A Technical Note

Basic gait parameters: Reference data for normal subjects, 10-79 years of age

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Abstract—Basic gait parameters were extracted from 233 healthy subjects—116 men and 117 women, 10 to 79 years of age. The measurements were made in a gait laboratory on a 5.5 m walkway. The results are presented in a series of reference tables for slow, normal, and fast gait. Mean, standard deviation, coefficient of variation, 95% confidence intervals, and 95% prediction intervals were calculated. Significant sex differences exist in all gait parameters. In a two-way analysis of variance (ANOVA) model, there was a statistically significant age-variability for gait speed and step length at normal and fast gait, but not for step frequency. In the step length parameter there was a significant interaction effect of age and sex at normal and fast gait. The reference data are considered valid in an indoor laboratory situation.

Key words: *gait, gait parameters, stride characteristics.*

INTRODUCTION

The basic gait parameters most frequently used are velocity, step length, and step frequency. Many reports are concerned with pathological gait, but such data must be compared with valid normal reference data to be interpretable. Published data are generally limited to specific groups, for example, normal men (1), normal women (2), and elderly women (3,4). These reports are often based on relatively small numbers of subjects, spread over many age groups. Different investigators use varying units of measurement, further hampering comparisons. Reference data for outdoor walking, based on measurements from 260 subjects, men and women divided into four age groups, have been published (5). The aim of this study was to present reference data on basic gait parameters for normal subjects.

MATERIAL AND METHODS

Subjects

Two hundred and forty healthy subjects were examined. However, seven subjects were excluded from the original material, 3 girls and 3 boys aged 0-9 years, and one subject aged 80, because they were too few to represent an age group. Age and sex characteristics are shown in **Table 1.**

Gait Analysis

We have used the gait analysis method that was developed at the Biomechanics Laboratory, University of California, Berkeley, California, and the

Table 1.

Age and sex characteristics of the subjects.

| Age group, years	Number		
	Men	Women	Total
10-19	27	27	54
20-29	15	15	30
30-39	15	15	30
40-49	15	15	30
50-59	15	15	30
60-69	15	15	30
70-79	14	15	29
Total	116	117	233

Department of Orthopaedic Surgery at the University of Uppsala, Sweden (6). The method was later further developed at the Department of Biomechanics and Orthopaedic Technology, Jönköping, Sweden. The gait laboratory has a walkway about

10 m long, including acceleration and deceleration distances. Two photocells with 5.5 m intervals, self-aligning electrogoniometers, a computer, and a plotter constitute the equipment used **(Figure 1)**. The measurement was performed between the two photocells. Goniometry was not used in the present study. Heel strike was indicated by means of a manual switch.

Basic temporal gait parameters (gait speed, step length, and step frequency) were collected during slow, normal, and fast gait. The subject had to walk between the photocells 13 times—10 times without goniometers, and 3 times with goniometers. The mean of the 10 measurements without goniometers was calculated for each gait parameter.

Statistical Methods

Analysis of variance (ANOVA) and regression analysis were performed according to standard methods (7,8). All computations were made with a commercial statistics package for a personal computer, SYSTAT 5.0/SYGRAPH 1.0.

