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James R. Roush

A. T. Still University of Health Sciences, jroush@atsu.edu

Kaylee L. Gombold

A. T. Still University of Health Sciences, kgombold@atsu.edu

R. Curtis Bay

A. T. Still University of Health Sciences, cbay@atsu.edu

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Normative Grip Strength Values in Males and Females, ages 50 to 89 years old

Purpose. To develop normative reference values for grip strength of males and females between the ages of 50 and 89 years old that can be used by health care professionals in clinical settings.

Methods. This study assessed data from a sample of males and females between the ages of 50 and 89 years old who participated in the Health and Retirement Study (HRS) sponsored by the National Institute on Aging. The Health and Retirement Study collected data from 6,266 participants in a physical measures sub-study. Grip strength was assessed in a standing position with the shoulder adducted and elbow flexed to 90 degrees. One practice trial was allowed and then the participant performed 2 maximal effort trials using each hand. Right and left hand mean scores were calculated. The HRS data were reported in kilograms.

Results. Subjects were stratified by sex and age. Each stratum was defined using 5-year intervals, male or female, and by right or left hand. Mean grip strength, standard deviation, sample size, and percentile ranks from 5 to 95 at intervals of 5 are reported for each stratum in both kilograms and pounds.

Conclusion. The normative values provided in this report should advance the clinical utility of grip strength as a physical measure. Percentile ranks are easy to determine and interpret for both the patient and clinician. Clinicians will benefit from the results of this study by better assessing the physical status of their patients, developing better goals for their patients, and providing better education to their patients on this aspect of physical health.

Author Bio(s)

James R. Roush, PT, PhD, ATC is a professor in the Physical Therapy Program at A. T. Still University of Health Sciences. Kaylee Gombold, PT, DPT, is a physical therapist in Minnesota. R. Curtis Bay, PhD, is a professor of Statistics in the Department of Interdisciplinary Studies at A. T. Still University of Health Sciences.



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Normative Grip Strength Values in Men and Women, Ages 50 to 89 Years' Old

James R. Roush, PT, PhD, ATC

Kaylee L. Gombold, PT, DPT

R. Curtis Bay, PhD

A. T. Still University

United States

Abstract

Purpose. The purpose was to develop normative reference values for grip strength of men and women between the ages of 50 and 89 years old that can be used by health care professionals in clinical settings. **Methods.** Data were analyzed from a sample of men and women between the ages of 50 and 89 years old who participated in the Health and Retirement Study (HRS) sponsored by the National Institute on Aging. Data collected from the Health and Retirement Study included 6,266 participants in a physical measures sub-study. Grip strength was assessed in a standing position with the shoulder adducted and elbow flexed to 90°. One practice trial was allowed and then the participant performed 2 maximal-effort trials using each hand. Right and left hand mean scores were calculated. The HRS data were reported in kilograms. **Results.** Subjects were stratified by sex and age. Each stratum was defined using five-year intervals, male or female sex, and right or left handedness. Mean grip strength, standard deviation, sample size, and percentile ranks from 5 to 95 at intervals of 5 were reported for each stratum in both kilograms and pounds. **Conclusion.** The normative values that were used in this report should advance the clinical utility of grip strength as a physical measure. Percentile ranks are easy to determine and interpret for both the patient and clinician. Clinicians will benefit from the results of this study by better assessing the physical status of their patients, developing better goals for their patients, and providing better education to their patients on this aspect of physical health.

INTRODUCTION

The hand performs many important functions, but its most distinctive trait is the ability to grip. During the aging process, many changes result in muscle weakness. These changes are associated with various morbidities. Gale et al reported that grip strength was a long-term predictor of mortality from all causes in men while Rantanen et al found that grip strength was strongly associated with impending mortality in older, disabled women.^{1,2} Simmons et al found a negative correlation between grip strength and probability of hospital admission.³ Leong et al noted that grip strength was more strongly predictive of mortality than systolic blood pressure.⁴

Grip strength measurements are used to provide clinicians with an indication of overall health, but interpretation of these data requires valid reference values so that patient measurements can be compared to age- and sex-specific normative data. The reference values for grip strength that are typically used in a clinical setting were developed by Mathiowetz et al in 1985.⁵ These values are based on a convenience sample of 310 male and 318 female participants, ranging in age from 20 to 94 years. The derived normative values were based on fewer than 30 subjects on average in each stratum. Little research has followed to help establish more robust normative values for grip strength. Clinicians have had little choice but to rely on Mathiowetz's normative values and have routinely accepted them as part of their practice.

