

## Development and validation of a hip hop intervention programme for pre-school children: Crianças+ (Children+)

### Desarrollo y validación de un programa de intervención hip hop para niños en edad preescolar: Crianças+ (Niños+)

### Desenvolvimento e validação de um programa de intervenção de hip hop para crianças em idade pré-escolar: Crianças+

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**Abstract.** Physical inactivity and obesity in children are public health problems that can be fought through the practice of rhythmic activities such as hip hop. The aim of this study was to develop and validate the Crianças+ hip hop physical exercise programme, designed to promote increased physical activity and improved physical-motor skills in children aged 3 to 5 years old. The exercise programme was designed and validated by physical fitness and motor development specialists, following the Revised Guidelines for Reporting Criteria on the Development and Evaluation of Complex Health Interventions (CRDeDEC12), and the Consensus Guidelines on Physical Exercise Programme Reporting Model (CERT), and went through three phases: development, piloting and evaluation. This study presents an intervention proposal based on children's motor development, emphasizing foundational motor skills and drawn on hip hop's identity motor skills, as well as its exploration of various coordinative abilities. The Crianças+ programme proposal presents suggestions for adapting to the target population and choreographies that can be replicated by physical fitness professionals.

**Keywords:** motor development, second childhood, foundational motor skills, complex intervention, fitness

**Resumen.** La inactividad física y la obesidad en niños son problemas de salud pública que pueden combatirse mediante la práctica de actividades rítmicas como el hip hop. El objetivo de este estudio fue desarrollar y validar el programa de ejercicio hip hop físico Crianças+, diseñado para promover el aumento de la actividad física y mejorar las habilidades físico-motoras en niños de 3 a 5 años. El programa de ejercicios fue diseñado y validado por especialistas en aptitud física y el desarrollo motor, siguiendo las Pautas Revisadas para el Informe de Criterios sobre el Desarrollo y Evaluación de Intervenciones de Salud Complejas (CRDeDEC12) y las Pautas de Consenso sobre el Modelo de Informe de Programa de Ejercicios Físicos (CERT), y pasó por tres fases: desarrollo, prueba piloto y evaluación. Este estudio presenta una propuesta de intervención basada en el desarrollo motor de los niños, haciendo hincapié en habilidades motoras fundamentales e inspirándose en las habilidades motoras identitarias del hip hop, así como en la exploración de diversas habilidades coordinativas. La propuesta del programa Crianças+ incluye sugerencias para adaptarse a la población objetivo y coreografías que pueden ser replicadas por profesionales de aptitud física.

**Palabras clave:** desarrollo motor, primera infancia, habilidades motoras fundacionales, intervención compleja, fitness

**Resumo.** A inatividade física e a obesidade em crianças são problemas de saúde pública que podem ser combatidos através da prática de atividades rítmicas como o hip hop. O objetivo deste estudo foi desenvolver e validar o programa de exercício físico de hip hop Crianças+, projetado para promover aumento da atividade física e melhoria das habilidades físico-motoras em crianças com idades entre 3 e 5 anos. O programa de exercício físico foi concebido e validado por especialistas em exercício físico e desenvolvimento motor, seguindo as Linhas Orientadoras Revistas para Critérios de Reporte sobre o Desenvolvimento e Avaliação de Intervenções Complexas em Saúde (CRDeDEC12), e as Diretrizes do Consenso sobre Modelo de Reporte de Programas de Exercício Físico (CERT), tendo passado por três fases de desenvolvimento, pilotagem e avaliação. O presente estudo apresenta uma proposta de intervenção baseada no desenvolvimento motor das crianças, enfatizando as habilidades motoras fundacionais e tirando partido das habilidades motoras identitárias do hip hop, bem como da sua exploração das várias capacidades coordenativas. A proposta do programa Crianças+ apresenta sugestões de adequação à população-alvo e coreografias replicáveis por profissionais de desporto.

**Palavras-chave:** desenvolvimento motor, segunda infância, habilidades motoras fundacionais, intervenção complexa, fitness

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## Introduction

Levels of physical inactivity in children remain high and worrying (ACSM, 2021a), resulting from a variety of causes, such as new technologies (television and computers), insufficient entertainment, less time playing outdoors due to the dangers of the external environment, and a lack of active transport (Büllbül, 2020). Physical inactivity is the cause of obesity in adults and children (Chen et al., 2020).

On the other hand, the practice of physical activity (PA) is salutogenic, promoting numerous health benefits throughout life, namely improved cardiorespiratory fitness, muscle strength and well-being in children with and

without typical motor development (Ermenova et al., 2021; Kanters et al., 2015; Mercê, Branco, et al., 2022; Mercê et al., 2023; Robles et al., 2023). PA is defined as any bodily movement produced by the contraction of skeletal muscles that results in an increase in calorific needs in relation to resting energy expenditure (ACSM, 2021b). Motor competence (MC) also plays an important role in growth, development and opportunities to lead an active lifestyle in children. This concept is often specified as proficiency in the execution of foundational motor skills (FMS, e.g., throwing, grasping, running) (Luz et al., 2016), which are ideally learned during second and third childhood period, and often categorized by stability (e.g., static

balance), object control or manipulation (e.g., throwing), or locomotion involving two or more body segments (e.g., jumping) (Barnett et al., 2016; Hulteen et al., 2018).

