	Buttock-Popliteal Length (mm)	9	9	9	9

UNCLASSIFIED



Figure 10 *Driver ensemble with warm weather clothing*



Figure 11 *Dismounted Close Combatant ensemble with warm weather clothing*

UNCLASSIFIED

7. Application Matrix

7.1 Anthropometric Dimension Application Matrix

Advice on the dimensions that should be considered when designing and/or assessing different military systems is provided in Table 11.

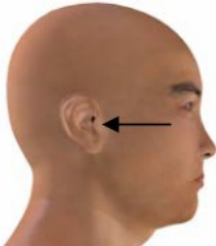
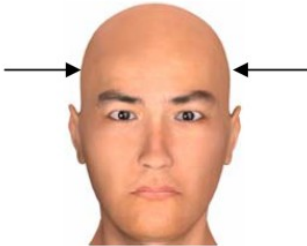
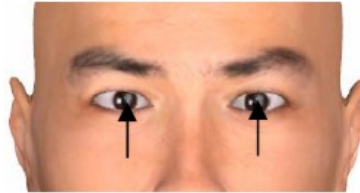
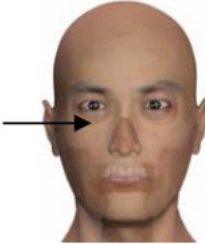
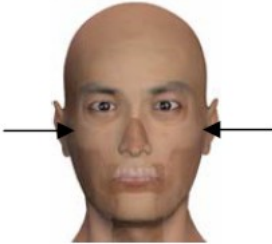
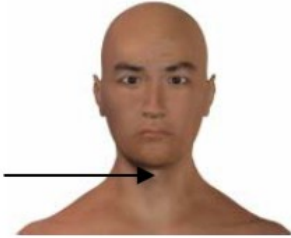
Table 11 Application matrix

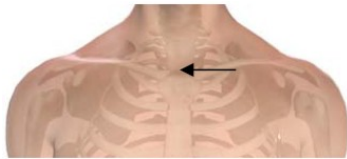
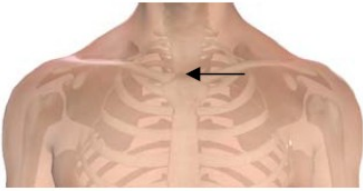
Dimension		Seated Working	Body Armour	Clothing	Headwear (e.g. helmets, respirators)	Footwear	Gloves
M01	Cervicale Height		X				
M02	T2 Height		X				
M03	Acromion Height	X					
M04	Suprasternale Height		X				
M05	Substernale Height		X				
M06	Tenth Rib Height		X				
M07	Iliocristale Height		X	X			
M08	Crotch Height			X			
M09	Eye Height, Sitting	X					
M10	Acromion Height, Sitting	X					
M11	Elbow Rest Height	X					
M12	Thigh Clearance	X					
M13	Knee Height, Sitting	X					
M14	Popliteal Height	X					
M15	Interpupillary Breadth				X		
M16	Bizygomatic Breadth				X		
M17	Biacromial Breadth	X	X	X			
M18	Bideltoid Breadth	X					
M19	Chest Breadth	X	X	X			
M20	Chest Depth	X	X	X			
M21	Bicristale Breadth	X					
M22	Forearm Breadth	X					
M23	Abdominal Extension Depth, Sitting	X					
M24	Hip Breadth Sitting	X					
M25	Buttock-Knee Length	X					
M26	Buttock-Popliteal Length	X					
M27	Foot Breadth	X				X	