During 2008, the Health and Retirement Study (HRS), sponsored by the National Institute on Aging, was used to collect data on various functional measures, including balance tests, walking speed, and grip strength from 6,266 individuals between the ages of 50 and 89. The Institute of Social Research at the University of Michigan⁶ conducted the study. The HRS was a longitudinal study of the economic, health, marital, and family status of older Americans in different living environments and different locations in the

United States.⁶ Normative values of grip strength for men and women at various ages may be calculated from these data. The purpose of this study was to establish clinical normative values, including percentile ranks for men and women between the ages of 50 and 89 years based on data collected in 2008 through the HRS.

METHODS

Data

Data for this project were acquired from HRS as a subset of data collected in 2008 from 6,266 participants. The Institutional Review Board for A. T. Still University of Health Sciences determined that this project was exempt from continuing review.

Data Collection Procedures

The HRS used testers trained to collect grip strength measurements using the Smedley spring-type, hand-held dynamometer (Scandidact, Denmark). The Smedley dynamometer records measurements to the nearest 0.5 kg of force. Guerra and Amaral reported that the Pearson correlation between forces recorded with the Smedley dynamometer and known forces was .98.⁷

Prior to dynamometer adjustment, participants provided consent to the HRS tester and confirmed that they had not had surgery, swelling, inflammation, severe pain, or injury in either of their hands in the past 6 months. After participants consented to the study, the tester adjusted the dynamometer for the individual's hand size. The lining of the bottom handle of the dynamometer was adjusted to the metacarpophalangeal joints, and the upper handle was adjusted to the second phalanx just above the interphalangeal joints of the index and little fingers. Subjects were placed in a standing position with the shoulder adducted and elbow flexed to 90°. Sitting and lying down were permitted if the subject was unable to assume the standing test position.

Participants were instructed to provide a maximal effort for several seconds and then release their grip. They were allowed to practice one time, and then the measurements were collected, using two trials from the right hand and two trials from the left hand. The average of the two trials for each hand was calculated.

Analyses

Data were weighted to account for differential probability in the selection process and nonresponse from potential participants, according to weights provided by HRS in order to accurately reflect the national population. Average grip strengths for the right and left hands and age and sex of participants were abstracted from the dataset.

Participants were stratified into 8 groups for each sex using an age interval of 5 years from 50 years to 89 years of age. Means and standard deviations for grip strength were calculated for age (50 to 54 years, 55 to 59 years, 60 to 64 years, 65 to 69 years, 70 to 74 years, 75 to 79 years, 80 to 84 years, and 85 to 89 years) and sex (male or female). Sample size for each of these strata was also calculated to assess the precision of our estimates. The goal was to estimate mean grip strength at a 99% confidence level and a margin of error of ± 5 pounds so that we would be 99% certain that the true population mean ranges from between 5 pounds lower and 5 pounds higher than the mean we obtained from the HRS survey. IBM SPSS 23 and Microsoft Excel statistical packages were used for all calculations.⁸ Data from the original HRS study were recorded in kilograms and reported to the nearest 0.5 kilograms. Data were reported in both kilograms and pounds (1 kg = 2.20 pounds).

RESULTS

A total of 2,582 men and 3,684 women provided data for grip strength measurement. The means and standard deviations for age, stratified by five-year intervals, are provided in Table 1. Means, standard deviations, and sample size for grip strength (in kilograms and pounds) stratified by 5 years and according to subjects' sex are found in Tables 2 and 3. Percentile ranks were calculated using the means and standard deviations. Percentile ranks for grip strength, stratified according to subjects' sex and age group can be found in Appendices 1 through 8. Percentile rank values for both men and women exhibited no overlap when expressed in pounds. Percentile rank values for the left hand in men between 85 and 89 years old overlapped across the 45th and 50th percentiles when expressed as kilograms (see Appendix 2). The percentile rank tables for women (measured in kilograms) demonstrated overlap across several age groups (Appendices 5 and 6).

