
**Ergonomija - Antropometrični in podatki o telesni moči otrok v Evropi - 1. del:
Statistični povzetki podatkov**

Ergonomics - Anthropometric and strength data of children in Europe - Part 1: Statistical summaries of the data

Ergonomie - Anthropometrische und Kraftdaten von Kindern in Europa - Teil 1:
Statistische Zusammenfassungen der Daten

Ergonomie - Données anthropométriques et de force des enfants en Europe - Partie 1 :
Synthèses statistiques des données

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13.180

Ergonomija

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Ergonomics - Anthropometric and strength data of children in Europe - Part 1: Statistical summaries of the data

Ergonomie - Données anthropométriques et de force
des enfants en Europe - Partie 1 : Synthèses
statistiques des données

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Kindern in Europa - Teil 1: Statistische
Zusammenfassungen der Daten

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Contents	Page
European foreword	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	6
4 Coding of percentile tables	7
5 Strength measurements	7
5.1 General.....	7
5.2 Finger Push	8
5.3 Tip pinch	9
5.4 Three-jaw chuck pinch.....	10
5.5 Pinch-Pull.....	11
5.6 Hand Grip.....	12
5.7 Hand pushing.....	13
5.8 Hand Pulling	14
5.9 Twisting (With hand)	15
5.10 Press with the foot.....	16
5.11 Pushing Forwards.....	17
5.12 Pushing downwards.....	18
5.13 Pulling.....	19
5.14 Lifting	20
5.15 Pushing with the shoulder.....	21
6 Anatomical Landmarks for anthropometric measurements	22
6.1 General.....	22
6.2 Tragion	22
6.3 Glabella.....	22
6.4 Sellion.....	23
6.5 Opisthocranion	23
6.6 Nuchale	24
6.7 Menton.....	24
6.8 Ectocanthus.....	24
6.9 Infraorbitale	25
6.10 Lateral and medial borders of the right and left pupil.....	25
6.11 Crinion/Trichion.....	26
6.12 Euryon.....	26
6.13 Zygon.....	26
6.14 Gonion.....	27
6.15 Cheilion.....	27
6.16 Dactylion	28
6.17 Radial stylium.....	28
6.18 Ulnar stylium (Wrist point)	28
6.19 Mid-stylium point.....	29
6.20 Metatarsal Tibiale.....	29
6.21 Metatarsal Fibulare.....	30

6.22	Toe 1 joint.....	30
6.23	Toe 5 joint.....	30
6.24	Medial malleolus.....	31
6.25	Lateral malleolus.....	31
6.26	Inside heel bone point	31
6.27	Vertex.....	32
6.28	Menton.....	32
6.29	Cervicale (Back neck point)	32
6.30	Front neck point.....	33
6.31	Side neck point	33
6.32	Acromion (shoulder point)	34
6.33	Armpit front fold point	34
6.34	Armpit back fold point.....	35
6.35	Thelion (Bust point)	35
6.36	Mesosternale.....	36
6.37	Highest point of the hip bone	36
6.38	Lowest rib point	37
6.39	Iliospinale anterius.....	37
6.40	Trochanter	38
6.41	Elbow point	38
6.42	Olecranon	39
6.43	Tibiale.....	39
6.44	Centre point of kneecap	40
6.45	Infrapatella	41
6.46	Suprapatella (sitting)	41
7	Body postures	42
8	Hand positions.....	44
9	Anthropometric measurements.....	45
9.1	General	45
9.2	Body.....	45
9.3	Foot.....	227
9.4	Hand	280
9.5	Head.....	368
9.6	Reach.....	421
9.7	Sitting.....	447
	Bibliography	482

CEN/TR 18296-1:2026 (E)**European foreword**

This document (CEN/TR 18296-1:2026) has been prepared by Technical Committee CEN/TC 122 “Ergonomics”, the secretariat of which is held by DIN.

This document is currently submitted to the Vote on TR.

The series on *Ergonomics — Anthropometric and strength data of children in Europe* consists of the following parts:

- *Part 1: Statistical summaries of the data* (CEN/TR 18296-1);
- *Part 2: Guidelines for the correct application of anthropometric and strength data* (CEN/TS 18296-2).

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Introduction

CEN/TC 122 “Ergonomics” has carried out a project funded by the European Commission to acquire anthropometric and strength data of children in Europe, initiated by the lack of up-to-date published data. These data have to be current and reliable being the basis for the safety, comfort and usability of products used for, by or with children.