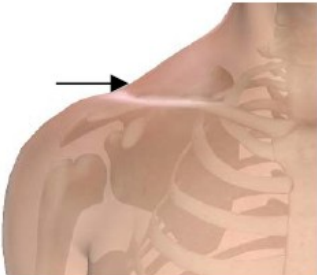
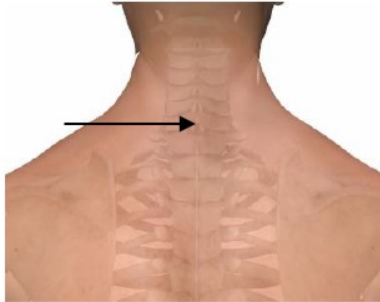
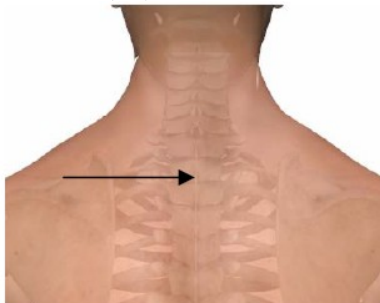
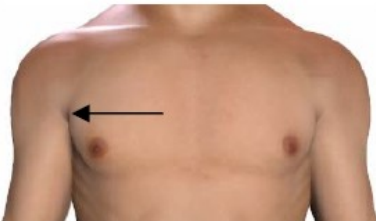
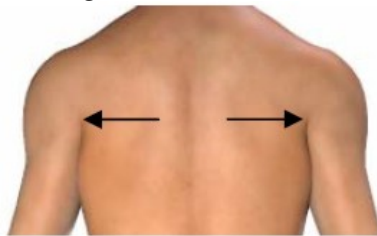
Dimension		Seated Working	Body Armour	Clothing	Headwear (e.g. helmets, respirators)	Footwear	Gloves
M28	Head Circumference				X		
M29	Neck Circumference, Base			X			
M30	Shoulder Length			X			
M31	Biceps Circumference, Flexed			X			
M32	Forearm Circumference, Flexed			X			
M33	Chest Circumference	X	X	X			
M34	Chest Circumference, Below Breast		X	X			
M35	Waist Circumference (Omphalion)	X	X	X			
M36	Buttock Circumference			X			
M37	Thumbtip Reach	X					
M38	Stature	X	X	X			
M39	Sitting Height	X					
M40	Weight	X	X	X			
M41	Head Breadth	X		X			
M42	Head Length	X		X			
M43	Menton-Sellion Length				X		
M44	Bitragion Submandibular Arc				X		
M45	Neck Circumference			X	X		
M46	Nape to Bustpoint Thelion Length			X			
M47	Nape to Waist over Bust			X			
M49	Scye Depth			X			
M50	Back Width		X	X			
M51	Back Length		X	X			
M52	Nape to Waist Centre Back			X			
M53	Vertical Trunk Circumference			X			
M54	Crotch Length Omphalion			X			
M55	Waist Circumference (Preferred)			X			
M56	Hip Circumference			X			
M57	Waist-Hip Distance			X			
M58	High Hip Circumference			X			
M59	Hip Circumference			X			
M60	Acromion-Radiale Length	X		X			
M61	Radiale-Stylian Length	X		X			
M62	Sleeve Outseam			X			

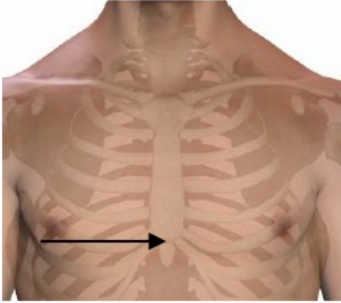
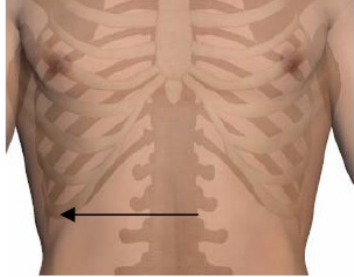
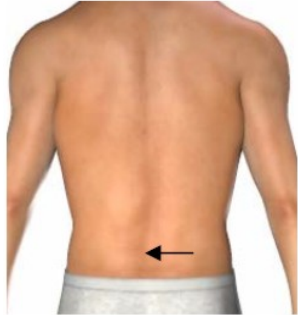
Dimension		Seated Working	Body Armour	Clothing	Headwear (e.g. helmets, respirators)	Footwear	Gloves
M63	Wrist Circumference			X			X
M64	Hand Circumference			X			X
M65	Hand Breadth	X		X			X
M66	Hand Length	X		X			X
M67	Thigh Circumference			X			
M68	Knee Circumference			X			
M69	Calf Circumference			X			
M70	Ankle Circumference			X			
M71	Foot Length					X	
M72	Ball of Foot Length					X	
M73	Seat Angle			X			
M74	Outside Leg Length			X			
M75	Chest Level			X			
M76	Bust Level			X			
M77	Waist Level Centre Front			X			
M78	Hip Level, female						
M79	Waist Level Centre Back			X			
M80	Seat Level			X			
M81	Trochanteric Height			X			
M82	Hip, male			X			
M83	Knee Level			X			
M84	Ankle Height			X		X	
M85	Front Length		X				

