PREFIT Battery: Assessing FITness in PREschoolers

Test Manual

Promoting Fitness & Health through Physical Activity

UNIVERSIDAD DE GRANADA

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1. WHAT IS HEALTH-RELATED FITNESS?

Physical fitness is typically defined focusing on two goals: performance or health. Health-related physical fitness can be defined as the ability of a person to perform daily activities with vigour, and by traits and capacities that are associated with a low risk in the development of chronic diseases and premature death. Despite chronic diseases and cardiovascular disease events occur most frequently during or after the fifth decade of life, there is evidence indicating that the precursors of cardiovascular disease have their origin in childhood and adolescence. Therefore, the assessment of health-related fitness at early ages is of public health and clinical interest. Health-related fitness components include cardiorespiratory fitness, musculoskeletal fitness, motor fitness, and body composition.

2. THE PREFIT FITNESS TEST BATTERY FOR PRESCHOOL CHILDREN

2.1. Importance of assessing fitness in preschool children

Physical fitness, particularly cardiorespiratory fitness and muscular strength, is considered a good indicator of health in children and adolescents[1, 2]. Longitudinal studies have contributed recently to increase scientific knowledge about physical fitness and health in youth. For instance, it has been demonstrated that an improvement of cardiorespiratory fitness reduces the risk of developing overweight/obesity in the adolescence[3]. Likewise, Ortega et al. (2013)[4] observed in over 1 million of Swedish people that a low level of muscular strength in the adolescence was associated with a high risk of premature death (due to cardiovascular diseases and suicide). Although most of current evidence is from studies conducted in 6-year-old children and older, there is no reason to believe that fitness is less important for health in preschoolers than in later ages.

Based on this evidence, we can affirm that the study and assessment of physical fitness in youth is becoming more and more important from the clinic and public health point of view. In this context, the European Commission developed the ALPHA project (Assessing Levels of Physical Activity and Fitness, www.thealphaproject.net) with the aim to establish a battery of tests in order to assess health-related fitness in children and adolescents (6 to 18 years old). However, it is also important to assess with accuracy physical fitness in preschool children (3 to 5 years old) in order to quantify the improvements of physical

fitness after an intervention program and examine its relation with health. For this reason, we created the PREFIT battery (Assessing **FIT**ness in **PRE**schoolers)[5] as an adaptation of the ALPHA-Fitness: Field-based fitness tests for the assessment of health-related physical fitness in children and adolescents[6-8].

2.2. Development of the PREFIT battery

The PREFIT battery is the result of a systematic review based on the existing evidence of the field tests for the assessment of physical fitness in preschool children[5]. Due to the scarcity of information available, the PREFIT battery is based on the combination of the information obtained in the review and the information obtained of the ALPHA battery for children and adolescents. Methodological papers have demonstrated feasibility and reliability of such tests in preschoolers[9-11]. The final aim of this battery is to provide a set of reliable, feasible, and safe tests to assess health-related fitness in preschoolers to be used in the public health monitoring system[5, 9-12].

2.3. Description of the PREFIT battery

PREFIT fitness test battery is low in cost and equipment requirements, and can be easily administered to groups of children simultaneously.

3. HOW TO CONDUCT THE TESTS

3.1. General instructions

The PREFIT battery presents only one version based on scientific evidence.

The PREFIT battery[5]. This version of the battery includes weight and height (body mass index, BMI) waist circumference, handgrip strength, standing long jump, 4x10m shuttle run, one-leg stance, and PREFIT 20m shuttle run tests. All these measurements have shown to be strongly related with the current and future health status of children and adolescents.

The time needed to administer this battery to a group of 20 individuals by four evaluators is around 2 hours and 30 minutes. However, this time is reduced when a greater number of evaluators are assessing.

3.2. Standardization

A strict standardization of the field work precludes to a great extent the confounding bias that often interferes when comparing results from isolated studies. This manual includes not only the description of the tests but also the most appropriate sequence. Moreover, the instructions for the evaluators and participants provided in this manual will enable a higher accuracy in the assessment of physical fitness and its relationship with health in preschool children.

3.3. The recommended sequence

The recommended sequence to administer this battery would be:

1. Weight and height (BMI).
2. Waist circumference.
3. Handgrip strength, standing long jump test, 4x10m shuttle run, and one-leg stance tests. These could be carried out alternatively or simultaneously when there are more than two evaluators.
4. PREFIT 20m shuttle run test.

3.4. Instructions for the participants

To wear comfortable sport clothes and shoes is vital for the appropriate administration of the battery. A notable and constant level of encouragement is recommended to guarantee the maximum performance from the participants throughout the tests.