Average velocity, $V = D/T_D$ cm/s

Average step frequency, $F = N/T_N$ steps/s

Average step length, $L = V/F$ cm
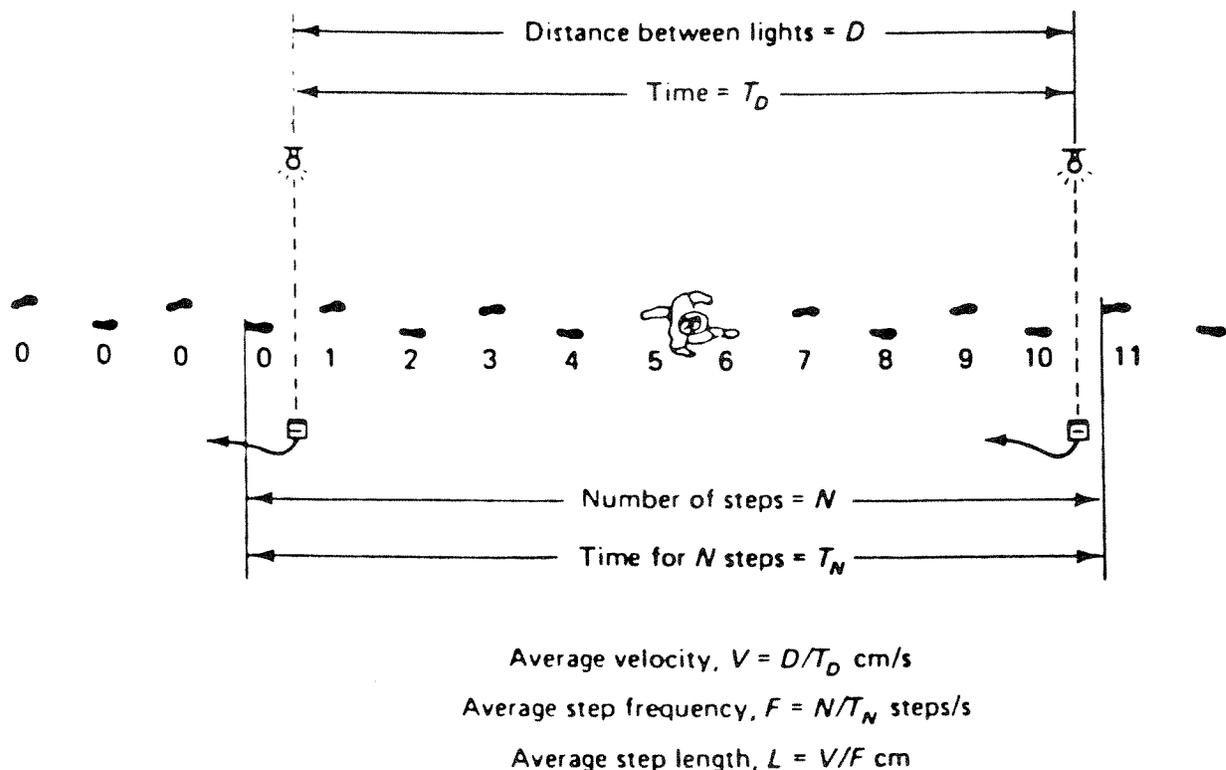
Figure 1.

Schematic top view of the walkway showing the measured variables desired for analysis (after Öberg and Lamoreaux, 1979).

RESULTS

Reference tables for slow, normal, and fast gait for different age groups and sexes are shown in the **Appendix** (*see p. 215*), and include mean, standard deviation, coefficient of variation, 95 percent confidence interval, and 95 percent prediction interval.

The results of one- and two-way ANOVA are presented in **Table 2** and **Table 3**. The results of regression analysis are presented in **Table 4**.

Table 2.
Gait parameters. One-way analysis of variance.

		p-value	
		Age group	Sex
Gait speed	Slow gait	N.S.	<0.001
	Normal gait	<0.01	<0.001
	Fast gait	<0.001	<0.001
Step length	Slow gait	N.S.	<0.001
	Normal gait	N.S.	<0.001
	Fast gait	<0.05	<0.001
Step frequency	Slow gait	N.S.	N.S.
	Normal gait	N.S.	<0.001
	Fast gait	N.S.	<0.001

N.S. = Not significant (p>0.05)

Table 3.
Gait parameters. Two-way analysis of variance.

		p-value		
		Age group	Sex	Age * Sex
Gait speed	Slow gait	N.S.	<0.001	N.S.
	Normal gait	<0.001	<0.001	N.S.
	Fast gait	<0.01	<0.001	N.S.
Step length	Slow gait	N.S.	<0.001	<0.05
	Normal gait	<0.01	<0.001	<0.05
	Fast gait	<0.001	<0.001	N.S.
Step frequency	Slow gait	N.S.	N.S.	N.S.
	Normal gait	N.S.	<0.001	N.S.
	Fast gait	N.S.	<0.001	N.S.

N.S. = Not significant (p>0.05)

Table 4.
Gait parameters and age. Regression analysis. Test for significant slope of regression line.

		p-value	
		Men	Women
Gait speed	Slow gait	N.S.	<0.05
	Normal gait	<0.05	N.S.
	Fast gait	<0.05	<0.01
Step length	Slow gait	N.S.	<0.01
	Normal gait	N.S.	<0.01
	Fast gait	N.S.	<0.001
Step frequency	Slow gait	N.S.	N.S.
	Normal gait	<0.001	N.S.
	Fast gait	<0.05	N.S.