DISCUSSION

As reported previously, grip strength decreases with age in both men and women.¹³⁻¹⁵ Decreased maximum grip strength is associated with limitations in a number of activities, including heavy housework, walking, climbing stairs, and lifting objects in older adults.⁹ Over the last 2 decades, grip strength has been touted as a simple and convenient measure to screen an individual's strength and to monitor changes over time.^{15,18-20} It has been used as an indicator of frailty in adults over the age of 65 years¹² and older and oncology patients.^{10,11} It may be predictive of future health,¹⁹ including all-cause death, cardiovascular death, and cardiovascular disease.⁴

Mathiowetz et al developed normative data for grip strength in 1985 for individuals between the ages of 20 years and 94 years.⁵ These data have been used in the instruction manuals for several prominent hand-held dynamometers, including the Jamar dynamometer and the Lafayette dynamometer.²¹ However, Mathiowetz et al employed a sample size of 628 volunteers. They divided the sample into 12 strata, which resulted in sample sizes between 21 and 29 subjects per stratum.⁵ They stratified their groups at five-year intervals, and all individuals over 75 years were combined into one stratum. These small sample sizes tend to yield unstable population estimates. The inclusion of all individuals over 75 into one group is ill-advised because there is considerable, uncaptured variability between 76- and 90-year-old patients. The normative data from the HRS reported in the current manuscript should provide more valid and current reference data about grip strength for clinicians.

Other reference values for grip strength have been published, but all suffer from inadequate sample sizes and/or strata, which are too wide to accurately capture the changes in grip strength, which occur quite rapidly with age. Budziareck et al provided grip strength data in dominant and non-dominant hands; however, their data were stratified using 30-year intervals.²² Corish and Kennedy provided reference values for grip strength based on 276 men and 598 women between 65 and 85 years, using intervals of 5 years.²³ Schlüssel et al presented reference values for 1,122 men and 1,928 women, using strata widths of 10 years.¹⁸ They categorized their subjects over the age of 70 years into one stratum. Luna-Heredia et al reported data for 229 men and 287 women, using strata of 10 years, and categorized their subjects over the age of 60 years into one stratum.²¹ Hanten et al also provided reference values for grip strength using 553 men and 629 women in strata of 5 years, but the upper limit of their sample was 65 years.²⁴ Werle et al provided reference values for grip strength for 507 men and 516 women between 20 years and greater than 85 years in strata of every 5 years, but the sample size in each stratum was low (ranging between 28 and 46 subjects).²⁵ Jansen et al also reported reference values for grip strength in a small sample between 65 years and greater than 85 years in strata of 5 years.²⁶ Finally, Spruit et al reported normative values from the United Kingdom for grip strength considering age, height, and measurement side in 102,972 men and 121,858 women between 39 and 73 years, using five-year strata.²⁷ However, they categorized all subjects over 65 years into one stratum.

Gunther et al reported correlations between grip strength and factors, such as weight, height, body mass index, forearm length, forearm circumference, hand width, hand length, and hand circumference.²⁸ Several of the relationships were reported to be significant (ie the relationship was not equal to 0). However, the coefficients of determination between grip strength and these factors were quite low; only a small amount of the variability in grip strength can be accounted for by any one of these factors.

Anakwe et al maintained that both age and sex were important in determining maximum grip strength measurements.²⁹ Their data showed that grip strength declines as an individual ages. Further, men show a greater decline than women. For both men and women, the right hand produces a greater mean grip strength measurement than the left hand in all age groups. Therefore, we have stratified our groups by age, sex, and handedness.

For data collected in the HRS study reported herein, the mean grip strength for two trials was used. Grip strength tends to decrease from the first to the third measurement in both men and women.³⁰ Using the mean of the first two measures may decrease the influence of fatigue. However, using the mean of two trials may have provided some difficulty in calculating the percentile ranks. We found some instances of overlap in percentile ranks. It is recommended that units of pounds be used as it is easier to discriminate between percentile ranks.

Challenges exist when comparing this study to the currently accepted normative values. Data were analyzed based on the Smedley-type dynamometer, whereas Mathiowetz et al used the Jamar dynamometer (Lafayette Instrument Co, Lafayette, IN). Innes reported that the Smedley dynamometer has excellent test-retest reliability similar to that of the Jamar dynamometer.³⁰ Therefore, clinicians should exercise caution when using a dynamometer other than the Smedley.