Stodden's (2012) theoretical model predicts the relationship between PA, MC, body composition and physical fitness, and, according to this model, children with low MC face significant restrictions when participating in physical activities. Lack of proficiency in foundational skills not only limits opportunities to engage in physical activity, but also creates a barrier to becoming active (Stodden et al., 2012), increasing sedentary time.

A previous systematic review concluded that the practice of PA in children aged 2 to 10 (ages corresponding to the second and third childhood, phase of motor development in which HMF should be explored) has benefits, such as, increasing proficiency in gross and fine motor skills (Foweather et al., 2008), improving executive functions (Emami Kashfi et al., 2019), as well as health-related physical fitness components (Nobre et al., 2017). There is a positive association among PA and MC, because children who are more agile and competent in motor skills are more likely to be more active throughout their lives (Rodrigues et al., 2021).

One of the most effective strategies for combating physical inactivity and obesity in children is to practice rhythmic activities (Cain et al., 2015), because they are fun and promote a pleasant atmosphere and interaction between children. This type of practice requires performing different types of movements and can involve various multisensory information (e.g., visual, auditory, tactile), which, in turn, can lead to different neurological adaptations, such as improved neural activity and neurogenesis (Lossing et al., 2017). Dance is a common physical activity for pre-school children and consists of a repetitive and progressive activity, facilitating motor learning and the mastery of FMS in children, including those with disabilities (Cameron et al., 2021). Dance as rhythmic-expressive content presents ample opportunities and benefits for the education of children and young people from an inclusive point of view, i.e., on a physical, intellectual and emotional level (Sánchez et al., 2011). There are many standard classical exercises that can develop the sense of rhythm in movements (Polevoy & Fuentes-Barría, 2023), but dance allows you to develop this coordinative ability and much more (Sánchez et al., 2011). Besides allowing a work for the education of the body and movement, dance develop creativity, the relationship between partners, the knowledge of oneself, the knowledge of other cultures and the development of the expressive capacity (Moledo & Hermoso, 2002; Sánchez et al., 2011). In this sense, dance becomes an activity that contributes to improving the health of all its practitioners, including children.

Nowadays, hip hop is one of the dance styles that is strongly present in the lives of children and young people. There has been a growing interest in the use of this type of dance, and it is believed that it can increase participants' engagement in health interventions, since hip hop promotes

psychomotor and physical work, social integration and even improves quality of life (Robinson et al., 2018; Withers et al., 2019). According to our research, only one hip hop intervention programme was applied to pre-school children-Hip-Hop to Health Jr., which covered the promotion of varied physical activity (not exclusively hip hop) and of improved nutrition, with the main aim of reducing BMI in pre-school children. The intervention consisted of three weekly sessions, where each session included 20 minutes of nutritional activity, followed by 20 minutes of aerobic activity, with moderate to vigorous general movements, involving some hip hop movements. Hip-Hop to Health Jr. was applied in several schools and was found to be effective in reducing subsequent increases in BMI in schools with black children, but was not effective when applied in schools with Latino children (Fitzgibbon et al., 2006, 2011).

A physical exercise programme is considered a complex intervention, as it has to be adapted to a specific population and context and is affected by various efficacy and safety components. It is therefore important to develop and validate well-defined and replicable exercise protocols to fill the identified gap (Santos-Rocha et al., 2020). For this purpose, specific tools have been used, such as the Criteria for Reporting on the Development and Evaluation of Complex Health Interventions (CReDEC12) guideline (Möhler et al., 2015), which is a reporting guideline that aims to improve the quality of reporting on the development and evaluation phases of complex healthcare interventions; and, the checklist for the Consensus for Exercise Programme Reporting Template (CERT) (Slade et al., 2016), which was developed to improve the description of essential characteristics of the intervention, in order to effectively enable the replication of the programme. Considering the potential and benefits of practicing hip hop, especially in children in their second and third phases of childhood, which correspond to the stage of FMS development as well as sensitive periods to develop the various coordination skills including rhythm (Anderson et al., 2012; Cordovil & Barreiros, 2014; Knudsen, 2004). This study aims to develop and validate the Crianças+ ("Children+") hip hop intervention programme. This programme is designed to increase physical activity and improve motor skills in pre-school children, and was developed and validated using the CReCEC12 and CERT tools.

## Materials and Methods

### Objectives

This study aims to develop and validate a hip-hop physical exercise programme for pre-school children, aged 3 to 5 years old, with the objectives of increasing physical activity and improving children's motor skills.

### Participants

The process of developing and validating the programme involved a total of 41 participants, composed of: (a) six exercise and motor development specialists, including two doctorate or degree in exercise science and movement science, one doctorate or degree in exercise science,

and three fitness professionals with experience teaching hip hop classes to children; (b) a group of 15 children who took part in the testing of the choreographies (c) 21 masters and bachelors specialised in physical activity, with experience of the target population and sport.