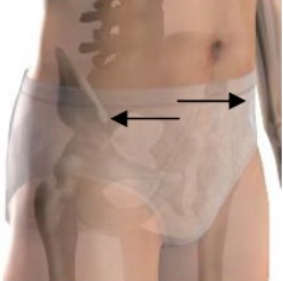
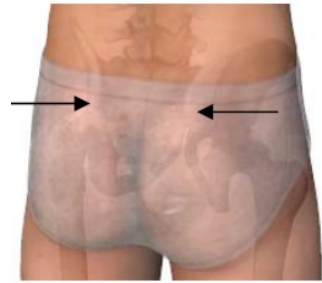
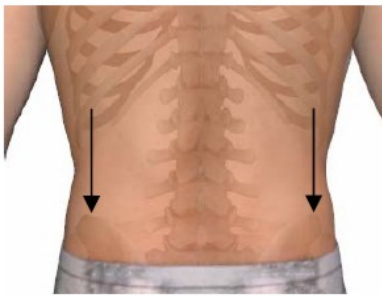
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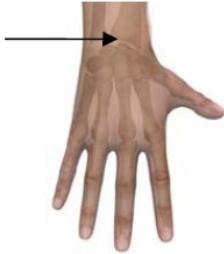
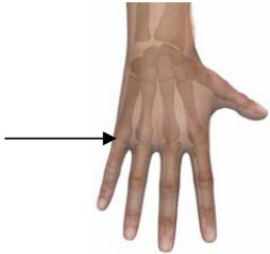
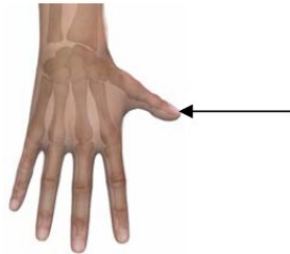
Top of the Head: The highest point of the head when the head is in the Frankfort Plane. 	Tragion (Right and Left): The superior point on the juncture of the cartilaginous flap (tragus) of the ear with the head. 	Head Breadth Marker (Right and Left): The most lateral point on the head above the ears. 
Glabella: The most anterior point on the frontal bone midway between the bony brow ridges. 	Ectocanthus: The outside corner of the right eye formed by the meeting of the upper and lower eyelids. 	Centre of Pupil (Right and Left): The centre of the pupil of the eye. 
Infraorbitale: The lowest point on the anterior border of the bony eye socket. 	Zygion (Right and Left): The most lateral points on the zygomatic arches. 	Submandibular: The juncture in the mid-sagittal plane of the lower jaw and the neck. 