This testing position also differs from the one used by Mathiowetz et al.⁵ The standard testing position is seated with shoulder adducted and elbow flexed to 90°. The subjects in the HRS study were asked to stand with shoulder adducted and elbow flexed to 90°. If subjects were unable to maintain standing, they were permitted to complete the test either seated or in a supine position,

but they maintained shoulder adduction and elbow flexion to 90°. Amosun et al reported that a standing position produced a higher grip strength measurement.³¹ Further investigation is needed to determine if these reference values can be applied to individuals with comorbidities who are unable to stand during the test.

With the sample sizes for each of the hand grip estimates reported in the current study, we were 99% confident that the true population mean was within a half-width of 5 pounds with two exceptions: men between 50 and 54 years and men between 85 and 89 years. The sample size required to achieve 99% confidence \pm 5 pounds was 57, and our sample was 44. For men 85 to 89 years, the sample size required for our confidence interval was 189, and the HRS data provided 139. Caution should be exercised when interpreting the estimates for these two, underrepresented groups.

CONCLUSION

Assessment of grip strength may be underutilized in the physical therapy setting,³² which may be due to the lack of clinician knowledge, accessibility to hand dynamometers, or minimal statistical support for the current normative values. There have been no normative values developed with large sample sizes. Studies have been completed regarding testing position, validity and reliability of specific hand dynamometers, and an individual's overall strength when compared with grip strength, but research regarding a single individual's grip strength compared with population values is minimal. Through this study, reference values with a large sample size can be used in a clinical setting to provide an alternative to the reference values from the Matiwetz et al.⁵ The HRS data were used to develop means, standard deviations, and percentile ranks for individuals between the ages of 50 and 89 years old, stratified by five-year age groups and sex. As clinical practice continues to advance and the population continues to age, we need to incorporate an array of objective measures that are reliable, convenient, and efficient for screening. Grip strength provides a comprehensive physical assessment that can be completed within one minute. With the development of normative values, clinicians are now able to use grip strength in their clinical practice and provide their patients/clients with information and data illustrating how their strength compares with that of other individuals similar in age and of the same sex.

TABLE 1. Means and Standard Deviation for Age According to Stratum and Sex

Age (yrs)	Sex	Mean	SD \pm	n
50 to 54	Male	52.26	1.45	44
	Female	52.46	1.35	197
55 to 59	Male	57.01	1.39	411
	Female	56.99	1.46	550
60 to 64	Male	61.80	1.35	317
	Female	61.93	1.42	515
65 to 69	Male	67.37	1.35	474
	Female	67.13	1.37	681
70 to 74	Male	71.85	1.40	518
	Female	71.92	1.43	706
75 to 79	Male	76.91	1.33	413
	Female	76.91	1.39	506
80 to 84	Male	81.86	1.40	266
	Female	81.90	1.40	309
85 to 89	Male	86.66	1.34	139
	Female	86.78	1.39	220
TOTAL	Male	69.73	9.00	2582
	Female	68.84	9.41	3684

\pm SD = standard deviation

TABLE 2. Means and Standard Deviations for Grip Strength (kg) According to Age and Sex

Age (yrs)	Hand	Mean	SD _±	Mean	SD _±
50 to 54	Right	44.72	9.60	28.19	6.29
	Left	42.22	9.75	25.56	5.60
55 to 59	Right	44.89	9.20	26.90	6.33
	Left	40.86	8.72	24.34	5.61
60 to 64	Right	42.10	9.99	25.58	6.08
	Left	39.32	9.00	23.05	5.55
65 to 69	Right	40.00	8.28	24.17	5.97
	Left	36.39	7.81	21.62	5.16
70 to 74	Right	36.90	8.45	23.01	5.59
	Left	34.39	7.77	20.58	9.29
75 to 79	Right	34.27	7.94	20.91	5.36
	Left	31.36	7.38	18.49	4.95
80 to 84	Right	30.35	8.07	18.87	4.76
	Left	27.84	7.35	16.73	4.21
85 to 89	Right	28.41	7.95	16.93	4.46
	Left	25.49	7.20	15.22	4.77

± SD = standard deviation

TABLE 3. Means and Standard Deviations for Grip Strength (Pounds) According to Age and Sex