### ***Instruments and Protocols***

Two guidelines were used in the development and validation of this programme. The guideline "Criteria for Reporting the Development and Evaluation of Complex Interventions" in healthcare (CReDECI 2) by Möhler et al. (2015) was used to improve the quality of the reporting of the development and validation stages of the programme. CReDECI 2 consists of 13 items, subdivided into three stages: development, piloting and evaluation; and, must include examples from real studies for each item (Möhler et al., 2015). The Consensus Guideline on Exercise Programme Reporting Template (CERT) (Slade et al., 2016), was also used to ensure a detailed description of the programme. The CERT checklist consists of 16 items, and was presented in item 2 of the 1st phase of CReDECI2, corresponding to the development phase.

### ***Ethical considerations***

All the procedures carried out complied with the 1964 Helsinki declaration for studies involving human participants. Informed consent was obtained from all the parents and carers, and the assent of the participating children was always taken into account. This study was approved by the Ethics Committee of the Research Unit of the Polytechnic Institute of Santarém, identified with the number 5A-2023 ESDRM.

## **Results**

The programme included various choreographies, with elements of hip hop, suitable to the target age group. All the lesson plans were described in a digital manual supported by video tutorials. The exercise programme went through the three stages proposed by Möhler et al. (2015): development, piloting and evaluation; which are presented in detail below.

### ***First phase: development***

*Item 1 - description of the theoretical basis underlying the intervention*

Regular physical activity provides children and young people with a number of important benefits, such as improved physical fitness, cardiometabolic health, bone health, cognition, mental health, reduced adiposity and obesity control (Camargo & Añez, 2020; Chen et al., 2020; Pandita et al., 2016). In order to promote the adoption of healthy lifestyles now and in the future, it is important to develop and implement intervention programmes with physical exercise from a young age (Hulteen et al., 2018). Stodden's model (2012) predicts that there is a close and direct relationship between physical activity, motor skills

and physical fitness in children and young people. Practicing more physical activity and exercise contributes to better motor skills (and vice versa), which in turn contributes to the child/young person feeling more enticed to practicing more and new physical activities, thus leading to a positive cascade effect (Stodden et al., 2012). At the same time, more activity and exercise leads to better physical condition and body composition (Chen et al., 2020; Pandita et al., 2016). In this context, the literature has pointed to rhythmic activities, including hip hop, as being effective in fighting physical inactivity and obesity in children (Cain et al., 2015; Leek et al., 2011; Romero, 2012; Shen et al., 2020; Tao et al., 2022; Williams & Noble, 2008), as well as improving physical and cognitive functions (Cherriere et al., 2020; Withers et al., 2019). It is important to note that in addition to physical and body composition improvements, hip hop, due to its identity characteristics, namely its rhythm and specific movements, also promotes the exploration of all coordinative abilities, i.e., rhythm, reaction, spatial orientation, balance, combination and differentiation (Laróvere, 2015). This exploration and improvement will be especially important considering the children's stage of motor development, due to the nervous system's critical period of growing and maturation. The exercise programme is aimed at children aged 3 to 5, who are in their second stage of childhood and in a sensitive period for the development of various motor coordination abilities (Cordovil & Barreiros, 2014; Laróvere, 2015). Thus, the participants' stage of motor development reinforces and justifies the relevance of applying this programme. It should also be noted that the exercise programme was prescribed in accordance with the ACSM (2021a) guidelines for children.

*Item 2 - description of all the components of the intervention, including the reasons for its selection and its essential objectives/functions*

Hip hop is one of the styles that is currently most present in young people's lives, with many benefits (physical-motor, social and emotional) and capable of exploring all coordinative abilities (Robinson et al., 2018; Withers et al., 2019), which is why it was selected for the intervention programme. The exercise programme focuses on the practice of hip hop as an extracurricular enrichment activity, prescribed in face-to-face group training sessions, conducted by accredited professionals, i.e., senior physical exercise technicians, currently undergoing specialized training through the Master's Degree in Physical Activity and Health, and with two years' experience in conducting hip hop classes with children. The programme, from now on identified as Crianças+ ("Children+"), was designed for a period of 3 months, with a 1-month break to control the variables under analysis, including a weekly frequency of 3 sessions (Fitzgibbon et al., 2006, 2011), lasting 30 minutes each. The duration of 30 minutes per session was chosen according to the target age and motor stage of development of the participants, who were 3 and 5 years old,

consequently in the foundational motor skills stage (Cordovil & Barreiros, 2014). Thus, a shorter duration was prioritized, interspersed with several breaks, to meet the specific needs of this group (ACSM, 2021a).

The programme focused on simple, short choreographies. Three of the four choreographies were taught and repeated during the first intervention, and a slightly more complex choreography was introduced during the second intervention.

