

*13th Fiep European Congress
26-29.09.2018*



*29th Fiep World Congress
Istanbul, TURKEY*

**Combined sets of European physical fitness
percentile scores, with appropriate interpolations,
for children and adolescents for the Alpha-fit test battery**

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PHYSICAL FITNESS

**is an important health factor
in children and adolescents.**



Body Composition



Cardiorespiratory Fitness



Musculoskeletal Fitness



Motor Fitness

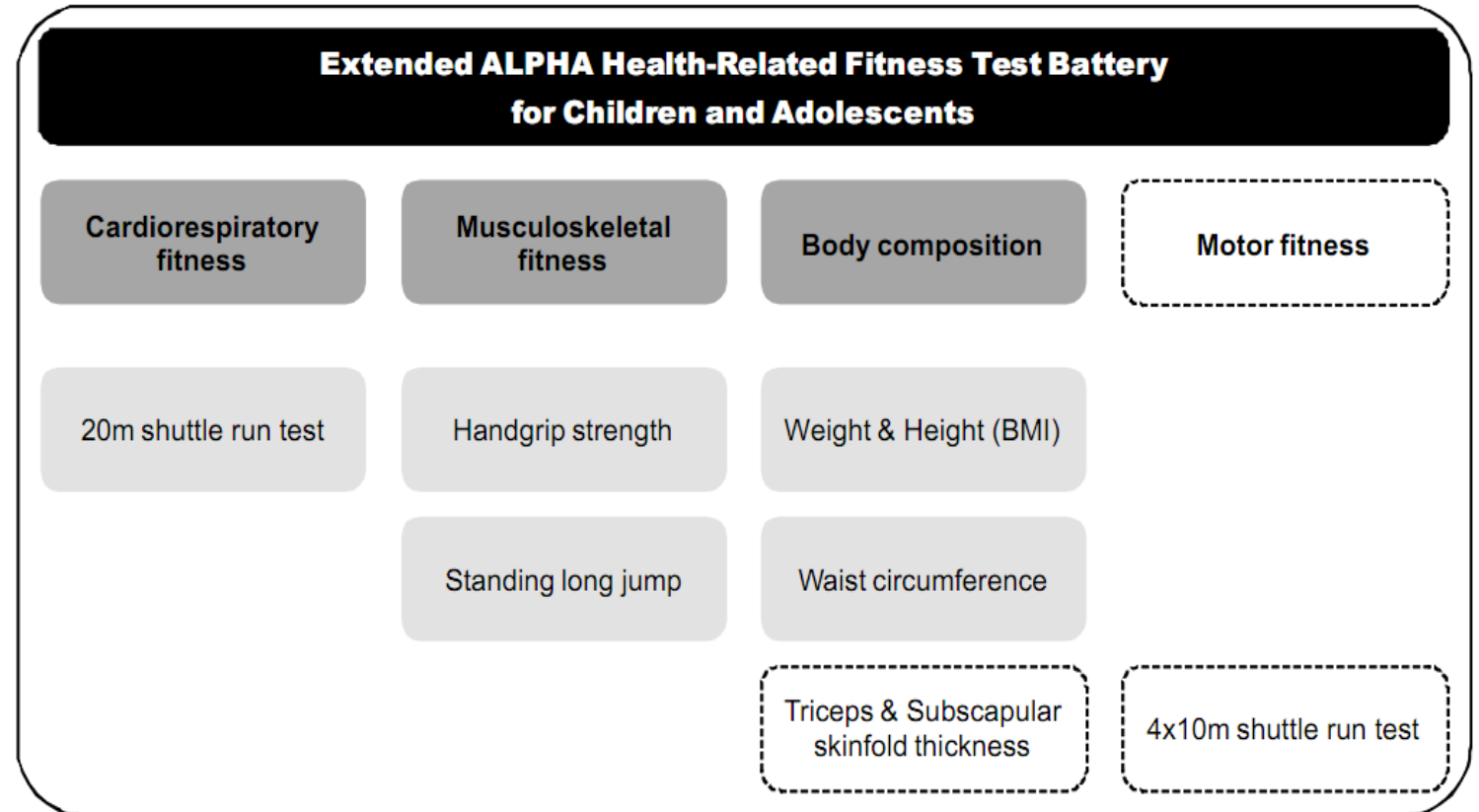
- Decreased future risk for obesity and cardiovascular diseases;
- Improved skeletal health;
- Improved quality of life;
- Improved mental health.

[Ortega, F. B., Ruiz, J. R., Castillo, M. J., & Sjostrom, M. (2008). Physical fitness in childhood and adolescence: a powerful marker of health. *Int J Obes (Lond)*, 32(1)]


PHYSICAL FITNESS ASSESSMENT



The Alpha-Fit test battery
is one of the most widely
applied in Europe for
assessing physical fitness
levels in children and
adolescents.