N.S. = Not significant (p>0.05)

DISCUSSION

Methodological Considerations

The results of all measurements, including gait analysis, are dependent on the test conditions. Consequently, reference data are only valid for a test situation similar to the conditions of the original reference test situation. Gait analysis data should always be interpreted with regard to a thoroughly defined test situation. Dahlstedt (9) reviewed 15 articles with respect to walking speed. He found values of 1.3-1.6 m/s for men and 1.3-1.5 m/s for women for normal self-selected gait. The mean speed in shopping centers was 1.17 m/s for women, and 1.33 m/s for men (10). However, laboratory gait data cannot be considered valid for such practical walking situations. We have a general impression that gait velocity data reported from long walkways tend to be higher than data obtained from a short walkway.*

These observations are supported by the results of a study by Waters et al. (5), who examined 260 healthy subjects aged 6 to 80 years along a level outdoor track of 60.5 m. In the present study, using a 5.5 m walkway with a 2.5 acceleration distance, and a 2.5 m retardation distance, we found mean normal self-selected gait speed to be 118-134 cm/s

*Healthy subjects tested in a long basement corridor, 65 m walking distance (Öberg U, Öberg T, unpublished observations).

for men and 110–129 cm/s for women. Thus, our values were slightly lower than those reported in the review of Dahlstedt. Murray et al. found the self-selected gait speed to be 151 cm/s for men (1), and 130 cm/s for women (2). Compared with the results of Waters et al., gait speed was lower in slow and normal gait in our study, but at fast gait the results were equivalent in the two studies. We also found higher step frequencies and lower step lengths at all gait speeds in our study. These results indicate that the gait pattern is different in indoor and outdoor gait. Most gait analysis is performed on relatively short indoor walkways. Thus, the results of our study together with the Waters et al. study seem to indicate that there is a need for separate reference data for free gait outdoors or on a long walk-way, and for short walkways in laboratory situations.

Sex Differences

Gait velocity and step length were lower, and step frequency was higher for women than for men. In the ANOVA, the influence of sex was highly statistically significant except for step frequency at slow gait. These results are in accordance with the results reported in the literature (1,2).

Age Effects

The changes of the basic gait parameters most frequently seen with advancing age are a reduction of gait speed and step length, but only small changes of the step frequency (11). In our study we found statistically significant age-related changes in gait speed at normal and fast gait and of step length at fast gait in the one-way ANOVA, and almost the same results were found in the two-way ANOVA (where also interaction effects were evaluated). In the two-way ANOVA there were no age variations with respect to step frequency. These findings are in general agreement with the findings reviewed by Winter (11). The magnitude of age-related reduction of gait velocity reported in the literature varies between 0.1 percent/year and 0.7 percent/year (3,12,13,14). Such differences between different studies may be due to differences between the examined groups and differences in technique as well. In the two-way ANOVA model, we also found significant interaction effects of age and sex in the step length parameter.

In old age groups (over 70 years), Dahlstedt (9) found slow pedestrians with a normal gait speed of only 0.9 m/s, a high speed of 1.1 m/s, and very high speed of 1.3 m/s. However, in our study, we had only few people of these old ages, and none over the age of 80.

Practical Use of the Reference Data

Our data may be used for the interpretation of gait analysis data, collected in a laboratory situation comparable with that of ours, for both healthy adults and those with neuromuscular or other pathology.

CONCLUSION

We have presented reference data for basic gait parameters in slow, normal, and fast gait for healthy subjects aged 10–79 years to be applied on gait measurements on short walkways under laboratory conditions.