4. SAFETY MODEL

4.1. Pre-testing health screening

Knowledge of the current and former health status of the children is important in order to enhance safe testing. A pre-testing screening should identify young people at high risk and should be similar to the one typically used to allow the children to take active part in the physical education lessons.

For this purpose, in most/many European countries, children have annual physical examinations carried out by school-doctors who provide detailed information regarding the skeletomuscular, cardiorespiratory, haematocirculatory, psychoneurological, and endocrinemetabolic systems. When this service is not available, it is recommendable that parents or guardians complete at least a pre-testing/pre-participation screening questionnaire before the child starts with the physical education lessons and/or the fitness testing. A good example of such questionnaire is the "Physical Activity Readiness Questionnaire" (PAR-Q).

In any case, it is important to be alert to the subjective symptoms such as skin pallor, dizziness, syncope, and dyspnoea. The tests should be immediately interrupted if there is any sign of problem or risk. Any child able to take part in physical education classes in the kindergarten or at school can perform the PREFIT fitness test battery.

4.2. Recommendation for safe testing

A small, comfortable, well ventilated and mild temperature chamber is highly recommended for body composition measurements. Ideally, nobody else apart from the evaluator, an assistant (if they are needed), and a maximum of 3 participants should be present in the chamber at the same time. If the chamber is not available, the measurements can be done in a small space in the playground (apart from the rest of the tests). A non-slippery surface is necessary for the standing long jump and 4x10m shuttle run tests. Finally, a space of at least 25m length is required for a safe administration of the PREFIT 20m shuttle run test.

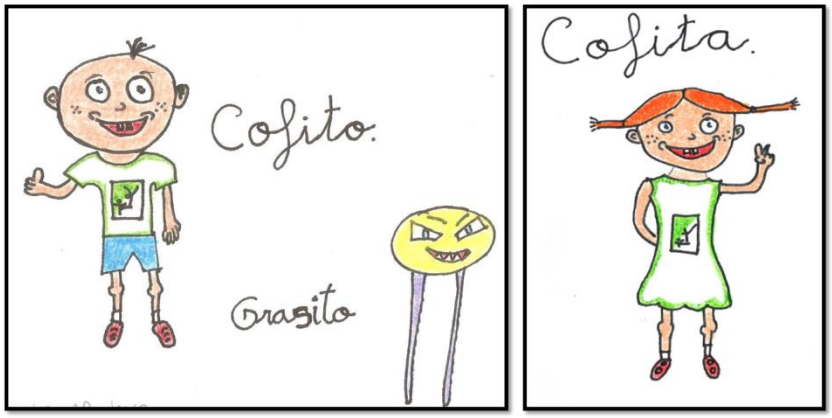
3-5 minutes of **warm-up** including jogging, jumping, and mobility exercises should be performed. Since they are very young, we recommend to perform the warm-up based on a fairy tale (for more information, see section 5). The best moment to warm-up is before all the measurements. Nevertheless, preschool children are continuously moving, thus the warm-up can be performed on their way from the class to the place of assessment or even do not perform it.

5. METHODOLOGICAL STRATEGY OF THE ADAPTATION OF PREFIT FITNESS TEST BATTERY IN THE PRESCHOOL STAGE: THE AVENTURES OF COFITO AND COFITA

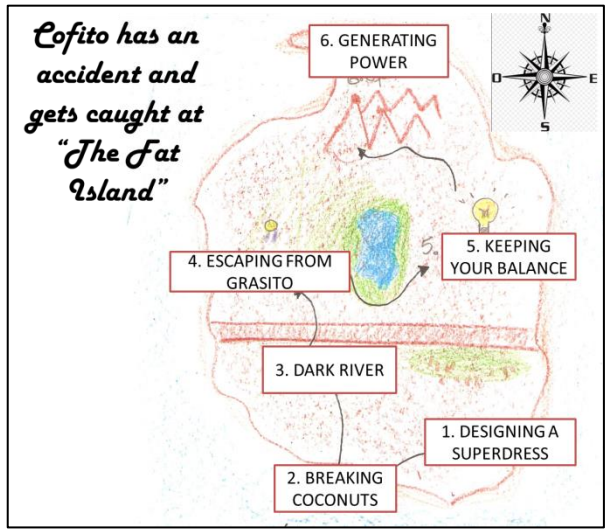
5.1. Who are COFITO and COFITA?