PHYSICAL FITNESS PERCENTILE SCORES

Age	Percentiles															
	1	3	10	20	25	30	40	50	60	70	75	80	90	97	99	100
6.0	46.7	56.6	69.1		81.1			93.8			106.1		116.7	127.0	134.4	
6.5	51.1	61.0	73.6		85.7			98.6			111.1		121.9	132.3	139.9	
7.0	55.6	65.5	78.2		90.4			103.5			116.0		127.0	137.6	145.2	
7.5	60.2	70.1	82.8		95.2			108.3			121.0		132.1	142.7	150.5	
8.0	64.9	74.8	87.5		99.9			113.1			125.9		137.1	147.9	155.7	
8.5	69.6	79.5	92.3		104.7			118.0			130.8		142.1	152.9	160.8	
9.0																
10.0																
11.0																
12.0																
13.0			107.0	118.1		126.3	133.5	140.3	147.2	154.8		163.7	176.4			207.8
14.0			110.4	121.8		130.2	137.4	144.2	151.1	158.5		167.3	179.6			209.3
15.0			111.6	123.0		131.3	138.3	145.0	151.7	158.8		167.2	179.0			207.1
16.0			114.8	126.0		134.1	141.0	147.5	154.0	160.9		169.1	180.4			207.5
17.0			118.6	129.5		137.4	144.2	150.6	157.0	163.9		172.0	183.4			210.7

Unfortunately, there is a reference gap between 9 and 13 years in the European norms for:

- Handgrip strength
- Standing long jump
- 4x10m shuttle run tests
- 20m shuttle run test,

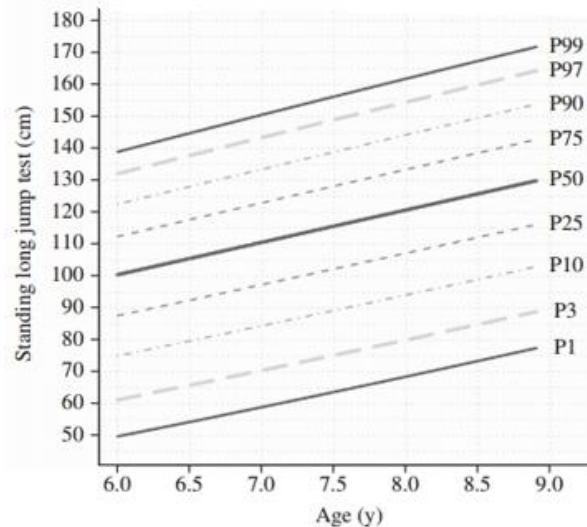
which has to be filled in to appropriately assess children's physical fitness.

AIM OF THE STUDY

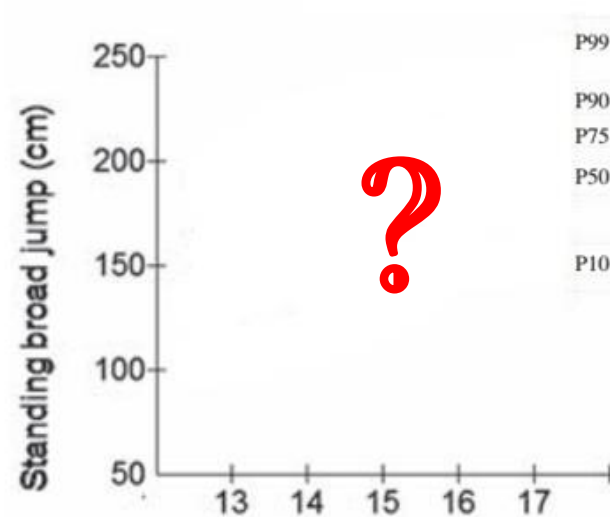
The aim of this study was to fill in the gap in the European physical fitness percentile norms for the main tests in the Alpha-fit test battery, by using a linear interpolation between the existing percentiles.

MATERIAL AND METHODS

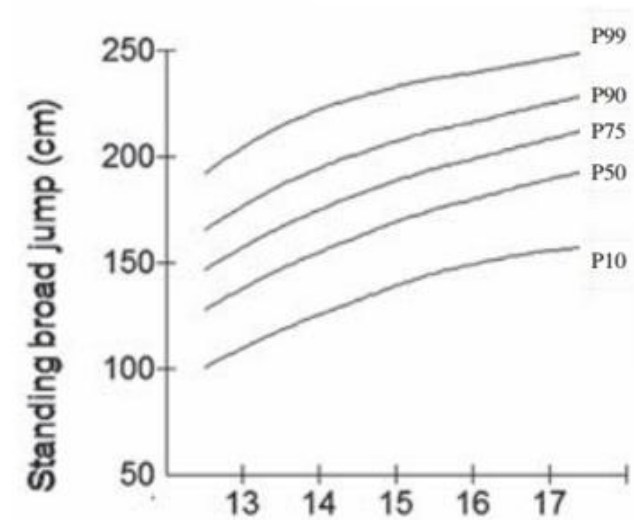
The available European normative values published by Miguel-Etayo et al., 2014, and Ortega et al., 2011, for the main tests of the Alpha-fit test battery were **linearly interpolated** in order to propose percentile scores to close the gap from 9 to 13 years of age.



Normative values
for children (6-9 y)



Normative values
(9-13 y)



Normative values for
adolescents (13-17 y)

MATERIAL AND METHODS

- Percentile scores for those of 5 and 18 years of age were also estimated by extrapolation.
- In addition, percentiles which were not given with the published norms (20th, 30th, 40th, 60th, 70th, 80th, and 100th in children, and the 1st, 3rd, 25th, 75th, 97th, and 99th in adolescents) were also interpolated.
- With regard to the VO_2max obtained by the 20m SRT, the European norms supplied by Miguel-Etayo et al., 2014 for children (6 to 9 years), and international norms in children and adolescents (9 to 17 years), as published by Tomkinson et al., 2016, were interpolated to produce a full set of percentile scores.