The motor skills (i.e., the choreographic steps) included in the programme and choreographies were selected according to the following criteria: i) steps of low to medium difficulty, based on foundational motor skills, such as walking, jumping and squatting, with a level of difficulty adjusted to the target audience; this methodological option allowed for the exploration of basic skills that support the future development of specialized skills (hip hop and others) (Hulsteen et al., 2018); ii) the inclusion of variations in the execution and style of hip hop, which gave body to the chosen modality and allowed children to experience new motor skills (Robinson et al., 2018; Withers et al., 2019); iii) the exploration of different planes of movement and levels of execution (i.e., lower, middle and upper levels), challenging the children's coordination and helping them to improve their ability to perform complex and synchronized movements in a tridimensional space; also adding diversity to the lessons, making them more fun and stimulating (Petersen, 2008).

In order to ensure a more detailed explanation of the programme, there follows a description of the 16 items in the CERT guideline:

#### CERT Item 1

Detailed description of the type of exercise equipment: all the sessions were carried out with music, using a computer (HP; California) and a speaker (RCF; United Kingdom); the participants did not use any additional exercise equipment apart from clothing and footwear suitable for exercise; the sessions took place in a large room (50 square meters), with a suitable sports floor, good ventilation, and acoustic conditions.

#### CERT Item 2

Detailed description of qualifications, competences and/or training undertaken by exercise professionals: the "Children+" programme was supervised by two teachers with advanced academic training, PhDs in Human Motricity, specialized in motor development and motor behaviour, both with professional experience in teaching classes to children. Both instructors who conducted the programme had a degree in sports science, more specifically in Sport, Physical Condition and Health and were doing advanced training through the Master's Degree in Physical Activity and Health. Both instructors had two years' experience teaching hip hop classes to children.

#### CERT Item 3

Description of how the exercises were carried out (individually or in groups): the "Children+" programme consisted of group exercise sessions for up to 20 participants. The number of participants was defined in such a way as to allow for close monitoring by the instructors and, at the same time, to allow for group practice, an attribute that characterizes hip hop. All the sessions were face-to-face, lasting 30 minutes of actual practice and 15 minutes for travelling between rooms and changing equipment. Each session consisted of: i) a 5-minute warm-up phase, performed through a game or a lower-speed choreography, less than 130 beats per minute (bpms) and with foundational motor skills; ii) a 20-minute fundamental phase, made up of various choreographies whose intensity and complexity alternated, but regulated for intermittent physical exercise (ACSM, 2021b); iii) introduction of new motor skills was favored at the beginning of the session, when children aged 3-4 are less neurologically fatigued (Apriantono et al., 2006); iv) a return to calm phase, consisting of a game chosen by the children from 3 possibilities given by the instructors; and v) the stretching phase, consisting of a slower choreography (64 bpms) and dynamic stretching exercises. All the exercise sessions were supervised by qualified professionals.

#### CERT Item 4

Description of the exercises (supervised or not) and how they are presented: The programme was based on performing hip hop choreographies with particular hip hop gestures (e.g., hang loose; crossed arm posture), as well as foundational motor skills adjusted to the children's ages (e.g., jumping and hopping in various directions). The foundational motor skills can be grouped in gross motor skills, that are present in specific body movements of hip hop; and fine motor skills, that are present in some finger gestures in hip hop. The choreographies were exemplified by the instructors and the children were invited to perform them simultaneously, imitating their gestures and movements. The basic phase of each session consisted of three or four hip hop choreographies, where the steps were initially presented and practiced separately and then added, until the complete choreography was achieved; i.e., from partial practice to global practice.

#### CERT Item 5

Detailed description of how adherence to the exercise is monitored: adherence to the programme was monitored through an attendance register, which was always updated at the beginning of each session. It should be noted that the participants' assent was always taken into account, i.e., whenever a child showed an intention not to take part in the class or to leave it earlier (e.g., illness, headaches, weariness), their wishes were always respected.

#### CERT Item 6

Detailed description of the motivation strategies: the programme was promoted and publicised through posters

delivered to partner organizations. As a strategy to motivate people to sign up for the programme, these posters were designed in bright colors and with eye-catching puppet images, in order to arouse the interest of future participants, pre-school children (Correia & Pereira, 2005). In addition, the posters also presented all the benefits that physical exercise promotes, in order to draw the attention not only of the children, but also of their guardians to adhering to the programme. During the sessions, the instructors gave positive reinforcement feedback, trying to create appealing dynamics. Two of the motivational strategies used consisted of: i) giving positive feedback on the children's progress throughout the programme, celebrating each small achievement (e.g., learning or improving in a new skill) (Villwock & Valentini, 2007); ii) allowing the children to select the play activity that was part of the return to calm phase.

#### CERT Item 7 (a)

Detailed description of the decision rules for determining exercise progression: intensity progression throughout the exercise programme was monitored using the following variables: beats per minute (bpm) of each song, number of choreographies presented in class, variation in planes (i.e., horizontal, sagittal and frontal) and movement levels (i.e., upper, middle and lower) proposed by the instructors. The programme was based on preparing and conducting hip hop choreographies that complemented each other, i.e., the hip hop steps taught in one choreography were complemented with other skills in the following choreographies. This way, the choreographies complemented each other, but without repeating the identifying elements of hip hop; augmenting the lexical motor repertoire and promoting practice in varied rhythmical conditions. The instructors only decided to move on to the next choreography and, consequently, for the exploration of new skills, if the previous ones have already been acquired. The criteria used to measure the consolidation phase of learning the choreography was that 65% of the children in the class were successful in achieving it.