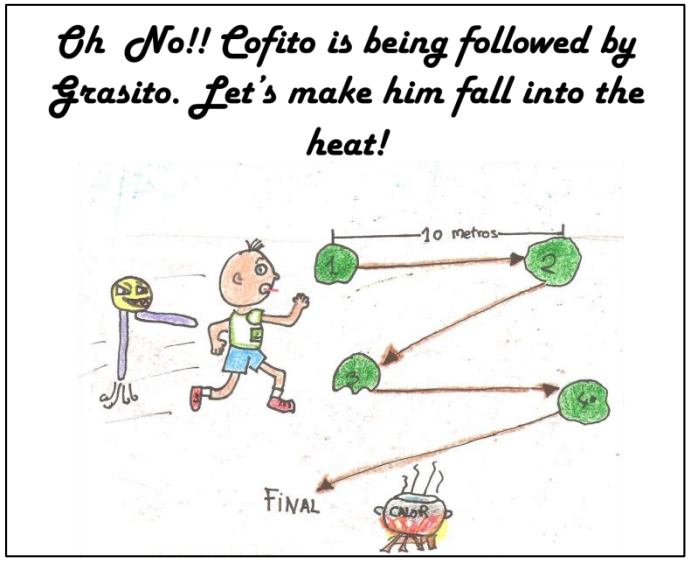
The PREFIT fitness test battery has been designed for preschool ages. At these ages, children have motor skills to perform activities such as running or jumping as well as cognitive skills having the capacity to imagine and create things.

For that purpose, with the aim to promote their imagination and in order to make the tests more attractive we created two different fairy tales. In this sense, the participants had to help "Cofito" (boy) and "Cofita" (girl) to overcome some adventures in imaginary places, such as the "Lipid Island" or in the "Banana Space" (see section 5.2). These fairy tales served to make the fitness testing fun and keep children motivated in their "adventures" (i.e. fitness tests) in order to obtain their maximum performance. It is important that evaluators constantly encourage children so that they do their best performance[10].



5.2. Example of a fairy-tale in pictures





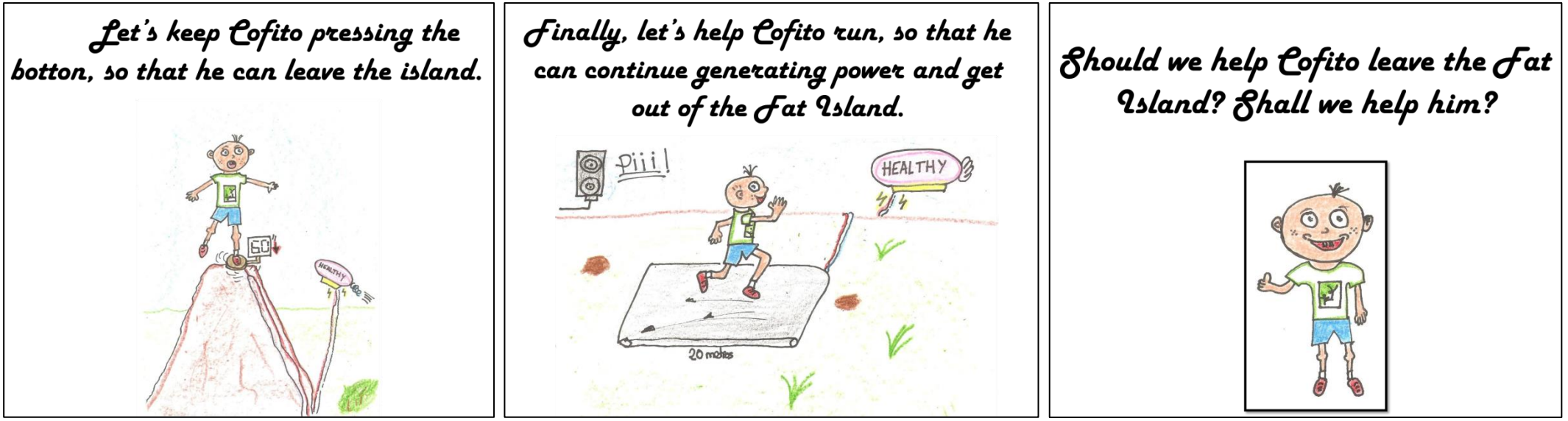


Figure 1. Cofito's fairy tale showing all the tests of PREFIT battery.

6. TESTS

6.1. Body composition

6.1.1. Body Mass Index (BMI)

Purpose To measure body size.

Health-relation Higher BMI is associated with a worse cardiovascular profile.

Equipment An electronic scale and a stadiometer (to start measuring height from 80 cm).

Performance Body weight in kilograms divided by the square of height in meters (kg/m^2).

Body weight

Description: The preschool child, without shoes, stands still over the centre of the platform with the body weight evenly distributed between both feet, looking to the front, with the arms along the body, and without moving any part of the body. Light underclothes can be worn, excluding shoes, long trousers, and sweater.

Instructions for the participant: Take the shoes and sweater off to perform the test. Get on the scale and maintain your arms along the body without any movement.