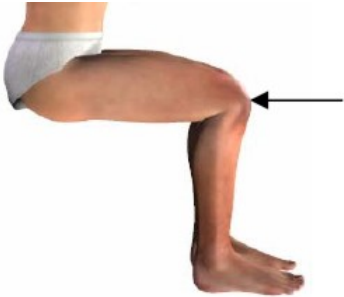
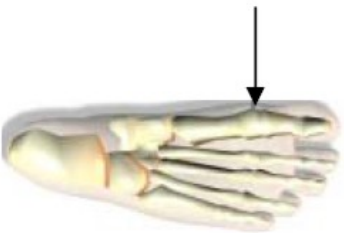
Sellion: The deepest depression of the nasal bones at the top of the nose. 	Menton: The inferior point of the mandible in the mid-sagittal plane. 	Opisthocranium: The posterior point on the back of the head. 
Anterior Neck: A mark made midway between the medial superior borders of the right and left clavicle. 	Lateral Neck (Right and Left): Lateral points located at the base of the neck. 	Suprasternale: The inferior point of the jugular notch at the top of the sternum. 
Trapezius Point (Right and Left): The point at which the anterior border of the trapezius muscle crosses the Lateral Neck landmark. 	Clavicle Point (Right and Left): The superior points on the lateral ends of the clavicle. 	Acromion (Right and Left): The point of intersection between the lateral border of the Acromion process and the extension of a line drawn from Trapezius Point which crosses over the Clavicle point landmark. 

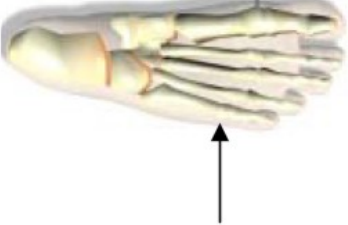
Midshoulder: The point on the top of the right shoulder midway between Trapezius Point, Right and Acromion, Right. 	Cervicale: The superior palpable point of the spine of the seventh cervical (C7) vertebrae. 	T2: The superior palpable point of the spine of the second thoracic (T2) vertebrae. 
Anterior Scye on the Torso: A point on the anterior torso in line with the height of the axilla. 	Posterior Horizontal Scye (Right and Left): A point on the posterior torso in line with the height of the axilla. 	Scye Level at Midspine: A point on the posterior torso in line with the height of the axilla, at the midspine. 
Back Length Marker: The point on the spine equidistant between the heights of the Iliocristale, Right and Iliocristale, Left landmarks. 	Thelion, Right: The centre of the nipple, right (males only). 	Bustpoint, Right: The most anterior point of the right bra cup (females only). 

Inferior Breastpoint: The most inferior point of the juncture of the lower of the two breasts with the torso (females only). 	Substernale: The lowest palpable point on the sternum. 	Tenth Rib: The inferior point on the right tenth rib. 
Abdominal Point, Anterior: The most protruding point of the relaxed abdomen of the seated subject. 	Waist (Omphalion) Anterior: The centre of the navel. 	Waist Preferred, Anterior: An anterior point of the torso in line with the spine and the preferred waist height. 
Waist Preferred, Posterior: A posterior point of the torso in line with the spine and the preferred waist height. 	Waist (Omphalion) Posterior: A point on the spine at the height of the Waist, Omphalion, Anterior landmark. 	Waist Preferred Posterior, Projected: A point on the right hand side of the anterior torso at the height of the Waist Preferred, Posterior landmark and a line projected vertically from the Thelion (Right) / Bustpoint (Right) landmark. 

High Hip Marker: The anterior point on the torso 8 cm below the Waist Preferred, Anterior landmark. 	Hip Marker: The maximum lateral trochanteric protrusion on the right side of the body. 	Anterior Superior Iliac Spine (ASIS) (Right and Left): The anterior point of the right and left iliac crests, respectively. 
Posterior Superior Iliac Spine (Right and Left): The posterior point of the crest of ilium. 	Iliocristale (Right and Left): The highest palpable point of the iliac crests of the pelvis. 	Biceps Point: The highest point of the right flexed biceps as viewed from the subject's right side. 
Elbow Crease: The skin crease on the anterior aspect of the elbow joint when the elbow is flexed to 90°. 	Olecranon Bottom: The lowest point of the elbow with the elbow joint flexed at 90°. 	Radiale: The highest point on the outside edge of the radius. 