REFERENCES

1. Murray MP, Kory RC, Clarkson BH, Sepic SB. Comparison of free and fast speed walking patterns of normal men. Am J Phys Med 1966:45:8-24.
2. Murray MP, Kory RC, Sepic SB. Walking patterns of normal women. Arch Phys Med Rehabil 1970:51:637-50.
3. Finley FR, Cody KA, Finizie RV. Locomotion patterns in elderly women. Arch Phys Med Rehabil 1969:50:140-7.
4. Leiper CI, Craik RL. Relationships between physical activity and temporal-distance characteristics of walking in elderly women. Phys Ther 1991:71:791-803.
5. Waters RL, Lunsford BR, Perry J, Byrd R. Energy-speed relationship of walking: standard tables. J Orthop Res 1988:5:215-22.
6. Öberg K, Lamoreux LW. Gait assessment of total joint replacement patients by means of step parameters and hip-knee angle diagrams. In: Kenedi R, Paul J, Hughes J, eds. Disabilities. London: McMillan, 1950.
7. Armitage P, Berry G. Statistical methods in medical research. 2d ed. Oxford: Blackwell Scientific Publications, 1987.
8. Altman DG. Practical statistics for medical research. London: Chapman and Hall, 1991.
9. Dahlstedt S. Slow pedestrians: walking speeds and walking habits of old-aged people. Stockholm: The Swedish Council for Building Research, Report R2:1978, 1977.
10. Braun WI. The pedestrian. In: Evans HK, ed. Traffic engineering handbook, 2d ed. New Haven: ITE, 1950.
11. Winter D. The biomechanics and motor control of human gait: normal, elderly and pathological. 2d ed. Waterloo: University of Waterloo Press, 1991.

12. Cunningham DA, Rechnitzer PA, Pearce ME, Donner AP. Determinants of self-selected walking pace across ages 19 to 66. J Gerontol 1982:37:560-4.

13. Blanke D, Hageman P. Comparison of gait of young and elderly men. Phys Ther 1989:69:144-8.

14. Bendall MJ, Bassey EJ, Pearson MB. Factors affecting walking speed of elderly people. Age Aging 1989:18:327-32.

Appendix

Basic Gait Parameters

Tables

Table 1a.
Gait speed. Slow gait. Men.

Age years	N	Mean cm/s	S.D. cm/s	C.V.	95% C.I. cm/s	95% P.I. cm/s
10-14	12	88.7	12.0	0.14	81.1-96.3	62.3-115.1
15-19	15	85.7	21.4	0.25	73.5-97.9	38.6-132.8
20-29	15	83.1	9.1	0.11	78.2-88.0	64.0-102.2
30-39	15	88.3	18.9	0.21	78.1-98.5	48.6-128.0
40-49	15	93.5	10.4	0.11	87.7-99.1	71.7-115.3
50-59	15	85.8	16.1	0.19	77.1-94.5	52.0-119.6
60-69	15	87.9	13.3	0.15	80.7-95.1	60.0-115.8
70-79	14	79.5	13.7	0.17	71.8-87.2	50.7-108.3

Table 1b.
Gait speed. Slow gait. Women.

Age years	N	Mean cm/s	S.D. cm/s	C.V.	95% C.I. cm/s	95% P.I. cm/s
10-14	12	70.1	12.8	0.18	62.0-78.2	41.9-98.3
15-19	15	91.3	21.4	0.23	79.1-103.5	44.2-138.4
20-29	15	83.7	19.7	0.24	73.0-94.4	42.3-125.1
30-39	15	86.7	15.7	0.18	78.2-95.2	53.7-119.7
40-49	15	79.2	18.2	0.23	69.3-89.1	41.0-117.4
50-59	15	72.9	15.7	0.22	64.4-81.4	39.9-105.9
60-69	15	73.9	18.3	0.25	64.0-83.8	35.5-112.3
70-79	15	73.5	10.1	0.14	68.0-79.0	52.3-94.7

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 2a.

Gait speed. Normal gait. Men.

Age years	N	Mean cm/s	S.D. cm/s	C.V.	95% C.I. cm/s	95% P.I. cm/s
10-14	12	132.3	19.6	0.15	119.9-144.7	89.2-175.4
15-19	15	135.1	13.3	0.10	127.5-142.7	105.8-164.4
20-29	15	122.7	11.1	0.09	116.7-128.7	99.4-146.0
30-39	15	131.6	15.0	0.11	123.5-139.7	100.1-163.1
40-49	15	132.8	9.8	0.07	127.5-138.1	112.2-153.4
50-59	15	125.2	17.7	0.14	115.6-134.8	88.0-162.4
60-69	15	127.7	12.4	0.10	121.0-134.4	101.7-153.7
70-79	14	118.2	15.4	0.13	109.8-126.6	85.9-150.5

Table 2b.

Gait speed. Normal gait. Women.