#### CERT Item 7 (b)

Detailed description of how the exercise programme progresses (number of repetitions, resistance, load, speed, etc...): the progression of intensity and complexity was planned over 8 weeks and divided into 4 different periods:

1st period (week 1 and 2) (Acquisition): During the initial phase of the programme, the main songs had a cadence of around 100 bpm. The choreographies used only included movement in two planes (frontal and sagittal), so that the participants never lost sight of the instructor, and only intermediate and upper levels were used;

2nd period (week 3 and 4) (Refinement): In this period, music was introduced at 128 bpm, exploring two levels of movement, i.e., intermediate and lower, and a new level (lower) was thus introduced. With regard to the planes of movement, the exploration of the horizontal plane was initiated by making complete turns;

3rd period (week 5 and 6) (Consolidation): in this

deepening phase, a new 120 bpm choreography was introduced, which contained all the movement levels (lower, middle and upper). In this period, the component of free and playful exploration was reduced, emphasizing the greater practice of hip hop's identity skills;

4th period (week 7 and 8) (Automation): The final period of the programme, the intensity of the session was increased by increasing the number of choreographies performed in a single session. At this stage, all the choreographies explored so far were performed.

#### CERT Item 8

Detailed description of each exercise to enable replication: the detailed characterization of each choreography and movement is presented in a "Children+" programme manual. In this guide, the training plans and all the detailed descriptions of the choreographies performed during the programme are presented in table format. The manual also has links to videos showing examples of the choreographies included in the programme.

#### CERT Item 9

Detailed description of any component of the programme carried out at home: the programme did not include any component carried out at home. In order to assess the effect of the programme, the instructors and researchers responsible for the programme asked parents not to make any significant changes to their children's lifestyles or routines.

#### CERT Item 10

Description of the existence of non-exercise components: at the start of the programme, posters were made available to kindergarten teachers and guardians with the various benefits of both the programme and physical exercise for the target age group.

#### CERT Item 11

Description of the type and number of adverse events occurring during the exercise: not applicable, as no adverse events occurred during the exercise programme. It should be noted that the application of the programme does not add any risk of physical or other injury to the participants.

#### CERT Item 12

Description of the location in which the exercises will be carried out: the hip hop sessions were held in a sports hall at a public kindergarten, located at the center of the country, in a city of median dimension. The venue met all the necessary conditions for the proposed activity, from flooring to acoustics and ventilation, as well as all the hygiene and safety regulations. The floor of the classroom was rubberized and safety was guaranteed throughout the session.

#### CERT Item 13

Detailed description of the exercise intervention

session, including, but not limited to, number of repetitions and sessions, and programme duration: the programme consisted of 3 sessions per week, each lasting around 45 minutes (with 30 minutes of actual practice). The sessions were divided into 4 phases:

1st phase - Initial instructions were given with everyone seated in a circle, with the aim of preparing the participants for the class activities, reminding them of some of the rules for the class to run smoothly and checking who was present;

2nd phase - Warm-up, consisting of a playful song lasting about 5 minutes with the aim of preparing the body for the fundamental part of the class, by increasing heart rate, cardiac output and temperature (Alencar & Matias, 2010), going through all levels of movement (lower, intermediate and upper);

3rd phase - Fundamental part, consisting of the exemplification and execution of different choreographies, lasting approximately 30 minutes (Green, 2015). After the choreographic exploration and assembly, each choreographic sequence was repeated twice;

4th phase - Return to calm and stretching, the last phase of the lesson, with a game followed by more relaxing music and the inclusion of stretching exercises, to maintain and improve mobility. This phase also included saying goodbye to the students, in which the link to the next class was always established.

#### CERT Item 14 (a)

Describe whether the exercises are generic (applicable to anyone) or personalised: the exercise programme consists of hip hop choreographies and some fun activities to promote interaction, create group spirit and motivate the participants. These activities were planned according to the characteristics of the participants, with special attention to their age, and 2nd childhood stage of motor development, the foundational motor skills (Cordovil & Barreiros, 2014; Hulteen et al., 2018). This way, the programme is (re)applicable to participants with identical characteristics.

#### CERT Item 14 (b)

Detailed description of how the exercises are adapted to the individual: the choreographies and the skills that make them up were planned according to the age and stage of motor development of the participants. In addition, care was taken so that, whenever the instructors noticed greater difficulty in acquiring a new skill, one or more of several strategies were followed: i) presenting the skill at a slower speed, ii) a greater number of repetitions of the activity, iii) positive reinforcement feedback whenever there was an improvement in the quality of the skill's execution, iv) performing the movement or exercise in parts (partial learning).