Stylian: The lowest point of the distal radius. 	Centre Wrist Marker: The point on the dorsal aspect of the wrist, (at the level of the Stylian), at the mid-width of the wrist. 	Metacarpale II: The anterior point on the right second metacarpophalangeal joint. 
Metacarpale V: The posterior point on the right fifth metacarpophalangeal joint. 	Dactylion III, Right: The tip of the middle finger. 	Thumbtip: The tip of the right thumb. 
Crotch: The underside of the groin on the right side of the genitalia. 	Buttock Point Posterior: The point of maximal protrusion of the right buttock. 	Trochanter: A point at the centre of the lateral surface of the right greater trochanter on a sitting subject. 

Trochanterion: The superior point of the greater trochanter of the right femur on a standing subject. 	Thigh Point, Top: The highest point of the top of the right thigh on a seated subject. 	Lateral Femoral Epicondyle, Sitting: The lateral point of the right femoral epicondyle while seated. 
Lateral Femoral Epicondyle, Standing: The lateral point of the right femoral epicondyle. 	Suprapatella: The superior point of the patella. 	Knee Point, Anterior: The most protruding point of the right kneecap of the subject in Anthropometric Sitting posture. 
Midpatella: The anterior point midway between the top and bottom of the right patella. 	Dorsal Juncture of Calf and Thigh: The juncture between the right calf and thigh behind the knee for the subject in the Anthropometric Sitting posture. 	First Metatarsophalangeal Protrusion: The most medial protrusion of the right foot in the region of the first metatarsophalangeal joint. 

Fifth Metatarsophalangeal Protrusion: The most lateral protrusion of the right foot in the region of the fifth metatarsophalangeal joint. 	Lateral Malleolus: The most lateral point on the right lateral malleolus. 	Pternion: The most posterior point of the right heel. 
Acropodion: The tip of the first or second toe, whichever is longer. 		

BOUNDARY MANIKIN MEASUREMENTS

Dimension	A	B	C	D	E	F	G
	Overall smallest female	Widest male	Largest upper body:lower body male	Smallest upper body:lower body male	Overall largest male	Overall smallest male	Average male
M01 Cervicale Height (mm)	1355	1605	1546	1496	1595	1436	1526
M02 T2 Height (mm)	1304	1545	1501	1441	1557	1401	1496
M03 Acromion Height (mm)	1297	1505	1459	1419	1535	1371	1471
M04 Suprasternale Height (mm)	1289	1514	1472	1426	1510	1359	1467
M05 Substernale Height (mm)	1096	1348	1306	1264	1343	1201	1254
M06 Tenth Rib Height (mm)	988	1201	1132	1130	1201	1088	1157
M07 Iliocristale Height (mm)	957	1120	1095	1087	1123	997.5	1112
M08 Crotch Height (mm)	760	891	859	857	910	814	870
M09 Eye Height Sitting (mm)	750	841	858	750	831	770	820
M10 Acromion Height Sitting (mm)	559	606.5	644	562	636	595	609
M11 Elbow Rest Height (mm)	231.4	218.5	271	192	230	247	248
M12 Thigh Clearance (mm)	153	172	162	179	196	153	187
M13 Knee Height Sitting (mm)	484	571	564	561	581	534	566
M14 Popliteal Height (mm)	381	473	455	454	471	438	454
M15 Interpupillary Breadth (mm)	64	67	74	69	62	57	59
M16 Bizygomatic Breadth (mm)	125	142.5	121	125	141	132	138
M17 Biacromial Breadth (mm)	345	440	443	420	421	390	392
M18 Bideltoid Breadth (mm)	404	517	516	495	504	462	469.5
M19 Chest Breadth (mm)	259	331	292	320	326.9	280	323.5
M20 Chest Depth (mm)	226	237	260	244	290	236	221
M21 Bicristale Breadth (mm)	254	297	297	281	315	267	308.5
M22 Forearm-Forearm Breadth (mm)	411	614	542	545	528	545.5	525
M23 Abdominal Extension Depth Sitting (mm)	198	236	235	240	301	216	258.5
M24 Hip Breadth Sitting (mm)	369	386	394	345	415	341	377.5
M25 Buttock-Knee Length (mm)	543.5	645	608	610	669	571	622
M26 Buttock-Popliteal Length (mm)	452.5	524	509	495	568	464	503
M27 Foot Breadth (mm)	92	101	99	107	104.5	101	101
M28 Head Circumference (mm)	552.5	572	585	560	576	569	553
M29 Neck Circumference Base (mm)	379	442	445	449	442	430	429
M30 Shoulder Length (mm)	109.5	160	159	148	152	130	119
M31 Biceps Circumference Flexed (mm)	275.5	346	341	363	365	385	327
M32 Forearm Circumference Flexed (mm)	250	307	302	323	310	306	321