Age years	N	Mean cm/s	S.D. cm/s	C.V.	95% C.I. cm/s	95% P.I. cm/s
10-14	12	108.6	11.2	0.10	101.5-115.7	84.0-133.2
15-19	15	123.9	17.5	0.14	114.0-133.8	85.4-162.4
20-29	15	124.1	17.1	0.14	114.8-133.4	88.2-160.0
30-39	15	128.5	19.1	0.15	118.1-138.9	88.4-168.6
40-49	15	124.7	14.4	0.12	116.9-132.5	94.5-154.9
50-59	15	110.5	9.7	0.09	105.2-115.8	90.1-130.9
60-69	15	115.7	16.7	0.14	106.6-124.8	80.6-150.8
70-79	15	111.3	12.5	0.11	104.5-118.1	85.1-137.6

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 3a.
Gait speed. Fast gait. Men.

Age years	N	Mean cm/s	S.D. cm/s	C.V.	95% C.I. cm/s	95% P.I. cm/s
10-14	12	167.9	32.1	0.19	147.5-188.3	97.3-238.5
15-19	15	184.3	17.0	0.09	174.6-194.0	146.9-221.7
20-29	15	162.6	20.1	0.12	151.7-173.5	120.4-204.8
30-39	15	176.8	28.5	0.16	161.3-192.3	117.0-236.7
40-49	15	171.7	17.6	0.10	162.2-181.2	134.7-208.7
50-59	15	164.0	24.6	0.15	150.7-177.3	112.3-215.7
60-69	15	163.9	20.2	0.12	152.9-174.9	121.5-206.3
70-79	14	158.6	24.9	0.16	144.6-172.6	106.3-210.9

Table 3b.
Gait speed. Fast gait. Women.

Age years	N	Mean cm/s	S.D. cm/s	C.V.	95% C.I. cm/s	95% P.I. cm/s
10-14	12	146.7	17.6	0.12	135.5-157.9	108.0-185.4
15-19	15	163.1	21.5	0.13	150.9-175.3	115.8-210.4
20-29	15	169.3	23.0	0.14	156.8-181.8	121.0-217.6
30-39	15	172.1	28.0	0.16	156.9-187.3	113.3-230.9
40-49	15	166.7	17.9	0.11	157.0-176.4	129.1-204.3
50-59	15	147.1	18.1	0.12	137.3-156.9	109.1-185.1
60-69	15	155.5	23.2	0.15	142.9-168.1	106.8-204.2
70-79	15	141.8	17.3	0.12	132.1-151.5	105.5-178.1

N   = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 4a.

Step frequency. Slow gait. Men

Age years	N	Mean steps/s	S.D. steps/s	C.V.	95% C.I. steps/s	95% P.I. steps/s
10-14	12	1.68	0.19	0.11	1.56-1.80	1.26-2.10
15-19	15	1.55	0.29	0.19	1.39-1.71	0.91-2.19
20-29	15	1.55	0.13	0.08	1.53-1.57	1.28-1.82
30-39	15	1.55	0.25	0.16	1.41-1.69	1.03-2.08
40-49	15	1.63	0.12	0.07	1.56-1.70	1.38-1.88
50-59	15	1.53	0.15	0.10	1.45-1.61	1.22-1.85
60-69	15	1.55	0.19	0.12	1.45-1.65	1.15-1.95
70-79	14	1.49	0.14	0.09	1.41-1.57	1.20-1.78

Table 4b.

Step frequency. Slow gait. Women.

Age years	N	Mean steps/s	S.D. steps/s	C.V.	95% C.I. steps/s	95% P.I. steps/s
10-14	12	1.48	0.21	0.14	1.35-1.61	1.02-1.94
15-19	15	1.68	0.21	0.13	1.56-1.80	1.22-2.14
20-29	15	1.59	0.20	0.13	1.48-1.70	1.17-2.01
30-39	15	1.632	0.18	0.11	1.53-1.73	1.25-2.01
40-49	15	1.61	0.24	0.15	1.48-1.74	1.11-2.11
50-59	15	1.54	0.29	0.19	1.38-1.70	0.93-2.15
60-69	15	1.50	0.28	0.19	1.35-1.65	0.91-2.09
70-79	15	1.53	0.12	0.08	1.46-1.60	1.28-1.78

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 5a.
Step frequency. Normal gait. Men.