#### CERT Item 15

Describe the rule for determining the starting level at which participants begin an exercise programme (e.g., beginner, intermediate, advanced): The "Children+"

programme was specifically tailored for children aged 3 to 5 without prior exposure to hip hop. Considering these premises, the initial level of the participants was defined as beginner. Beyond these initial considerations, in order to check the children's motor competence, the Motor Competence Assessment (MCA) battery was applied (Luz et al., 2016). This battery covers three categories, each composed of two tests: locomotion, which includes running and agility tests (Shuttle Run) and horizontal jumping (Standing Long Jump); stability, which includes platform traversal tests (moving platform) and lateral jumps (jumping laterally); and, finally, manipulation, which comprises launching speed and kicking speed tests. Applying the battery made it possible to identify that, overall, participants needed to explore the fundamental motor skill of jumping (where they obtained relatively low scores), leading the instructors to emphasize this skill more in choreographies.

#### CERT Item 16 (a)

Describe how adherence or fidelity to the exercise intervention is assessed/measured: an attendance sheet was used to monitor the number of sessions attended by each participant throughout the entire intervention. Based on the records collected during all sessions, an attendance rate of 88.26% was observed.

#### CERT Item 16 (b)

Describe to what extent the intervention was carried out as planned: the intervention proceeded as planned. Some sessions were not conducted on the scheduled days due to strikes by preschool teaching and non-teaching staff.; however, these sessions were always rescheduled for subsequent days. It should also be noted that the participants' adherence to the program was high, with their absences primarily attributed to illness. The maximum gap between two consecutive sessions was 3 days without class, resulting from a Friday holiday. The average gap was only one day without intervention, as sessions were scheduled for Mondays, Wednesdays, and Fridays.

#### *Item 3 - illustration of any intended interactions between different components*

In addition to promoting improvements in the physical and motor abilities of children, the programme also aimed to simultaneously raise awareness among the school community and parents about the benefits of physical exercise for preschool children. To achieve this, presentation and clarification sessions were conducted with the school educators. Informative posters about the benefits of physical activity and the programme's characteristics were displayed. The programme coordinators also provided contact information for addressing questions and sharing information with the entire school community.

#### *Item 4 - description and consideration of the contextual characteristics in shaping the intervention*

The exercise programme was planned to take place in

preschools, for a group of up to 20 children aged 3 to 5. The maximum number of children per class was established based on the professionals' previous empirical experience in conducting hip hop classes for this age group. The limited number of children per class also enables the possibility of more individualized feedback (Sidaway et al., 2012) and contributes to the creation of empathy and a sense of group (Horton, 2005). The group classes were conducted in an outdoor space or a spacious room, covering approximately 50 square meters, allowing for the execution of choreographies without spatial limitations. All hygiene, cleanliness, and safety standards regarding the type of flooring and ventilation were adhered to. Exercise professionals maintained visual contact with the group throughout the session and provided positive reinforcement feedback, motivating the group to continue with the practice (Santos-Rocha et al., 2020).

### *Second stage: feasibility and piloting*

#### *Item 5 - description of the pilot test and its impact on the definitive intervention*

The pilot test aimed to determine the feasibility, acceptability and practicality of the Crianças+ (“Children+”) programme. To this end, several phases and procedures were followed, which are detailed below.

The first version of the Crianças+ (“Children+”) programme was developed by four exercise specialists, two of whom had two years' experience in planning and conducting hip hop classes for children, and two other motor development specialists with a doctorate in Human Motricity and specialists in motor development and learning. The choreographies in this first version were tested in February 2023 with a group of 15 participants aged between 3 and 6. Following the test and a subsequent session for reflection and refinement of the choreographies, incorporating feedback from two additional specialists, one being a seasoned technician with a decade of experience instructing hip hop to children, and the other an exercise specialist holding a PhD in Sports Science and with experience teaching hip hop across various age groups, some enhancements were implemented in the program. These improvements consisted of: i) reducing the time of each choreography and, in some cases, ii) introducing more elements of hip hop identity into them.

To collect comprehensive feedback on the Crianças+ (“Children+”) programme, specifically regarding its structure, duration, frequency, variations, progression, and replicability, the program manual and a corresponding

questionnaire were disseminated by physical exercise professionals with expertise in conducting hip hop classes for children. The questionnaire, adapted from a prior publication validating a physical exercise program (Santos-Rocha et al., 2020), comprised 18 questions responded to using a 5-point Likert scale, ranging from "totally agree" (assigned a value of 5 on the scale) to "totally disagree" (assigned a value of 1 on the scale). Additionally, the questionnaire featured an open-ended 19th question, providing respondents the option to offer any additional comments, whether positive or suggestions for improvement. Furthermore, four questions aimed to characterize the surveyed professionals, capturing information about their gender, age, years of experience teaching hip hop classes, and years of experience specifically teaching hip hop to children. The table (Table 1) below presents the questionnaire's questions and the corresponding feedback (frequency of responses) provided by the professionals who participated in the survey.