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Dimension	A	B	C	D	E	F	G
	Overall smallest female	Widest male	Largest upper body:lower body male	Smallest upper body:lower body male	Overall largest male	Overall smallest male	Average male
M33 Chest Circumference (mm)	842	1028	995	999	1060	947	999
M34 Chest Circumference Below Breast (mm)	715	-	-	-	-	-	-
M35 Waist Circumference Omphalion (mm)	731	843	882.5	846	1009	779	909
M36 Buttock Circumference (mm)	927	1017	1034	974	1109	912	1006
M37 Thumbtip Reach (mm)	684	898	760	750	847.5	747	809
M38 Stature (mm)	1593	1884	1808	1760	1843	1685	1800
M39 Sitting Height (mm)	864	982.7	976	913	956	896.6	940
M40 Weight (kg)	58	85.1	83.5	80.4	95.1	69.4	83.8
M41 Head Breadth (mm)	152.2	165.2	159.3	157.1	160.6	157.2	161.7
M42 Head Length (mm)	225.7	205.1	215	208.1	206	208.1	202.2
M43 Menton-Sellion Length (mm)	112.1	121.7	130.9	128.7	123.8	128	123.4
M44 Bitragion Submandibular Arc (mm)	245.5	326.6	293.1	297.7	325.3	311.3	312.1
M45 Neck Circumference (mm)	296.1	395.8	388.2	392.8	393.1	367.9	392.4
M46 Nape to Bustpoint Thelion Length (mm)	350.5	390.6	393.6	382.7	399.2	362.1	390.2
M47 Nape to Waist over Bust (mm)	568.3	681.1	641.4	623.2	694.2	611.2	692.3
M49 Scye Depth (mm)	179.4	225.1	209.6	182.8	224.7	194.4	185.5
M50 Back Width (mm)	289.3	410.6	373.1	379.4	370.2	354	384.6
M51 Back Length (mm)	427.6	490.3	466.5	430.2	495.4	448.3	432.7
M52 Nape to Waist Centre Back (mm)	472.2	569.8	523.1	485.2	591	493.3	550.5
M53 Vertical Trunk Circumference Wide (mm)	1496.9	1796	1786	1684	1782	1641	1797
M54 Crotch Length Omphalion (mm)	632.4	815	746.8	727.4	748.2	716.5	769.5
M55 Waist Circumference Preferred (mm)	811.3	884.4	902.5	872.1	1058	818.3	947.5
M56 Maximum Hip Circumference (mm)	961.5	1063	1078	1006	1126	949.4	1052
M58 High Hip (mm)	901	-	-	-	-	-	-
M59 Hip (mm)	961.2	1062	1080	1007	1133	919	1044
M60 Acromion-Radiale Length (mm)	290	364.4	338.6	349.6	350.3	318.9	342.6
M61 Radiale-Stylelon Length (mm)	232.2	289.1	270.2	250.8	297.7	241.3	266.2
M62 Sleeve Outseam (mm)	534	660.5	614.3	615	656	566.3	618
M63 Wrist Circumference (mm)	162.9	189.3	183.5	181.1	194.4	181.2	182.1
M64 Hand Circumference (mm)	185	237.8	207.7	211.3	223.8	215.6	220
M65 Hand Breadth (mm)	78.7	92.7	88.3	89.6	95.3	88.4	88.8
M66 Hand Length (mm)	175.5	207.4	200.1	191.4	189.7	201.8	196.3
M67 Thigh Circumference (mm)	573.5	617.4	636.9	585.1	706.8	582	635.8