Since there had been no sufficient knowledge neither on the existing anthropometric data and its availability nor on the specific demand of data from the relevant stakeholders a first project phase had been carried out in order to gather such knowledge as a basis for European anthropometric surveys. This first phase of the project included an extensive research on the demands, necessity and existence of Anthropometric and Strength data of European population under 18 years old. Results have been published in CEN/TR 17698:2021 “Ergonomics — Demands and availability of anthropometric and strength data of children in Europe”.

The second phase of the project included a measurement campaign to obtain updated anthropometric and strength data for the European population under 16 years of age and resulted in the publication of this technical report as well as CEN/TS xxx “...”.

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CEN/TR 18296-1:2026 (E)

1 Scope

This document provides statistical summaries of anthropometric data (body dimensions and physical strength) of children in Europe considering different age groups. The age range covered by this report is up to 15 years.

This document also provides information about:

- date and origin of the data;
- geographic limitations of the data;
- size and sex of the population measured or scanned;
- description of the anthropometric and strength measures.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

isometric strength

ability of muscles to generate force without changing their length during contraction

Note 1 to entry: No body movement occurs during the measurement period. The posture and joint angles remain the same during the measurement.

3.2

LMS method

Lambda-Median-Sigma method

method applied in this report to calculate percentiles

Note 1 to entry: The LMS method is a statistical technique used to construct growth reference curves. It's particularly good at modelling data that changes with age and is not normally distributed, by accounting for skewness and kurtosis.

Each letter corresponds to a parameter that changes smoothly with age:

- L (Lambda): Represents the Box-Cox transformation power to normalize the distribution (adjusts for skewness).
- M (Median): The median of the measurement at each age (central tendency).
- S (Sigma): The coefficient of variation, or the generalized standard deviation (adjusts for spread or variability).

More information about the method can be found in [5].

3.3

Frankfurt plane

standard horizontal plane at the level of the left trignon and the left orbitale (infraorbitale) when the midsagittal plane of the head is held vertically

4 Coding of percentile tables

This report contains tables covering the 1st to 99th percentiles.

— Age (p01–p99): age group

m03: $3 \leq \text{months} < 6$

m06: $6 \leq \text{months} < 9$

m09: $9 \leq \text{months} < 12$

y01: $1 \leq \text{years} < 2$

y02: $2 \leq \text{years} < 3$

y03: $3 \leq \text{years} < 4$

y04: $4 \leq \text{years} < 5$

y05: $5 \leq \text{years} < 6$

y06: $6 \leq \text{years} < 7$

y07: $7 \leq \text{years} < 8$

y08: $8 \leq \text{years} < 9$

y09: $9 \leq \text{years} < 10$

y10: $10 \leq \text{years} < 11$

y11: $11 \leq \text{years} < 12$

y12: $12 \leq \text{years} < 13$

y13: $13 \leq \text{years} < 14$

y14: $14 \leq \text{years} < 15$

y15: $15 \leq \text{years} < 16$

— Sex:

F: females.

M: males

U: unisex (males and females)

— N: sample size considering only valid measurements.

— Pxx: percentile (1, 5, 10, 25, 75, 90 and 95, 99).

5 Strength measurements

5.1 General

The following subclauses describe the strengths measurements included in this report. All strengths included in this report are voluntary isometric strengths.

Data source: survey conducted in Spain in 2023 and 2024.

Strength measurements were carried out with the age groups y02, y07, y11 and y13. However, some measurements have not been performed with the age group y02 because two-year-old children have difficulties in performing the measurement protocol correctly.

CEN/TR 18296-1:2026 (E)

5.2 Finger Push

Description: The maximum static force that can be exerted in a forward direction with one index finger against an object (round base button). See Figure 1.

Units: Newtons (N)



Figure 1 — Finger Push

Method: The finger push is performed from a standing position. The feet are kept hip-width apart, with one foot forward and the other back from the starting position, to ensure a self-stable position and to perform the gesture with maximum effort. The starting position of the upper limb is defined by the shoulder slightly abducted, the arm along the side of the body, neutrally rotated, and the elbow flexed at 90°. The forearm is pronated and functional extension of the wrist (15° to 20°) is allowed, with the metacarpal joint at approximately 90° and extension of the interphalangeal joints required.

Table 1 — Percentiles: Finger Push

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y07	U	147	10	13	15	20	25	31	37	41	49
y07	F	73	10	13	16	20	25	31	37	41	48
y07	M	74	10	13	15	19	24	30	37	41	51
y11	U	143	14	20	23	30	37	45	52	57	66
y11	F	71	13	19	22	28	35	43	51	57	67
y11	M	72	14	21	25	31	39	46	53	57	65
y13	U	146	21	27	31	38	46	56	65	71	84
y13	F	74	22	27	31	37	45	54	63	69	81
y13	M	72	20	27	31	38	47	57	67	74	87

5.3 Tip pinch

Description: The maximum static force that can be exerted on an object placed in the hand by squeezing together the pad of the thumb as opposed to the pad of the index finger. See Figure 2.