Age (yrs)	Hand	<u>Men</u>		<u>Women</u>	
		Mean	<i>SD</i> _±	Mean	<i>SD</i> _±
50 to 54	Right	98.59	21.16	62.16	13.87
	Left	93.07	21.49	56.35	12.34
55 to 59	Right	98.96	20.28	59.31	13.96
	Left	90.08	19.21	53.66	12.37
60 to 64	Right	92.81	22.02	56.38	13.41
	Left	86.69	19.84	50.82	12.23
65 to 69	Right	88.18	18.25	53.29	13.16
	Left	80.23	17.21	47.67	11.37
70 to 74	Right	81.36	18.63	50.72	12.32
	Left	75.81	17.14	45.36	10.89
75 to 79	Right	75.55	17.51	46.11	11.81
	Left	69.13	16.27	40.77	10.90
80 to 84	Right	66.91	17.79	41.60	10.49
	Left	61.38	16.20	36.88	9.28
85 to 89	Right	62.63	17.52	37.33	10.19
	Left	56.21	15.87	33.56	10.51

±SD = standard deviation

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APPENDIX 1. Percentile Ranks for Men–Right Hand (kg)

Percentile rank	<u>Age Stratum</u>							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	61	60	59	52	51	47	44	41
90	57	57	55	49	48	44	41	39
85	55	54	52	47	46	43	39	37
80	53	53	51	45	44	41	37	35
75	51	51	49	44	43	40	36	34
70	50	50	47	42	41	38	35	33
65	48	48	46	41	40	37	33	31
60	47	47	45	40	39	36	32	30
55	46	46	43	39	38	35	31	29
50	45	45	42	38	37	34	30	28
45	44	44	41	37	36	33	29	27
40	42	43	40	36	35	32	28	26
35	41	41	38	35	34	31	27	25
30	40	40	37	34	32	30	26	24
25	38	39	35	32	31	29	25	23
20	37	37	34	31	30	28	24	22
15	35	35	32	29	28	26	22	20
10	32	33	29	27	26	24	20	18
5	29	30	26	24	23	21	17	15

APPENDIX 2. Percentile Ranks for Men—Left Hand (kg)

Percentile rank	<u>Age Stratum</u>							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	58	55	54	39	47	43	40	37
90	55	52	51	36	44	41	37	35
85	52	50	49	34	42	39	35	33
80	50	48	47	33	41	38	34	32
75	49	47	45	32	40	36	33	30
70	47	45	44	30	38	35	32	29
65	46	44	43	29	37	34	31	28
60	45	43	42	28	36	33	30	27
55	43	42	40	27	35	32	29	26
50	42	41	39	26	34	31	28	25
45	41	40	38	25	33	30	27	25
40	40	39	37	24	32	29	26	24
35	38	38	36	23	31	29	25	23
30	37	36	35	22	30	27	24	22
25	36	35	33	21	29	26	23	21
20	34	34	32	20	28	25	22	19
15	32	32	30	18	26	24	20	18
10	30	30	28	16	24	22	18	16
5	26	27	25	13	22	19	16	14

APPENDIX 3. Percentile Ranks for Men—Right Hand (Pounds)

Percentile rank	<u>Age Stratum</u>							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	133	132	129	118	112	104	96	91
90	126	125	121	112	105	98	90	85
85	121	120	116	107	101	94	85	81
80	116	116	111	104	97	90	82	77
75	113	113	108	100	94	87	79	74
70	110	110	104	98	91	85	76	72
65	107	107	101	95	89	82	74	69
60	104	104	98	93	86	80	71	67
55	101	102	96	90	84	78	69	65
50	99	99	93	88	81	76	67	63
45	96	96	90	86	79	73	65	60
40	93	94	87	84	77	71	62	58
35	90	91	84	81	74	69	60	56
30	87	88	81	79	72	66	58	53
25	84	85	78	76	69	64	55	51
20	81	82	74	73	66	61	52	48
15	77	78	70	69	62	57	48	44
10	71	73	65	65	57	53	44	40
5	64	66	57	58	51	47	38	34

APPENDIX 4. Percentile Ranks for Men—Left Hand (Pounds)

Percentile rank	<u>AgeStratum</u>							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	128	122	119	109	104	96	88	82
90	121	115	112	102	98	90	82	77
85	115	110	107	98	94	86	78	73
80	111	106	103	95	90	83	75	70
75	108	103	100	92	87	80	72	67
70	104	100	97	89	85	78	70	65
65	101	97	94	87	82	75	68	62
60	99	95	92	85	80	73	65	60
55	96	92	89	82	78	71	63	58
50	93	90	87	80	76	69	61	56
45	90	88	84	78	74	67	59	54
40	88	85	82	76	71	65	57	52
35	85	83	79	74	69	63	55	50
30	82	80	76	71	67	61	53	48
25	79	77	73	69	64	58	50	45
20	75	74	70	66	61	55	48	43
15	71	70	66	62	58	52	45	40
10	66	65	61	58	54	48	41	36
5	58	58	54	52	48	42	35	30