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Dimension	A	B	C	D	E	F	G
	Overall smallest female	Widest male	Largest upper body:lower body male	Smallest upper body:lower body male	Overall largest male	Overall smallest male	Average male
M68 Knee Circumference (mm)	373.2	405.1	407.3	374.4	422.2	377.8	385.4
M69 Calf Circumference (mm)	391.7	388	395.6	408	390.9	384.8	375.2
M70 Ankle Circumference (mm)	228.6	238.4	234.3	233	222.3	229.4	220.8
M71 Foot Length (mm)	236.2	290.9	275.2	270.1	271.8	265.2	268.5
M72 Ball of Foot Length (mm)	187.8	216.6	199.3	204.3	202	204.9	197.5
M73 Seat Angle (°)	15.7	12.7	27.4	18.1	16.6	19.7	14.2
M75 Chest Level (mm)	-	1384	1308	1270	1339	1215	1305
M76 Bust Level (mm)	1131.6	-	-	-	-	-	-
M77 Waist Level Centre Front (mm)	902.2	1077	1013	999.3	1018	924.8	995.2
M78 Hip Level female (mm)	742.8	-	-	-	-	-	-
M79 Waist Level Centre Back (mm)	916.9	1090	1059	1028	1045	961.3	1001
M80 Seat Level (mm)	760.8	949.9	897.4	909.7	958.4	842.3	908.5
M81 Trochanteric Height (mm)	803.7	1023	912.1	930.5	968.3	888.9	916.5
M82 Hip Level (mm)	-	913.9	829.5	876.7	929.8	754	855
M83 Knee Level (mm)	431.8	530.7	508	501.2	519.7	480.7	492.3
M84 Ankle Height (mm)	73.6	73.4	82.4	65.1	70	71.9	72.1
M85 Front Length (mm)	332	394	377	339	387	361.5	355

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A Preliminary Anthropometry Standard for Australian Army Equipment Evaluation

Mark Edwards, Alistair Furnell, Jemma Coleman and Sheena Davis

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19. ABSTRACT Anthropometry is the measurement and comparison of different body shapes and sizes in the general population. This standard presents anthropometric data representative of Australian Defence Force (ADF) Army, specifies the summary values for 84 anthropometric dimensions, provides a set of boundary manikins and provides guidance on how the data presented can be used to perform anthropometric assessments to assess fit, clearance, reach, vision and/or posture of a human operator in a system using a risk based approach. The procedures and data provided within this standard are intended to be used to evaluate soldier systems for use by the Australian Army in terms of user fit, clearance, reach, vision and posture. Soldier systems that this is applicable to include land vehicles and body worn equipment. In addition to providing a method for producing verification evidence for completed system designs, it is intended that the data and procedures given in this standard can be used early in the design process to de-risk the design process as a built system is not a requirement of the processes described in this standard. It must be noted that the data provided in this report is representative of the 2012 ADF Army population. The impact of secular growth					

changes are not addressed in this standard and, should secular growth be identified as of importance, appropriate modifications should be made to the data contained in this standard.

This report supports Defence outcomes by providing an up to date anthropometric dataset that is representative of Australian Army personnel. This will allow assessments to be made of the performance of existing and new soldier systems in terms of fit, clearance, reach, vision and posture.

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