Regarding the feedback provided by physical exercise professionals, the majority of them (76.2-100%) agreed or totally agreed with the following aspects: (1) the exercise programme is well structured (95.2%); (2) the duration (30 min sessions) is suitable for the target population (76.2%); (3) the duration of each choreography is suitable for the target population (95.2%); (4) the frequency (three times a week) of the exercise programme is suitable (95.2%); (5) the variety of motor skills (choreographic steps) provided in the programme is suitable for the target population (100%); (6) the choreographic steps are suitable for the target population (100%); (7) the choreographic setup is suitable for the population (95.2%); (8) the choreographies include hip hop identity movements (90.5%); (9) the rhythm is suitable for the population (100%); (10) the rhythm is hip hop identity (85.7%); (11) the programme manages to capture the essence of hip hop, adjusting it to the population (95.2%); (12) the variations of the choreographic steps provided in the programme are suitable for the target population (100%); (13) the structure of each session model is suitable for the target population (100%); (14) the structure of each session model is clear and easy for physical exercise professionals to follow (100%); (15) the explanations of the movements/choreography provided by the instructor are clear to the population (100%); (16) the exercise programme has the potential to be replicated (90.5%); (17) the exercise programme should be available to hip hop professionals (95.2%); and (18) the exercise programme is an asset to hip hop professionals (95.2%).

Table 1.  
Questions asked and feedback given by the specialists in physical exercise

| Question | 5-point Likert scale | Specialists in Physical Exercise (N=21) | Total (%) |
|----------|----------------------|---|-----------|
|----------|----------------------|---|-----------|

|   |                                |    |      |
|---|--------------------------------|----|------|
|   | (5) Totally agree              | 15 | 71,4 |
|   | (4) Agree                      | 5  | 23,8 |
| 1- Is the exercise programme well structured?   | (3) Neither agree nor disagree | 1  | 4,8  |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 12 | 57,1 |
|   | (4) Agree                      | 4  | 19   |
| 2- Is the duration (30min sessions) of the exercise programme adequate?   | (3) Neither agree nor disagree | 3  | 14,3 |
|   | (2) Disagree                   | 2  | 9,5  |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 12 | 57,1 |
|   | (4) Agree                      | 8  | 38,1 |
| 3- Is the duration of each choreography appropriate for the population?   | (3) Neither agree nor disagree | 1  | 4,8  |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 10 | 47,6 |
|   | (4) Agree                      | 10 | 47,6 |
| 4- Is the frequency (3x a week) of the exercise programme adequate?   | (3) Neither agree nor disagree | 1  | 4,8  |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 13 | 61,9 |
|   | (4) Agree                      | 8  | 38,1 |
| 5- Are the variety of motor skills (choreographic steps) offered in the programme suitable for the target population? | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 12 | 57,1 |
|   | (4) Agree                      | 9  | 42,9 |
| 6- Are the choreographic steps suitable for the population?   | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 14 | 66,7 |
|   | (4) Agree                      | 6  | 28,6 |
| 7- Is the choreography suitable for the population?   | (3) Neither agree nor disagree | 1  | 4,8  |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 10 | 47,6 |
|   | (4) Agree                      | 9  | 42,9 |
| 8- Do the choreographies include hip hop identity moves?  | (3) Neither agree nor disagree | 2  | 9,5  |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 13 | 61,9 |
|   | (4) Agree                      | 8  | 38,1 |
| 9- Is the pace appropriate for the population?  | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 11 | 52,4 |
|   | (4) Agree                      | 7  | 33,3 |
| 10- Is rhythm an identity of hip hop?   | (3) Neither agree nor disagree | 3  | 14,3 |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 11 | 52,4 |
|   | (4) Agree                      | 9  | 42,9 |
| 11- Does the programme succeed in capturing the essence of hip hop and adjusting it to the population?                | (3) Neither agree nor disagree | 1  | 4,8  |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 14 | 66,7 |
|   | (4) Agree                      | 7  | 33,3 |
| 12- Are the variations of the choreographic steps in the programme suitable for the target population?                | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 12 | 57,1 |
|   | (4) Agree                      | 9  | 42,9 |
| 13- Is the structure of each session model suitable for the target population?  | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 15 | 71,4 |
|   | (4) Agree                      | 6  | 28,6 |
| 14- Is the structure of each session model clear and easy for professionals to follow?                                | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |
|   | (5) Totally agree              | 14 | 66,7 |
|   | (4) Agree                      | 7  | 33,3 |
| 15- Are the explanations of the moves/choreography provided by the instructor clear to the public?                    | (3) Neither agree nor disagree | 0  | 0    |
|   | (2) Disagree                   | 0  | 0    |
|   | (1) Totally disagree           | 0  | 0    |



|  |                                |    |      |
|--|--------------------------------|----|------|
| 16- Does the exercise programme have the potential to be replicated?           | (5) Totally agree              | 13 | 61,9 |
|  | (4) Agree                      | 6  | 28,6 |
|  | (3) Neither agree nor disagree | 2  | 9,5  |
|  | (2) Disagree                   | 0  | 0    |
|  | (1) Totally disagree           | 0  | 0    |
| 17- Should the exercise programme be made available to hip hop professionals?  | (5) Totally agree              | 14 | 66,7 |
|  | (4) Agree                      | 6  | 28,6 |
|  | (3) Neither agree nor disagree | 1  | 4,8  |
|  | (2) Disagree                   | 0  | 0    |
|  | (1) Totally disagree           | 0  | 0    |
| 18- Do you think the exercise programme is an asset for hip hop professionals? | (5) Totally agree              | 15 | 71,4 |
|  | (4) Agree                      | 5  | 23,8 |
|  | (3) Neither agree nor disagree | 1  | 4,8  |
|  | (2) Disagree                   | 0  | 0    |
|  | (1) Totally disagree           | 0  | 0    |