Age years	N	Mean steps/s	S.D. steps/s	C.V.	95% C.I. steps/s	95% P.I. steps/s
10-14	12	2.14	0.19	0.09	2.02-2.26	1.72-2.56
15-19	15	2.02	0.20	0.10	1.91-2.13	1.58-2.46
20-29	15	1.98	0.13	0.07	1.91-2.05	1.71-2.25
30-39	15	2.00	0.14	0.07	1.92-2.08	1.71-2.29
40-49	15	2.01	0.11	0.05	1.95-2.07	1.78-2.24
50-59	15	1.96	0.18	0.09	1.86-2.06	1.58-2.34
60-69	15	1.95	0.14	0.07	1.87-2.03	1.66-2.24
70-79	14	1.91	0.14	0.07	1.83-1.99	1.62-2.20

Table 5b.
Step frequency. Normal gait. Women.

Age years	N	Mean steps/s	S.D. steps/s	C.V.	95% C.I. steps/s	95% P.I. steps/s
10-14	12	1.97	0.17	0.09	1.86-2.08	1.60-2.34
15-19	15	2.09	0.18	0.09	1.99-2.19	1.69-2.49
20-29	15	2.08	0.15	0.07	2.00-2.16	1.77-2.40
30-39	15	2.13	0.17	0.08	2.04-2.22	1.77-2.49
40-49	15	2.16	0.16	0.07	2.07-2.25	1.82-2.50
50-59	15	2.03	0.13	0.06	1.96-2.10	1.76-2.30
60-69	15	2.06	0.18	0.09	1.96-2.16	1.68-2.44
70-79	15	2.03	0.14	0.07	1.95-2.11	1.74-2.32

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 6a.
Step frequency. Fast gait. Men.

Age years	N	Mean steps/s	S.D. steps/s	C.V.	95% C.I. steps/s	95% P.I. steps/s
10-14	12	2.51	0.29	0.12	2.33-2.69	1.87-3.15
15-19	15	2.41	0.24	0.10	2.27-2.55	1.88-2.94
20-29	15	2.34	0.17	0.07	2.25-2.43	1.98-2.70
30-39	15	2.39	0.24	0.10	2.26-2.52	1.87-2.89
40-49	15	2.39	0.21	0.09	2.28-2.50	1.95-2.83
50-59	15	2.33	0.31	0.13	2.16-2.50	1.68-2.98
60-69	15	2.32	0.19	0.08	2.22-2.42	1.92-2.72
70-79	14	2.27	0.23	0.10	2.14-2.40	1.79-2.71

Table 6b.
Step frequency. Fast gait. Women.

Age years	N	Mean steps/s	S.D. steps/s	C.V.	95% C.I. steps/s	95% P.I. steps/s
10-14	12	2.42	0.18	0.07	2.31-2.53	2.02-2.82
15-19	15	2.52	0.27	0.11	2.37-2.67	1.93-3.11
20-29	15	2.56	0.25	0.10	2.42-2.70	2.04-3.09
30-39	15	2.59	0.24	0.09	2.46-2.72	2.09-3.09
40-49	15	2.61	0.25	0.10	2.47-2.75	2.09-3.14
50-59	15	2.49	0.23	0.09	2.37-2.61	2.01-2.97
60-69	15	2.53	0.24	0.09	2.40-2.66	2.03-3.03
70-79	15	2.40	0.21	0.09	2.29-2.51	1.96-2.84

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 7a.

Step length. Slow gait. Men.

Age years	N	Mean cm	S.D. cm	C.V.	95% C.I. cm	95% P.I. cm
10-14	12	51.7	3.0	0.06	49.8-53.6	45.1-58.3
15-19	15	53.8	6.8	0.13	49.9-57.7	38.8-68.8
20-29	15	52.7	3.1	0.06	51.0-54.4	46.2-59.2
30-39	15	55.1	5.1	0.09	52.3-57.9	44.4-65.8
40-49	15	56.2	3.3	0.06	54.4-58.0	49.3-63.1
50-59	15	55.4	7.4	0.13	51.4-59.4	39.9-70.9
60-69	15	56.0	3.5	0.06	54.1-57.9	48.7-63.4
70-79	14	52.7	5.2	0.10	49.8-55.6	41.8-63.6

Table 7b.

Step length. Slow gait. Women.