RESULTS

Table 1. Percentiles for the handgrip strength (kg) in girls

	Percentiles															
Age	1	3	10	20	25	30	40	50	60	70	75	80	90	97	99	100
5.0	4.2	4.5	5.0	5.3	5.4	5.6	5.9	6.3	6.7	7.1	7.3	7.7	8.4	10.1	10.8	11.2
6.0	5.0	5.5	6.2	6.7	7.0	7.2	7.7	8.1	8.6	9.1	9.3	9.7	10.6	12.1	13.2	13.8
6.5	5.4	6.0	6.8	7.5	7.8	8.0	8.5	9.0	9.5	10.0	10.3	10.8	11.7	13.1	14.4	15.1
7.0	5.8	6.4	7.4	8.1	8.5	8.8	9.3	9.8	10.4	10.9	11.2	11.7	12.7	14.2	15.4	16.0
7.5	6.1	6.9	8.0	8.8	9.2	9.5	10.0	10.6	11.2	11.9	12.2	12.7	13.7	15.3	16.5	17.1
8.0	6.5	7.3	8.6	9.5	9.9	10.2	10.9	11.5	12.1	12.8	13.1	13.6	14.7	16.3	17.6	18.3
8.5	6.7	7.7	9.1	10.1	10.6	10.9	11.6	12.3	13.0	13.7	14.1	14.6	15.7	17.4	18.6	19.2
9.0	7.8	8.7	10.1	11.2	11.7	12.1	12.8	13.6	14.3	15.1	15.5	16.1	17.3	19.2	20.4	21.0
10.0	10.0	10.7	12.1	13.4	13.9	14.4	15.2	16.1	16.9	17.8	18.3	19.0	20.4	22.8	24.0	24.6
11.0	12.1	12.8	14.1	15.5	16.2	16.7	17.7	18.6	19.6	20.6	21.2	21.8	23.5	26.4	27.6	28.1
12.0	14.3	14.8	16.1	17.7	18.4	19.0	20.1	21.1	22.2	23.3	24.0	24.7	26.7	30.0	31.2	31.7
13.0	16.5	16.8	18.1	19.9	20.6	21.3	22.5	23.6	24.8	26.0	26.8	27.6	29.8	33.7	34.8	35.3
14.0	18.3	18.6	19.8	21.5	22.2	22.9	24.1	25.2	26.4	27.7	28.5	29.2	31.5	35.4	36.5	37.1
15.0	19.1	19.4	20.7	22.5	23.2	23.9	25.1	26.2	27.4	28.7	29.5	30.3	32.6	36.7	37.9	38.5
16.0	19.7	20.0	21.2	22.9	23.6	24.3	25.4	26.6	27.8	29.1	30.0	30.8	33.2	37.8	39.1	39.7
17.0	20.7	21.0	22.2	23.9	24.6	25.2	26.4	27.6	28.9	30.3	31.2	32.1	34.8	40.3	41.9	42.7
18.0	21.7	22.0	23.2	24.9	25.5	26.1	27.4	28.6	30.0	31.5	32.5	33.4	36.4	42.9	44.8	45.7

RESULTS

Table 2. Percentiles for the handgrip strength (kg) in boys

Percentiles																
Age	1	3	10	20	25	30	40	50	60	70	75	80	90	97	99	100
5.0	4.4	4.8	5.5	6.0	6.3	6.5	6.9	7.3	7.7	8.2	8.4	8.8	9.5	10.4	11.5	12.1
6.0	5.4	6.0	6.9	7.6	7.9	8.1	8.6	9.1	9.6	10.1	10.4	10.8	11.7	13.0	14.1	14.7
6.5	5.9	6.6	7.6	8.3	8.7	9.0	9.5	10.0	10.6	11.1	11.4	11.9	12.8	14.3	15.4	16.0
7.0	6.4	7.2	8.3	9.0	9.4	9.7	10.3	10.9	11.5	12.1	12.4	12.9	13.9	15.5	16.8	17.5
7.5	7.0	7.8	8.9	9.8	10.2	10.5	11.1	11.7	12.4	13.1	13.4	14.0	15.1	16.8	18.1	18.8
8.0	7.5	8.3	9.6	10.5	11.0	11.3	12.0	12.6	13.3	14.0	14.4	15.0	16.2	18.0	19.5	20.3
8.5	8.0	8.9	10.3	11.2	11.7	12.1	12.8	13.5	14.3	15.0	15.4	16.0	17.3	19.3	20.8	21.6
9.0	9.0	9.9	11.3	12.4	12.9	13.3	14.1	14.9	15.8	16.6	17.1	17.8	19.3	21.8	23.3	24.1
10.0	11.1	11.8	13.3	14.6	15.2	15.7	16.8	17.7	18.8	19.9	20.5	21.3	23.2	26.7	28.3	29.1
11.0	13.1	13.8	15.2	16.9	17.6	18.2	19.4	20.6	21.8	23.1	23.9	24.8	27.2	31.6	33.2	34.1
12.0	15.2	15.7	17.2	19.1	19.9	20.6	22.1	23.4	24.8	26.4	27.3	28.3	31.1	36.5	38.2	39.1
13.0	17.2	17.7	19.2	21.4	22.3	23.1	24.7	26.2	27.8	29.6	30.7	31.8	35.1	41.4	43.2	44.1
14.0	20.8	21.4	23.4	26.3	27.4	28.5	30.4	32.2	34.0	36.1	37.3	38.5	42.0	48.1	49.8	50.7
15.0	25.2	25.9	28.1	31.3	32.5	33.7	35.7	37.7	39.7	41.8	43.1	44.3	47.9	54.0	55.7	56.6
16.0	30.4	31.0	33.0	35.9	37.0	38.1	40.0	41.8	43.7	45.7	46.9	48.1	51.5	57.5	59.2	60.0
17.0	35.2	35.7	37.4	39.9	40.9	41.8	43.5	45.1	46.7	48.5	49.6	50.6	53.7	59.2	60.7	61.5
18.0	39.9	40.3	41.8	43.9	44.7	45.5	47.0	48.4	49.7	51.3	52.2	53.1	55.9	60.9	62.3	63.0