Body height

Description: The child stands on the stadiometer with bare feet placed slightly apart. The back of the head, shoulder blades, buttocks, calves, and heels touch the vertical board. Legs must be kept straight and the feet flat. The tester must position the child's head so that a horizontal line drawn from the ear canal to the lower edge of the eye socket runs parallel to the baseboard (i.e., the Frankfort plane positions horizontally). The headboard must be pulled down to rest firmly on top of the head and compress hair. Hair ornaments must be removed and braids must be undone.

Instructions for the participant: Take the shoes and sweater off to perform the test. Get on the stadiometer and keep straight and with the feet flat. Maintain the heels touching the vertical board and your arms along the body. Breathe in deeply and maintain your breath when the evaluator tells you.

Fairy-tale relation: Dressmaking as Cofito with a suit that will give you Cofi-powers!

Number of test trials: Two measurements of both body weight and body height are performed and the mean of each one is retained.

Measurement It starts when the child has reached the correct test position.

Scoring	Body weight is recorded to the nearest 100 g. *Example:* a result of 28 kg scores 28.0. In body height the Reading must be taken to the last completed 1 mm. *Example:* a result of 100.3 cm scores 100.3.
Video	https://www.youtube.com/watch?v=1XGXjqgXMJU

6.1.2. Waist circumference

Purpose	To estimate central body fat.
Health-relation	A higher waist circumference is a risk factor for cardiovascular disease.
Equipment	Non-elastic tape.
Performance	**Description:** The child wears little clothing so that the tape may be correctly positioned. The child stands erect with the abdomen relaxed, the arms at the sides, and the feet together. The tester faces the child and places an inelastic tape around him/her, in a horizontal plane, at the level of the umbilical zone. **Instructions for the participant:** Take the shoes and sweater off to perform the test. Cross your arms over your chest. When the evaluator tells you, you must move down your arms. **Number of test trials:** Two measurements are performed not consecutively and the mean of each one is retained.
Measurement	It starts when the child has reached the correct test position. Measurement should not be taken over clothing, they should be taken at the end of a normal expiration without the tape compressing the skin and with the child's arms at the sides.
Scoring	It is recorded to the nearest 0.1 cm. *Example:* a result of 60.7 cm scores 60.7.
Video	https://www.youtube.com/watch?v=1XGXjqgXMJU

6.2. Musculoskeletal fitness

6.2.1. Handgrip strength

Purpose	To measure upper body isometric strength
Health-relation	Muscular strength is inversely associated with established and emerging cardiovascular disease risk factors, back pain, and with bone mineral content and density. Musculoskeletal improvements from childhood to adolescence are negatively associated with changes in overall adiposity.
Equipment	A hand dynamometer with adjustable grip (TKK 5001 Grip A, analogue model[9], measurement range 0-100; Takey, Tokio Japan).
Performance	**Description:** Child squeezes gradually and continuously for at least 2 seconds, performing the test twice (alternately with both hands) with the optimal grip-span (4.0 cm[12]) and allowing short rest between measures. For each measure, the hand to first be tested is chosen randomly. The elbow must be in full extension and avoiding contacting with any other part of the body with the dynamometer, except the hand being measured. **Instructions for the participant:** Take the dynamometer with one hand. Squeeze it as tightly as you can while holding the dynamometer away from your body. Squeeze gradually and continuously for at least 2 seconds. **Fairy-tale relation:** Help Cofito break coconuts with just one hand. **Practice and number of test trials:** The evaluator shows the right performance. Both hands are to be tested twice, and the best result (of each hand) scored.
Measurement	The maximal duration of the test is 3-5 seconds. The precision of the measure is 0.5 kg. During the test, the arm and hand holding the dynamometer should not touch the body. The instrument is held in line with the forearm and hands down at the side. After a short rest, a second attempt is made. The indicator needs to be returned to zero after the first attempt.
Scoring	For each hand, we register the best trial (in kilograms, precision 0.5 kg). *Example:* a result of 4 kg scores 4.0.
Video	https://www.youtube.com/watch?v=OE_oZqV-cGU