Age years	N	Mean cm	S.D. cm	C.V.	95% C.I. cm	95% P.I. cm
10-14	12	46.6	3.2	0.07	44.6-48.6	39.6-53.6
15-19	15	51.8	4.4	0.08	42.1-61.5	49.3-54.3
20-29	15	51.8	7.2	0.14	47.9-55.7	36.7-66.9
30-39	15	51.5	5.2	0.10	48.7-54.3	40.6-62.4
40-49	15	48.5	5.2	0.11	45.7-51.3	37.6-59.4
50-59	15	46.8	2.8	0.06	45.3-48.3	40.9-52.7
60-69	15	47.5	4.5	0.09	45.1-49.9	38.1-57.0
70-79	15	47.1	4.1	0.09	44.9-49.3	38.5-55.7

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 8a.
Step length. Normal gait. Men.

Age years	N	Mean cm	S.D. cm	C.V.	95% C.I. cm	95% P.I. cm
10-14	12	61.5	3.9	0.06	59.0-64.0	52.9-70.1
15-19	15	66.0	4.8	0.07	63.3-68.7	55.4-76.6
20-29	15	61.6	3.5	0.06	59.7-63.5	54.3-69.0
30-39	15	64.9	4.6	0.07	62.4-67.4	55.2-74.6
40-49	15	64.7	3.7	0.06	62.7-66.7	56.9-72.5
50-59	15	63.5	6.0	0.09	60.2-66.8	50.9-76.1
60-69	15	65.0	3.6	0.06	63.0-67.0	57.4-72.6
70-79	14	61.5	5.1	0.08	58.6-64.4	50.8-72.2

Table 8b.
Step length. Normal gait. Women.

Age years	N	Mean cm	S.D. cm	C.V.	95% C.I. cm	95% P.I. cm
10-14	12	54.2	2.9	0.05	52.4-56.0	47.8-60.6
15-19	15	59.3	4.3	0.07	56.9-61.7	49.8-68.8
20-29	15	59.1	6.3	0.11	55.7-62.5	45.9-72.3
30-39	15	59.7	5.3	0.09	56.8-62.6	48.6-70.8
40-49	15	57.1	3.7	0.06	55.1-59.1	49.3-64.9
50-59	15	53.5	2.6	0.05	52.1-54.9	48.0-59.0
60-69	15	55.3	4.2	0.08	53.0-57.6	46.5-64.1
70-79	15	54.2	3.7	0.07	52.2-56.2	46.4-62.0

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval

Table 9a.
Step length. Fast gait. Men.

Age years	N	Mean cm	S.D. cm	C.V.	95% C.I. cm	95% P.I. cm
10-14	12	68.7	7.9	0.11	63.7-73.7	51.3-86.1
15-19	15	78.7	6.0	0.08	75.3-82.1	65.5-91.9
20-29	15	71.2	5.7	0.08	68.1-74.3	59.2-83.2
30-39	15	76.0	8.2	0.11	71.6-80.4	58.8-93.2
40-49	15	73.7	4.4	0.06	71.3-76.1	64.5-82.9
50-59	15	72.2	5.7	0.08	69.1-75.3	60.2-84.2
60-69	15	73.6	5.3	0.07	70.7-76.5	62.5-84.7
70-79	14	71.5	7.4	0.10	67.3-75.7	56.0-87.0

Table 9b.
Step length. Fast gait. Women.

Age years	N	Mean cm	S.D. cm	C.V.	95% C.I. cm	95% P.I. cm
10-14	12	62.6	5.3	0.08	59.2-66.0	50.9-74.3
15-19	15	67.8	4.4	0.06	65.3-70.3	58.1-77.5
20-29	15	66.7	6.1	0.09	63.4-70.0	53.9-79.5
30-39	15	68.6	6.9	0.10	64.9-72.3	54.1-83.1
40-49	15	65.4	3.5	0.05	63.5-67.3	58.1-72.8
50-59	15	60.3	4.5	0.07	57.9-62.7	50.8-69.8
60-69	15	62.5	5.6	0.09	59.5-65.5	50.7-74.3
70-79	15	60.4	3.9	0.06	58.3-62.5	52.2-68.6

N = number of subjects
S.D. = standard deviation
C.V. = coefficient of variation

C.I. = confidence interval
P.I. = prediction interval