RESULTS

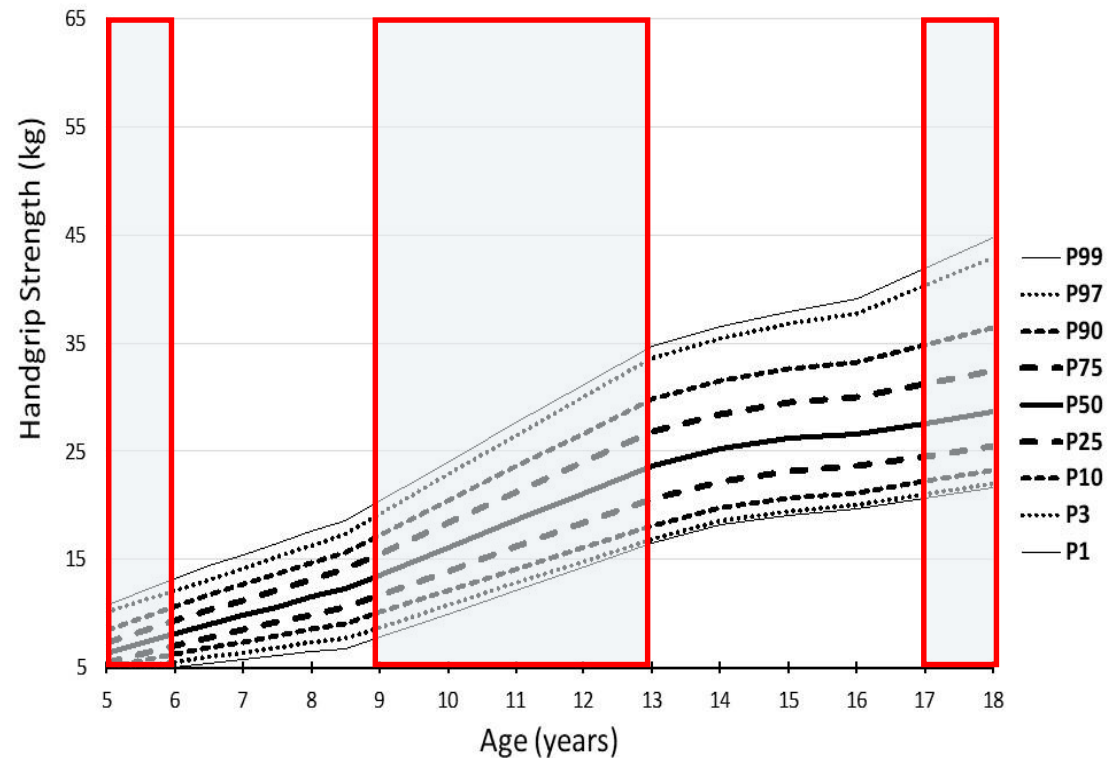


Fig. 1. Percentile curves for the handgrip strength (kg) in girls

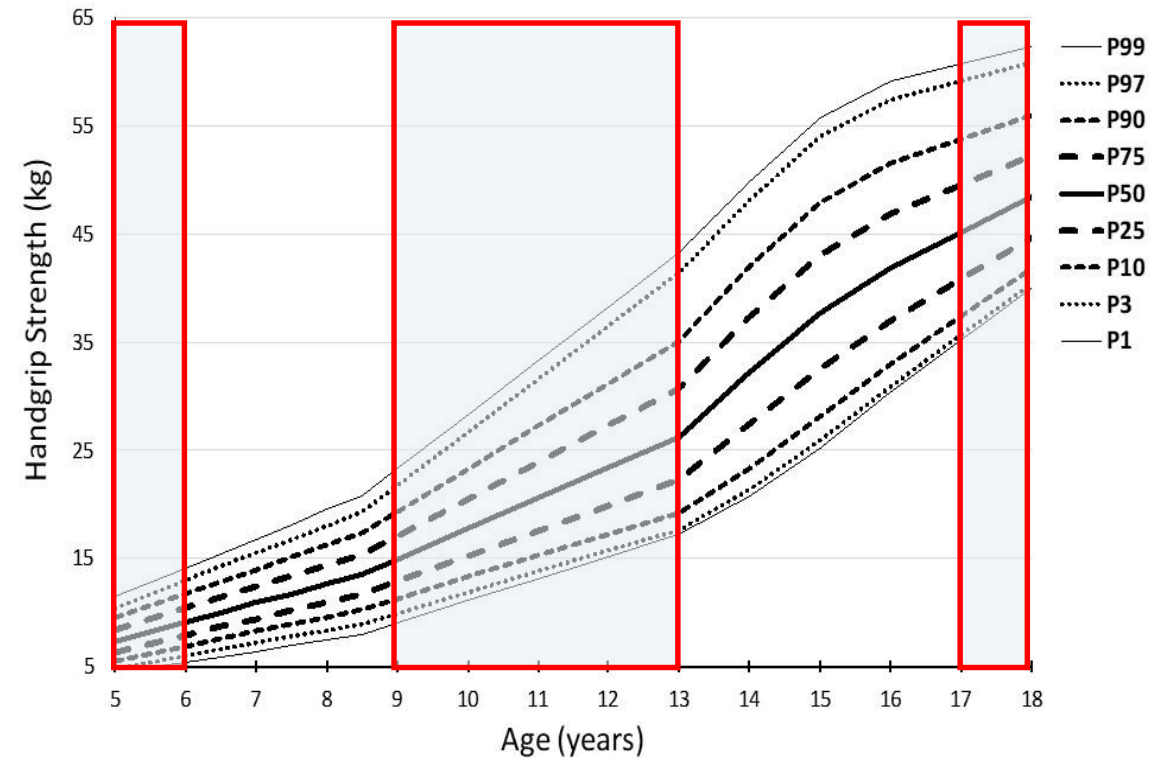
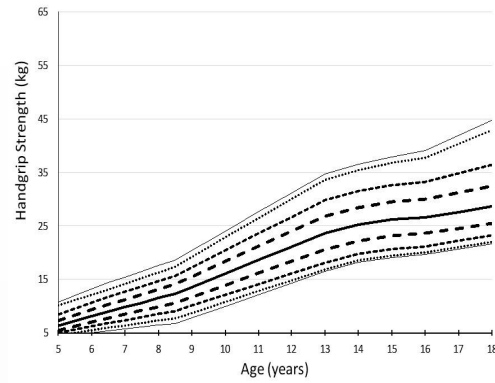
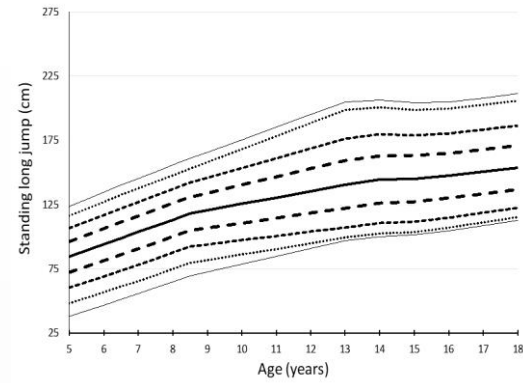