6.2.2. Standing long jump

Purpose	To measure lower body explosive strength.
Health-relation	Muscular strength is inversely associated with established and emerging cardiovascular disease risk factors, back pain, and with bone mineral content and density. Musculoskeletal improvements from childhood to adolescence are negatively associated with changes in overall adiposity.
Equipment	Non-slippery hard surface, stick, tape measure, adhesive tape, and cones.
Performance	**Description:** The participant will stand with the feet at the shoulder's width, and toes just behind the line. From this position, the children bend their knees, swing both arms, push off vigorously, and jump as far as possible. The children try to land with the feet together and stay upright. **Instructions for the participant**: Stand with your feet at the shoulder's width, and toes just behind the line. Bend your knees with your arms in front of you, parallel to the ground. As you swing both arms, push off vigorously and jump as far as possible. Try to land with your feet together and to stay upright. **Fairy-tale relation**: Cofito needs to jump the dark river, do you want to join him? **Practice and number of test trials:** The evaluator shows the right performance. Three trials are carried out and the best result is scored.
Measurement	Horizontal lines are drawn on the landing region 10 cm apart, parallel to and starting 1 m from the take-off line. A tape measure perpendicular to these lines gives accurate measurements. Stand on one side and record the distances jumped. The distance is measured from the take-off line to the point where the back of the heel nearest to the take-off line lands on the ground. A further attempt is allowed if the child falls backwards or touches the mat with another part of the body.
Scoring	Results are given in cm. *Example:* a jump of 1 m 06 cm scores 106.
Video	https://www.youtube.com/watch?v=iKV9FClnqV8

6.3. Motor fitness

6.3.1. 4x10m shuttle run

Purpose	To measure speed of movement, agility, and coordination.
Health-relation	Improvements in speed/agility seem to have a positive effect on skeletal health.
Equipment	Clean, non-slippery floor, stopwatch, four cones, and adhesive tape.
Performance	**Description:** A running and turning (shuttle) test at maximum speed (4x10m). Two parallel lines are drawn on the floor (with tape) 10 m apart, placing one evaluator at each end. When the start signal is given, the child runs as fast as possible to the other line, touches the evaluator 1's hand (sort of "give me five"), and returns to the starting line, crossing both lines with both feet and touching evaluator 2's hand. Then, the child returns running as fast as possible to the opposite line, touches evaluator 1's hand and runs back to the starting line. **Instructions for the participant:** Get ready behind the line. One foot should be just behind the line. When the start signal is given, run as fast as possible to the other line, touch the evaluator 1's hand and return to the starting line. Cross both lines with both feet and touch evaluator 2's hand (sort of "give me five"). Thereafter, go back running as fast as possible to the opposite line and touch evaluator 1's hand. Finally, run back to the starting line without getting down speed before crossing it. **Fairy-tale relation:** Oh no! Cofito is being following by Grasito. Let's make him fall into the heat! **Practice and number of test trials:** The evaluator shows the right performance. Two trials are performed and the best time scored.
Measurement	Make sure that both feet cross the line each time, that the child remains in the required path and that the turns are made as quickly as possible. Call out the number of cycles completed after each one. The test stops when the child crosses the finishing line with one foot. The child should not slip or slide during the test, so a slip-proof floor is necessary.
Scoring	The test result is scored in seconds with one decimal. *Example:* a time of 21.6 seconds is expressed as 21.6.
Video	https://www.youtube.com/watch?v=IiPROnriQSU

6.4. Balance

6.4.1. One-leg stance

Purpose To measure static balance.

Health-relation Low levels of balance at early ages may indicate a problem or pathology of the neuromuscular system.

Equipment Non-slip surface and stopwatch.

Performance

Description: The child will be placed static on the floor with one leg flexed and eyes open. An attempt was made with each leg, noting the time that gets hold in that position.

Instruction for the participant: This test consists in maintaining balance as long as possible. The time will be controlled with a stopwatch. The child is placed in a static way, taking the supporting leg on the floor and the other leg flexed. An attempt will be made on each leg. If it is necessary, the child will use their arms for balance. Their objective will be to maintain balance in the established position as long as possible. The stopwatch is activated when the free leg leaves the floor. The test will end when the child cannot maintain the required position, that is, moves the support leg, heel, or toe considerably from the original position; touches the floor with the free foot or support the free leg on the supporting leg.
Fairy-tale relation: Let's keep Cofito pressing the button, so that he can leave the island.
Practice and number of test trials: Before the test, a trial will be performed on each leg. The evaluator will help the child take a position of balance holding them one or two hands if it is necessary. The test is done once with each leg and then the mean is calculated.

Measure Make sure that the starting position is correct and that the leg is flexed. Note the time it gets to maintain this position in each attempt. You need avoid distracting factors that may influence the results of the test.

Score The result is recorded in seconds with one decimal.

Example: a duration of 15.3 seconds.

IMPORTANT: After testing the reliability of the PREFIT Fitness test battery[10,11], the one-leg stance test was not recommended from the proposed battery due to the low reliability in the 3-5 year-old groups.