Units: Newtons (N)



Figure 2 — Tip pinch

Method: The finger pinch is performed from a standing position. No slipping between the fingers and the object during measurement. For stability and comfort, feet are placed hip-width apart, and with one foot forward and the other foot backward from the starting position. The upper limb is positioned with the shoulder slightly abducted and neutrally rotated, the elbow flexed at approximately at 90°, and the forearm and wrist in neutral position.

Diameter of the object: 20 mm

Table 2 — Percentiles: Tip pinch

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y07	U	146	15	17	19	22	26	32	39	44	57
y07	F	73	14	17	18	21	26	32	40	46	62
y07	M	73	15	18	20	23	27	32	38	42	52
y11	U	143	22	26	29	34	41	48	55	59	69
y11	F	71	24	28	30	34	40	47	54	60	71
y11	M	72	20	25	28	34	41	48	55	60	69
y13	U	146	31	35	37	42	49	57	65	71	84
y13	F	74	31	35	37	42	48	56	65	71	84
y13	M	72	30	35	38	43	49	57	66	71	84

CEN/TR 18296-1:2026 (E)

5.4 Three-jaw chuck pinch

Description: The maximum static force that can be exerted on an object placed in the hand by squeezing together the pad of the thumb in opposition to the pads of the index and middle fingers. See Figure 3.

Units: Newtons (N)

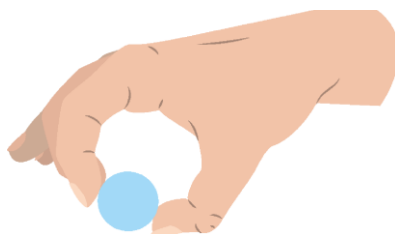


Figure 3 — Three-jaw chuck pinch

Method: The finger pinch is performed from standing position. No slipping between the fingers and the object during measurement. For greater stability and comfort, the feet are kept hip-width apart and move one foot can be moved forward and the other backward from the starting position. The upper limb is positioned with the shoulder slightly abducted and neutrally rotated, the elbow flexed approximately at 90°, and the forearm and wrist in neutral position.

Diameter of the object: 20 mm

Table 3 — Percentiles: Three-jaw chuck pinch

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y07	U	146	21	24	26	29	33	38	43	46	53
y07	F	73	22	24	26	29	33	38	44	48	57
y07	M	73	21	24	26	29	33	38	42	45	50
y11	U	143	30	35	38	44	52	61	70	76	88
y11	F	71	28	34	38	44	53	63	73	80	94
y11	M	72	31	36	39	44	51	59	66	72	82
y13	U	145	36	43	48	55	64	74	84	90	102
y13	F	74	39	44	48	54	62	70	79	85	97
y13	M	71	34	43	48	57	67	78	88	94	105

5.5 Pinch-Pull

Description: The maximum static force that can be exerted by pulling the fingers towards the body against various objects. This pulling force is exerted when performing a lateral pinch. The thumb pulp against the lateral side of the middle phalanx of the index finger. See Figure 4.

Units: Newtons (N)

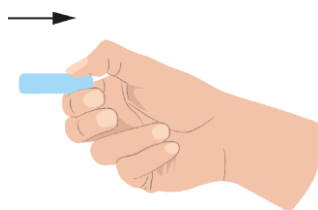


Figure 4 — Pinch-Pull

Method: The pinch pull is performed from a standing position. No slipping between the fingers and the object during measurement. For greater stability and comfort, feet can be hip-width apart and one foot can be moved forward and the other backward from the starting position. The upper limb position shoulder is placed slightly adducted and neutrally rotated, the elbow flexed at 90° and the forearm and wrist in neutral position.

Height of the object: 8 mm

Table 4 — Percentiles: Pinch-Pull

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y07	U	146	16	19	21	25	29	34	40	43	50
y07	F	73	15	19	21	24	29	33	37	40	45
y07	M	73	16	19	21	25	30	36	42	46	56
y11	U	142	25	29	32	37	44	53	62	68	82
y11	F	70	26	30	32	36	42	49	57	63	75
y11	M	72	24	30	33	39	47	56	66	73	88
y13	U	146	29	34	38	44	53	63	74	81	95
y13	F	74	28	32	35	41	49	57	67	73	87
y13	M	72	31	38	42	49	58	68	78	85	99

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5.6 Hand Grip

Description The maximum force that can be exerted by the forearm with all fingers flexed around an object. See Figure 5.