Fig. 2. Percentile curves for the handgrip strength (kg) in boys

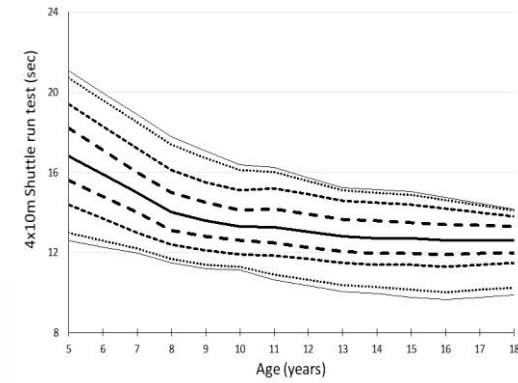
RESULTS



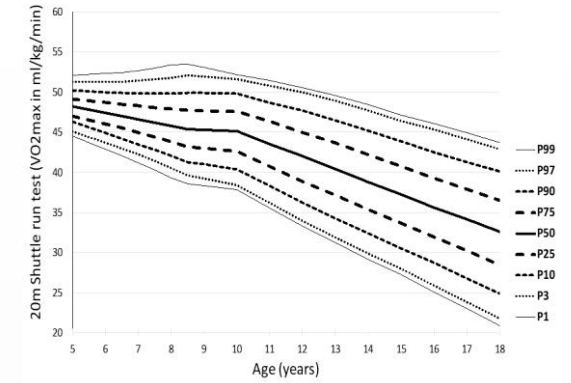
Handgrip Strength



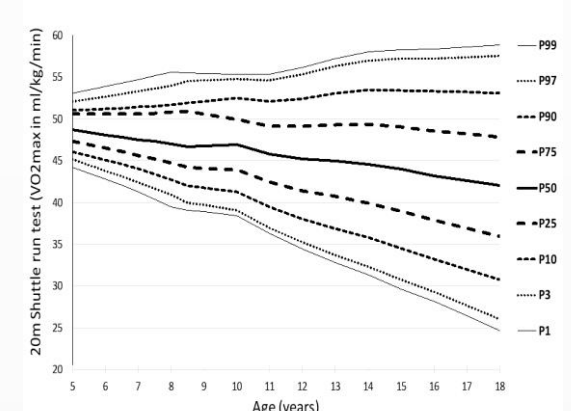
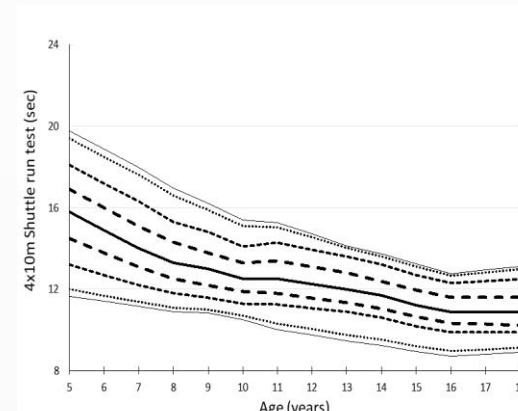
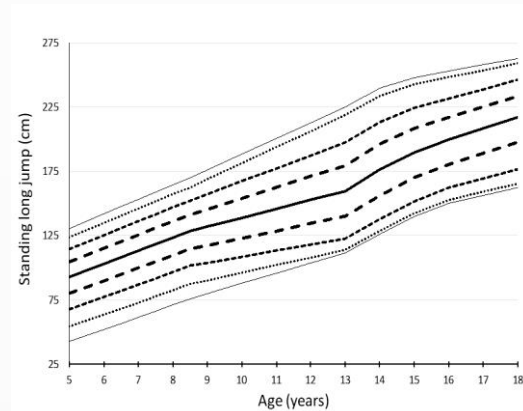