6.5.1. PREFIT 20 m shuttle run

Purpose	To assess cardiorespiratory fitness.
Health-relation	High cardiorespiratory fitness during childhood and adolescence is strongly associated with a healthier current and future cardiovascular health.
Equipment	A gymnasium or space large enough to mark out a 20m track, four cones, tape measure, CD-player, and a pre-recorded CD of the test protocol.
Performance	**Description:** Children are required to run between 2 lines 20m apart in time with an audio signal. It is recommended that at least one evaluator performs the test with the children. Ideally, the test requires two evaluators running with the children, one in front and the other one behind, forming an imaginary moving band that helps them maintain the proper pace. The initial speed of the signal is 6.5 km/h and is increased by 0.5 km/h/min (1 minute equal to 1 stage). This is the major adaptation from the original test[10, 11, 13]. The test finishes when the child fails to reach the end lines concurrent with the audio signals on 2 consecutive occasions. Otherwise, the test ends when the child stops because of fatigue. This test is done once. **Instructions for the participant:** This test consists in running back and forth. Speed will be controlled by means of a tape emitting buzzing sounds at regular intervals. Pace yourself as the evaluator's pace so as to be at one end of the 20m track or the other when you hear a sound. Touch the line at the end of the track with your foot, turn sharply and run in the opposite direction. At first, the speed is low but it will increase slowly and steadily every minute. Your aim in the test is to follow the set pace for as long as you can. You should therefore stop when you can no longer keep up with the set rhythm or feel unable to complete the one-minute period. To sum up, the test is maximal and progressive, in other words, easy at the beginning and hard towards the end. **Fairy-tale relation:** Finally, let's help Cofito run, so that he can continue generating power and get out of the Fat Island. **Practice and number of trials:** Only one trial is performed.
Measurement	Select test site, preferably in a 25 m long gym. Allow for a space of at least one metre at both ends of the track. With a wider area, more children can be tested simultaneously: one metre between each child is recommended. The surface should be uniform but the material of which it is made is not specifically important. The two ends of the 20m track should be clearly marked.

Check the functioning of the sound track and CD player. Ensure that the device is loud enough for group testing. Listen to the contents of the sound track. Note the numbers on the CD player timer so as to be able to locate the key sections of the track quickly.

Scoring

After the child has stopped, the last completed lap is retained by one external evaluator. *A posteriori*, the lap conversion to stages can be done observing Table 1 of this manual.

Example: a score of 5 laps correspond to 1 stage. If a higher precision is required (e.g. intervention studies aiming to detect small changes), the laps performed instead of half-stages can be retained.

Video

https://www.youtube.com/watch?v=pv7_3-l3nH0

Audio

http://profith.ugr.es/pages/investigacion/recursos/audio

Table 1. Stages, speed (km/h), and laps of the PREFIT 20m shuttle run test[11].

Stages	Speed (km/h)	Laps	Total laps
0.5	6.5	3	3
1	6.5	2	5
1.5	7.0	3	8
2	7.0	3	11
2.5	7.5	3	14
3	7.5	3	17
3.5	8.0	3	20
4	8.0	4	24
4.5	8.5	4	27
5	8.5	3	31
5.5	9.0	4	35
6	9.0	4	39
6.5	9.5	4	43
7	9.5	4	47
7.5	10.0	4	51
8	10.0	4	55
8.5	10.5	5	59
9	10.5	4	64
9.5	11.0	5	68
10	11.0	4	73
10.5	11.5	5	78
11	11.5	5	83
11.5	12.0	5	88

12	12.0	5	93
12.5	12.5	5	98
13	12.5	5	103

6.6. Practical considerations

Table 2. Practical considerations when using the tests proposed in the PREFIT battery, field-based **FIT**ness testing in **PRE**school children aged 3 to 5[10].

Fitness test	Practical considerations/recommendations
Overall recommendation	- Evaluators must constantly encourage and motivate children. We recommend doing the evaluation as a game/fairy tale, presenting each test like an adventure or challenge. Telling them a story (preschoolers can be in a circle and the evaluator in the middle of it) with many adventures can be a good strategy. See Figure 1 as an example. - The person who tells the fairy tale must interact with children when they are telling the adventures (e.g. for anthropometry test, "How can we dressed up Cofito? We need to do some measurement to make a suit that perfectly fits him.") and they have to imitate the gestures of dressing, etc. When testing, each evaluator should remind the children in which adventure station they are and what the task of that place consists in. - A minimum of 2 evaluators are needed, although, ideally 5 evaluators are recommended. - Children are in their normal classroom and a researcher takes them to a separate testing room in groups of 8. The 8 children are organized by couples, each couple going to one of the four stations (1= anthropometry, 2= handgrip and standing long jump, 3=4x10m shuttle run test, 4= one-leg stance test). PREFIT 20 m shuttle run test was assessed at the end of the evaluation session, since this is a maximal test and children are exhausted after that. - The tests could be located in the same area, although whenever possible, we recommend performing the anthropometric measurements and one-leg stance test separately and in a quiet room. - We recommend performing an example before the test. - The scores obtained in all attempts are recorded, yet the best performance will be used for analyses, except for anthropometric measurements in which the average score is computed and used in analyses.
Weight, height and waist circumference	- For waist circumference, we recommend the measurement at the umbilical level, since typical body shape at these ages does not allow often to identify minimal/narrowest waist.
Handgrip strength test	- We recommend using the analogue version (TKK model 5001), since the range of measurement is from 0 to 100 kg, while the digital version (TKK 5401) is from 5 to 100 kg, and some small kids perform less than 5 kg. (See methodological paper about these dynamometers[9]) - In a previous methodological paper, we observed that the optimal grip span for preschoolers was 4.0 cm[12].