APPENDIX E. Percentile Ranks for Women—Right Hand (kg)

Percentile rank	AgeStratum							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	39	37	36	34	32	30	27	25
90	36	35	33	32	30	28	25	23
85	35	33	32	30	29	26	24	22
80	33	32	31	29	28	25	23	21
75	32	31	30	28	27	25	22	20
70	31	30	29	27	26	24	21	19
65	31	29	28	26	25	23	21	19
60	30	29	27	26	24	22	20	18
55	29	28	26	25	24	22	19	18
50	28	27	26	24	23	21	19	17
45	27	26	25	23	22	20	18	16
40	27	25	24	23	22	20	18	16
35	26	24	23	22	21	19	17	15
30	25	24	22	21	20	18	16	15
25	24	23	21	20	19	17	16	14
20	23	22	20	19	18	16	15	13
15	22	20	19	18	17	15	14	12
10	20	19	18	17	16	14	13	11
5	18	16	16	14	14	12	11	9

APPENDIX 5. Percentile Ranks for Women–Left Hand (kg)

Percentile rank	<u>Age Stratum</u>							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	35	34	32	30	29	27	24	23
90	33	32	30	28	27	25	22	21
85	31	30	29	27	26	24	21	20
80	30	29	28	26	25	23	20	19
75	29	28	27	25	24	22	20	18
70	28	27	26	24	23	21	19	18
65	28	27	25	24	22	20	18	17
60	27	26	24	23	22	20	18	16
55	26	25	24	22	21	19	17	16
50	26	24	23	22	21	18	17	15
45	25	24	22	21	20	18	16	15
40	24	23	22	20	19	17	16	14
35	23	22	21	20	19	17	15	13
30	23	21	20	19	18	16	15	13
25	22	21	19	18	17	15	14	12
20	21	20	18	17	16	14	13	11
15	20	19	17	16	15	13	12	10
10	18	17	16	15	14	12	11	9
5	16	15	14	13	12	10	10	7

APPENDIX 6. Percentile Ranks for Women–Right Hand (Pounds)

Percentile rank	<u>AgeStratum</u>							
	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	85	82	78	75	71	66	59	54
90	80	77	74	70	67	61	55	50
85	77	74	70	67	63	58	52	48
80	74	71	68	64	61	56	50	46
75	72	69	65	62	59	54	49	44
70	69	67	63	60	57	52	47	43
65	68	65	62	58	55	51	46	41
60	66	63	60	57	54	49	44	40
55	64	61	58	55	52	48	43	39
50	62	59	56	53	51	46	42	37
45	60	58	55	52	49	45	40	36
40	59	56	53	50	48	43	39	35
35	57	54	51	48	46	42	38	33
30	55	52	49	46	44	40	36	32
25	53	50	47	44	42	38	35	30
20	50	48	45	42	40	36	33	29
15	48	45	42	40	38	34	31	27
10	44	41	39	36	35	31	28	24
5	39	36	34	32	30	27	24	21

APPENDIX H. Percentile Ranks for Women–Left Hand (Pounds)

Percentile rank	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89
95	77	74	71	66	63	59	52	51
90	72	70	66	62	59	55	49	47
85	69	66	63	59	57	52	47	44
80	67	64	61	57	55	50	45	42
75	65	62	59	55	53	48	43	41
70	63	60	57	54	51	46	42	39
65	61	58	56	52	50	45	40	38
60	59	57	54	51	48	44	39	36
55	58	55	52	49	47	42	38	35
50	56	54	51	48	45	41	37	34
45	55	52	49	46	44	39	36	32
40	53	51	48	45	43	38	35	31
35	52	49	46	43	41	37	33	30
30	50	47	44	42	40	35	32	28
25	48	45	43	40	38	33	31	26
20	46	43	41	38	36	32	29	25
15	44	41	38	36	34	29	27	23
10	41	38	35	33	31	27	25	20
5	36	33	31	29	27	23	22	16