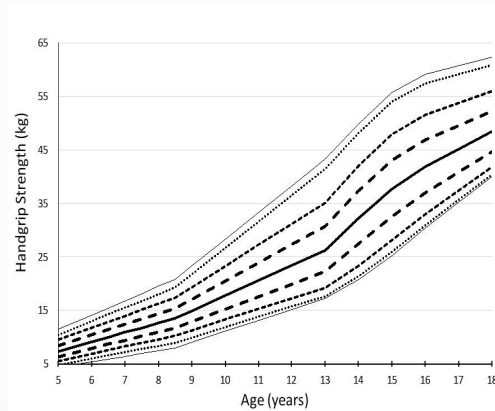
Standing Long Jump



4x10 m SRT



20 m SRT



DISCUSSION

HELENA study (2011)

Ortega et al., 2011

3 528

Adolescents

IDEFICS study (2014)

Miguel-Etayo et al., 2014

18 745

Children

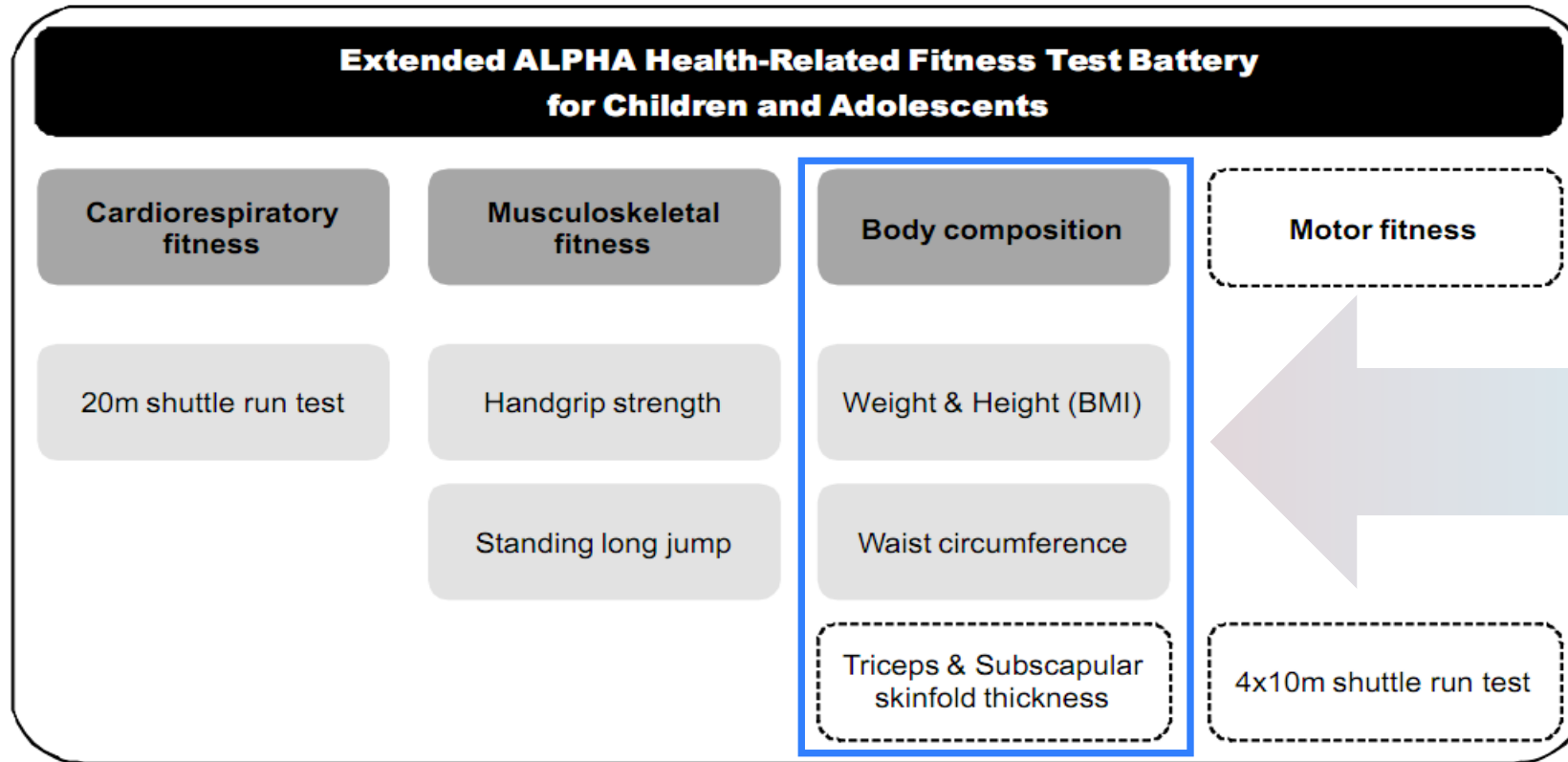
Tomkinson et al. (2016)