	- Children tend to take the dynamometer with both hands and squeeze it simultaneously. It is something that needs to be corrected most of times.
Standing long jump test	- Young preschoolers (especially the 3 year-old group) have difficulties jumping with their feet together and landing without falling. Therefore, one or two familiarization attempts before trial are recommended. - We also recommend performing 3 trials instead of 2 in comparison with the rest of the tests. - We recommend drawing footprints on the floor in order to guide the child to know the take-off line.
4×10 m shuttle run test	- To make this test simpler compared with older children and adolescents, do not use sponges to be exchanged when crossing the lines 10 m apart (4 times × 10 m). Instead of sponges, two evaluators are located at behind each line (10 m apart) and preschoolers have to touch the evaluators' hands (placed behind the line) and return at maximum speed. - The evaluator can provide the instructions during the development of the test. For example: "Now, you have to clap my hand and turn quickly".
One-leg stance test	- There are many versions of this test (e.g. eyes open vs. closed, standing on the floor vs. on a beam forefoot or with shoes). We recommend using the simplest one when implemented in preschoolers. The child stands on a non-slippery floor with their eyes opened. The time (seconds with two decimal) that the child is able to maintain the requested position is scored. Each leg is tested once and the average of both legs is used for analyses.
PREFIT 20 m shuttle run test	- Very young children have problems to keep the appropriate pace while doing this test, so it is recommended that one or two evaluators run with them. When two evaluators are available, then, one of them can run in front of the preschoolers and the other one behind, keeping the children between them. - Groups should be 4-8 children. If only one evaluator is available, no more than 3-4 children are recommended. - While scoring this test, you may record the number of laps instead of completed stages as sometimes is done in older children (conversions from laps to stages or final speed can be done *a posteriori* if needed). This will make the test more precise and discriminant.

7. GRAPHIC REPRESENTATION OF THE PREFIT FITNESS BATTERY TESTS

Body composition

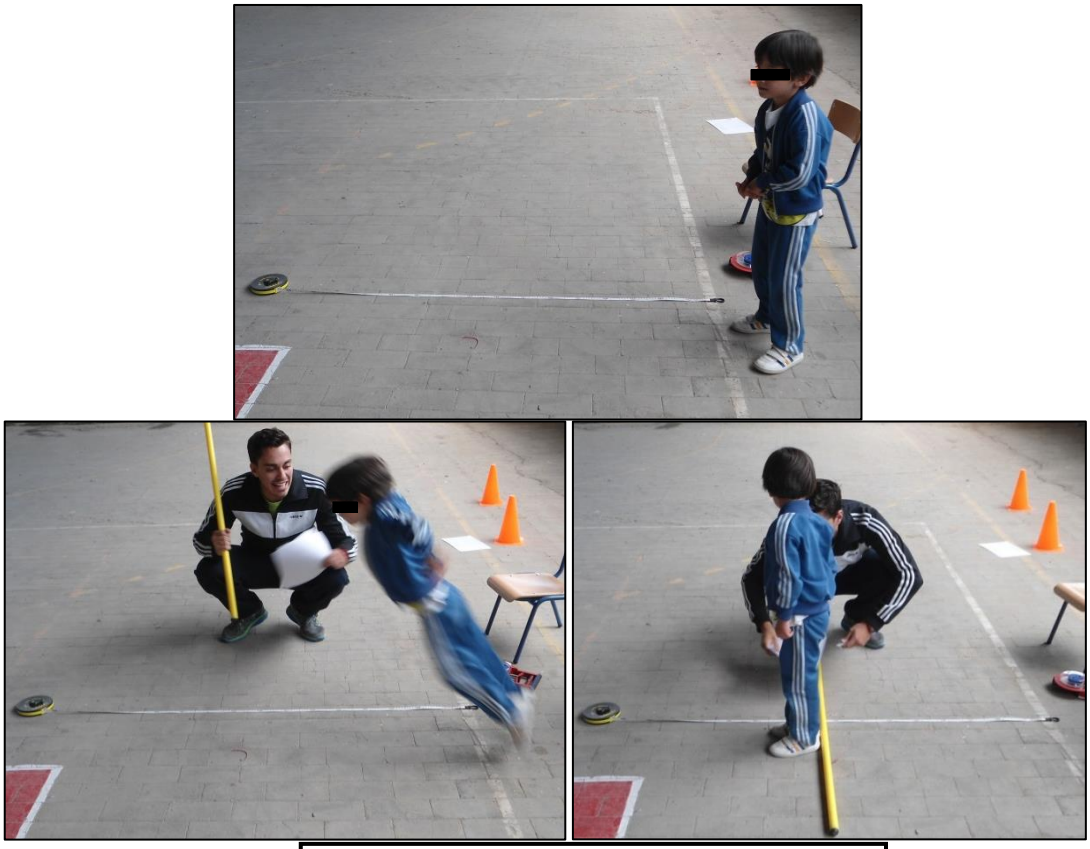
Weight (kg)