Units: Newtons (N)

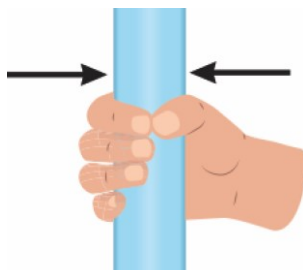


Figure 5 — Hand grip

Method: The hand grip is performed from a standing position. To provide a better stability and comfort to perform the feet are kept hip width apart; and move one foot forward and move the other foot back from the starting position to ensure a self-stable position to make the gesture with the maximal effort. Regarding upper limb, shoulder is placed slightly abducted and neutrally rotated; elbow flexed approximately at 90°; and the forearm and wrist in neutral position.

The hand grip measurement device is available in two sizes (Figure 6) to ensure an ergonomically comfortable grasp, characterized by the middle phalanx of the other fingers being approximately parallel to the thumb during use.

— Small: A: 40 mm, B: 30 mm

— Large: A: 46 mm, B: 34 mm

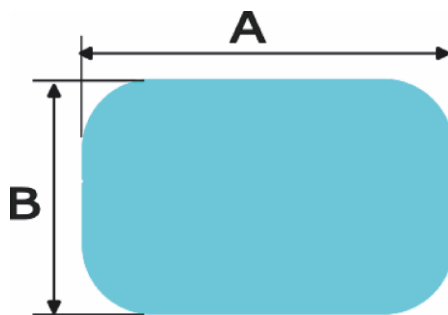


Figure 6 — Hand grip device

Table 5 — Percentiles: Hand grip

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y02	U	127	3	8	11	16	22	28	35	39	47
y02	F	62	4	8	11	16	22	28	34	38	45
y02	M	65	3	7	10	15	22	29	35	40	48
y07	U	146	40	51	57	67	81	95	109	118	135
y07	F	73	38	47	52	63	76	91	107	117	138

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y07	M	73	47	57	63	73	85	98	110	118	134
y11	U	143	72	88	98	116	138	163	187	203	234
y11	F	71	67	83	93	111	134	162	190	209	249
y11	M	72	74	93	104	122	142	163	183	194	216
y13	U	146	99	121	134	159	191	229	267	293	346
y13	F	74	93	113	126	148	177	209	242	263	306
y13	M	72	113	135	149	174	207	247	288	316	375

5.7 Hand pushing

Description The maximum static force that can be exerted forward with the upper limb and palm of the hand against an object (hemisphere with a round base). See Figure 7.

Units: Newtons (N)

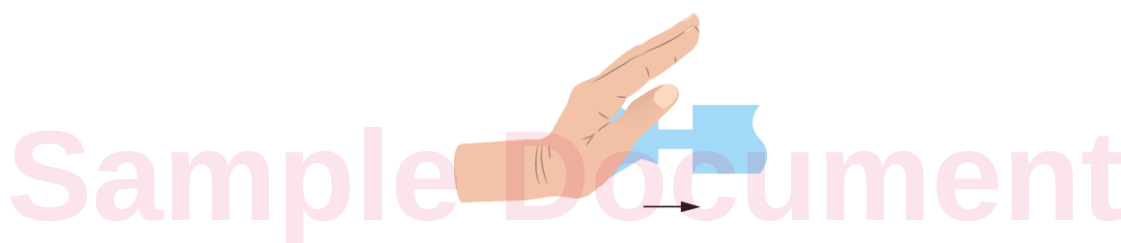


Figure 7 — Hand pushing

Method: The hand push is performed from a standing position. To ensure greater stability and comfort, the feet are positioned hip-width apart. The subject moves one foot forward and the other backward from the initial stance until reaching a posture perceived as most comfortable. The position of the upper limb is defined by slight shoulder abduction, neutral arm rotation along the side of the body, and 90° elbow flexion. The forearm is pronated and the wrist extended to allow supportive contact of the palm against the object. The posture remains unchanged throughout the measurement.

The pushing surface area is available in two sizes to ensure comfortable support for the palm, such that the surface remains approximately within the hand's width and half its length.

- Small: 60 mm × 47 mm
- Large: 80 mm × 57 mm

Table 6 — Percentiles: Hand pushing

Age	Sex	N	P01	P05	P10	P25	P50	P75	P90	P95	P99
y07	U	147	13	20	25	33	45	59	74	84	106
y07	F	73	10	17	22	31	43	56	68	76	93
y07	M	74	20	25	28	36	46	61	80	94	130
y11	U	142	27	35	40	50	64	82	104	119	156
y11	F	70	25	33	38	48	61	77	93	105	128
y11	M	72	29	37	42	52	68	88	113	131	174