1 142 026

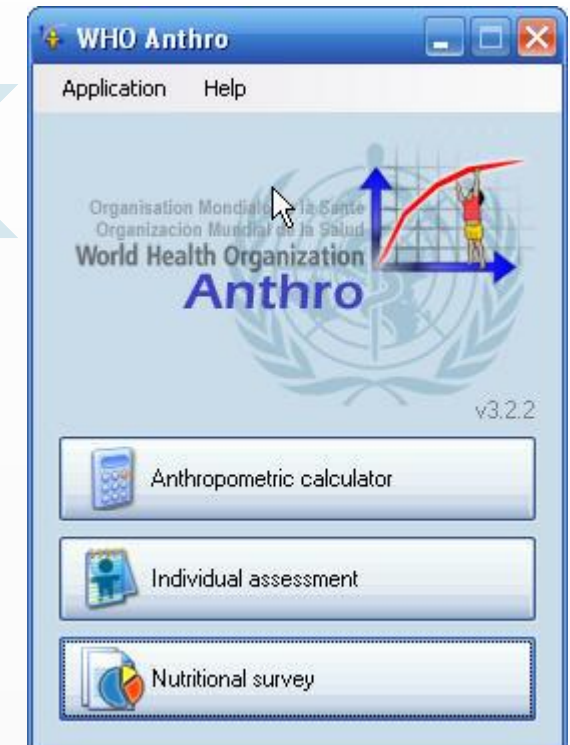
Children &
Adolescents

Studies which are conducted in order to obtain physical fitness percentile scores require a considerable amount of time and financial support due to the need to cover a substantial number of participants.

RECOMMENDATIONS & CONCLUSION



World Health
Organization



When evaluating the anthropometric result, we recommend that the international normative values for children and adolescents provided by the World Health Organisation are used.

RECOMMENDATIONS & CONCLUSION

BeepShuttle Junior V3.0

TeamManager TestControl Results Settings Help

Track	No.	Name	Age	Gender	Duration [hh:mm:ss]	Stage [#]	Shuttle [#]	Dist. [m]	Speed [km/h]	VO2max [ml/kg/min]	HR [bpm]	Finish
1	1	Khalid K.	6.5	M	00:03:09	4	1	480	10.0	52.3		<input checked="" type="checkbox"/>
2	2	Daniel M.	8.8	M	00:01:26	2	4	220	9.0	44.6		<input checked="" type="checkbox"/>
3	3	Vivian A.	9.4	F	00:01:06	2	1	160	9.0	42.6		<input checked="" type="checkbox"/>
4	4	Stephanie B.	8.7	F								<input type="checkbox"/>
5	5	Phillip A.	9.5	M								<input type="checkbox"/>
6	6	Jada K.	9.2	F	00:02:02	2	8	300	9.0	45.0		<input checked="" type="checkbox"/>

STOP Duration 00:03:56 Stage 4 Shuttle 8 Shtl/Stg 9 Distance, m 620 km/h 10.0 ACCEPT

20m Shuttle Run Test (Leger et al.'s protocol 1)



12th FIEP European Congress, Luxembourg

BEEPSHUTTLE JUNIOR: SOFTWARE FOR THE ADMINISTRATION OF THE 20m SHUTTLE RUN TEST IN CHILDREN AND ADOLESCENTS

STEFAN KOLIMECHKOV, LUBOMIR PETROV, ALBENA ALEXANDROVA & KOSTADIN CHOLAKOV

Introduction

The 20 m shuttle run test (20mSRT) is the most widely used to assess the cardiorespiratory fitness of children and adolescents, and it is part of the most extensively applied health-related fitness test batteries. The aim of this study was to approve software which administers the 20mSRT, calculates the VO₂max in children and adolescents (6-18 years), and classifies them in accordance with current international norms.

Results

The administration of the 20mSRT by 'BeepShuttle Junior' is highly convenient, comprehensive, and with good visualisation. The individual results and assessments exactly matched the interpolated normative data tables. Whilst boys performed significantly better than girls (47.71±3.13 vs. 45.85±2.17 ml/kg/min, p<0.05), the percentile scores were, however, similar (53.17±23.64 and 53.90±22.14). A significant negative correlation between the BMI Z-scores and VO₂max in girls and boys (-0.54, p=0.002 and -0.44 respectively, p=0.011) was observed.