Height (cm)

Waist circumference (cm)

Musculoskeletal fitness

Handgrip strength (kg)



Standing long jump (cm)

Motor fitness

4x10 m shuttle run (seconds)

Balance

One-leg stance test (seconds)

Cardiorespiratory fitness

PREFIT 20 m shuttle run test (laps)

8. REFERENCE STANDARDS

With the aim to interpret correctly the fitness assessment in pre-schoolers, it is necessary to have sex- and age-reference standards. This information is relevant to health screening and early prevention as many non-communicable diseases aggravate during growth and development. Therefore, the main objective of the PREFIT-Spain project was to provide sex- and age-specific anthropometric and physical fitness reference standards from a relatively large sample of preschool children aged 3 to 5 geographically distributed across Spain. Additionally, we have collected information about parental educational level, breastfeeding, perceived physical fitness level, physical activity, and mode of commuting to school.

The PREFIT project (http://profith.ugr.es/prefit) aimed to assess anthropometric characteristics and physical fitness in preschool children from 10 different cities/towns in Spain (i.e. Almería, Cádiz, Castellón de la Plana, Cuenca, Granada, Las Palmas de Gran Canaria, Madrid, Palma de Mallorca, Vitoria-Gasteiz, and Zaragoza). Data collection took place from January 2014 to November 2015. Thereby, a total of 3179 (4.6 ± 0.9 years old, 1678 boys -52.8%-) preschool children participated in the PREFIT Project.

The anthropometric and physical fitness reference standards allow other researchers or professionals to classify preschool children in sex- and age-percentiles and categories such as very low ($X < P10$), low ($P10 \leq X < P25$), medium ($P25 \leq X < P75$), high ($P75 \leq X < P95$), and very high ($X \geq P95$) and also scaling them from 0 to 10. In line with this assumption, we uploaded to the website an excel-based calculator so that the researcher or practitioner can copy and paste age, sex, and the result of the anthropometry and fitness test. The calculator will inform at which percentile value belongs to. The calculator will work entering either the data of one child, or copying and pasting whole columns from a data set, for instance of 3000 participants (freely available at http://profith.ugr.es/recursos/prefit). Thereby, professionals (sports practitioners, teachers, health care, trainers, etc.) can identify and help young children classified into the lowest categories, implementing strategies to promote physical fitness and physical activity to prevent or reduce future health-related problems.

Figure 2. Town/Cities involved in PREFIT-Spain.

9. MEASUREMENT SHEET

Assessing **FIT**ness in **PRE**schoolers

PREFIT Battery: Assessing FITness in PREschool children

Measurements

Name and surname: _____ **Sex**: M / F **Birth date:** _____

School: _____ **Grade:** _____ **Evaluation date:** _____

Body composition			
Body weight (kg)		Body weight (kg)	
Body height (cm)		Body height (cm)	
Waist circumference (cm)		Waist circumference (cm)	
Musculoskeletal fitness			
Handgrip strength – right hand (kg)		Handgrip strength – right hand (kg)	
Handgrip strength – left hand (kg)		Handgrip strength – left hand (kg)	
Standing long jump (cm)		Standing long jump (cm)	
Standing long jump (cm)			
Motor fitness			
4x10 m shuttle run (sec)		4x10 m shuttle run (sec)	
Cardiorespiratory fitness			
20 m shuttle run PREFIT (laps)			

Notes: (e.g. reasons for exclusion, problems occurring during the test)

Name/s of the evaluator/s:_____.

10. WORKING GROUP

List of the PREFIT project members

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