Table 1. Age, BMI, BMI Z-score, VO₂max and percentile score

	Mean ± SD	Girls (n=31)	Boys (n=32)	Significance
Age (y)	9.01 ± 0.48	8.62 ± 0.72	p<0.05	
BMI (kg/m ²)	18.88 ± 3.63	18.63 ± 3.06		
BMI Z-score	0.92 ± 1.23	1.14 ± 1.29		
VO ₂ max (ml/kg/min)	45.85 ± 2.17	47.71 ± 3.13	p<0.01	
VO ₂ max percentile score	53.90 ± 22.14	53.17 ± 23.64		

Summary and Conclusion

Some test batteries, such as Alpha-fit and ASSO-FTB, do not refer to VO₂max, but only to the completed stages of the 20mSRT, which is not an appropriate way to compare results from different aerobic tests. However, the 'BeepShuttle Junior' has the following advantages: it provides immediate assessment of cardiorespiratory fitness, and calculates VO₂max and percentile scores of individuals between the ages of 6 and 18 in accordance with comprehensive international norms. 'BeepShuttle Junior' is available online [4] and can be applied for health and fitness monitoring purposes in schools and sports clubs.

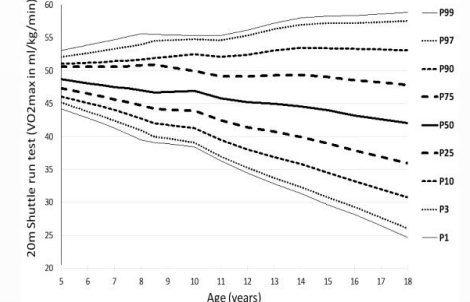
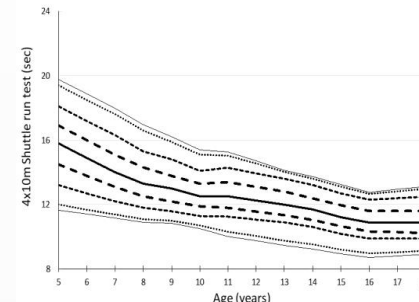
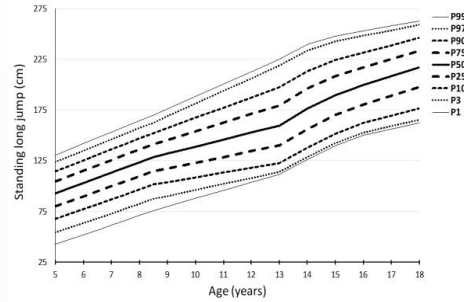
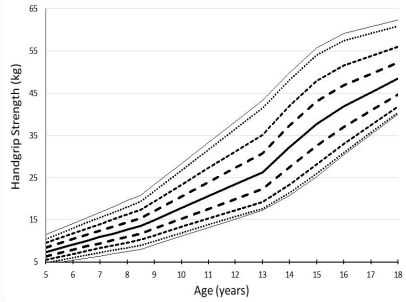
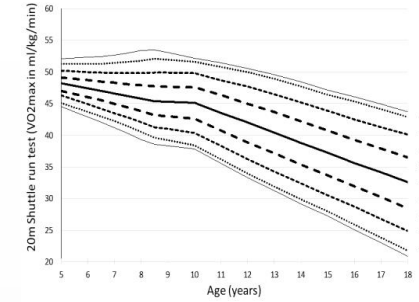
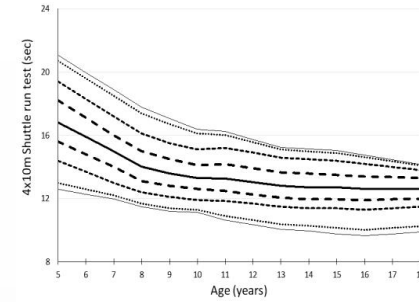
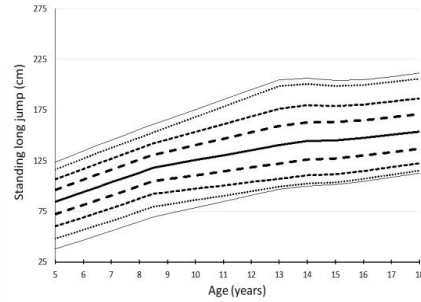
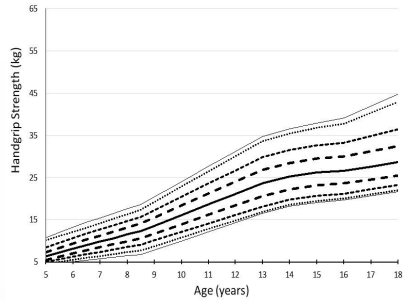
References

- Leger, L., et al. (1988). "The multistage 20 metre shuttle run test for aerobic fitness." J Sports Sci 6(2): 89-101.
- Magnusson, K., et al. (2014). Physical fitness reference standards in European children: the EUROAS study. International journal of Obesity, 38, 97-106.
- Beckmann, et al. (2016). International normative 20 m shuttle run values from 1,842,000 children and youth representing 50 countries. Br J Sports Med.
- BeepShuttle Junior (2017). Software for monitoring aerobic fitness. Retrieved from UK Sport - <https://www.uk-sport.co.uk/beepshuttle-junior.html>

For the administration of the 20 m SRT, we recommend using the specialised software 'BeepShuttle Junior'.

[Kolimechkov, S., Petrov, L., Alexandrova, A., & Cholakov, K. (2018). BeepShuttle Junior: Software for the administration of the 20m shuttle run test in children and adolescents. Journal of Advanced Sport Technology, 1 (3), 35-40.]

RECOMMENDATIONS & CONCLUSION



The proposed combined and interpolated percentile scores can be applied in order to evaluate European children and adolescents at all ages until the missing values are established by experimental research.

OUR TEAM



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