In response to feedback from physical exercise professionals, slight modifications have been applied to the manual. Notably, in relation to session duration (item 2), the specified 30-minute duration now exclusively refers to the practical component. It has been clarified that instructors should allocate between 40 and 45 minutes for the entire class to allow for transitions between rooms and the welcoming of the children. The exercise programme manual is scheduled for future publication and will be provided free of charge to all exercise professionals interested in accessing it.

The program has received validation from 27 exercise experts, comprising specialists with a doctorate in human motricity and dozens of professionals with extensive practical experience in instructing hip hop to children.

### **Third stage: evaluation**

*Item 6 - description of the control condition (comparator) and reasons for the selection*

This programme will be applied in the form of a semi-experimental, non-equivalent, self-controlled study, comprising three four-week periods: a first intervention period, followed by a break of the same duration, and finally a new intervention.

The programme will be applied to a group of around 30 children aged 3 and 4. This age group was selected on the basis of the motor development phase of foundational motor skills and sensitive periods for the acquisition of coordinative abilities (Cordovil & Barreiros, 2014). The effect of the hip hop intervention on motor competence (MC) (Luz et al., 2016), perceived motor competence (PMC) (Lopes et al., 2016), motor coordination (MCoor) (Prado et al., 2009; Wilson et al., 2000) and levels of physical activity (PA) (Mercê, Cordeiro, et al., 2022) will also be assessed.

Taking into account the benefits of hip hop practice (Lemieux et al., 2008; Williams & Noble, 2008; Withers et al., 2019) and previous studies (Fitzgibbon et al., 2006, 2011; Romero, 2012; Withers et al., 2019), the following hypotheses were defined: the application of the hip hop programme will result in improvements in i) MC, ii) PMC, iii) MCoor and iv) PA.

*Item 7 - description of the strategy for delivering the intervention within the study context*

The exercise programme was planned to be carried out in a pre-school setting. This programme should be

applicable in the children's school programme. The classes will follow a previously defined protocol, the structure of which has been planned and rehearsed by all the professionals involved in its implementation. The programme will be taught by specialists in physical exercise with experience in teaching hip hop to this age group.

*Item 8 - description of all materials or tools used to deliver the intervention*

The exercise programme was designed to be applied in indoor or outdoor school' space. If possible, this programme should be carried out in a large room (around 50 square meters) with a suitable physical practice floor and good ventilation and acoustic conditions. The materials needed to apply the programme are described in item 1 of the CERT and include a loudspeaker and laptop computer.

To guide and support the professional conducting the lessons, a manual was created in digital format explaining the lesson plans accompanied by video demonstrations.

*Item 9 - Description of the fidelity of the delivery process compared to the study protocol*

The exercise programme includes a plan organized into 8 stages (1-week micro-cycles), including the structure of the sessions and the choreographies suggested for each stage, taking into account the predefined objectives. It also includes a description of each routine, levels of complexity, variations, intensity levels and videos demonstrating the routines. In this way, other exercise professionals can safely replicate the programme.

*Item 10 - description of a process evaluation and its underlying theoretical basis*

With the study design and evaluation methodology defined, the aim is to evaluate a set of data on motor competence, perception of motor competence, physical activity and development of motor coordination so that it will be possible to evaluate the objectives that the programme sets out to achieve. These evaluations will be carried out at the beginning and end of each intervention, thus verifying and quantifying the effect that the hip hop programme has had on the children.

Motor competence will be assessed using the Motor Competence Assessment (MCA) battery of tests (Luz et al., 2016), a quick-to-apply battery that has been validated for the

Portuguese population. The battery includes three categories made up of two tests each, namely locomotion (Shuttle Run and Standing Long Jump), stability (Platform Change and Lateral Jump) and manipulation (Throwing Speed and Kicking Speed).

The pictorial instrument designed by Barnett et al. (2015) and validated for the Portuguese population by Lopes et al. (2016) will be used to assess perceived motor competence. Participants will be assessed using the 12 items of the Fundamental Movement Skill (FMS) in the Pictorial Scale for Perceived Motor Skill Competence, with these items assessing six object control skills and six locomotor skills. Perceived motor competence for each skill is assessed by a 4-point scale and then the scores for each type of skill are calculated.

In order to assess the development of motor coordination, the "Questionnaire on the Development of Motor Coordination in Children aged 3 to 5 for Mothers/Fathers and Educators" will be applied (Prado et al., 2009; Wilson et al., 2000), which is based on parents' reports comparing their child's motor performance with other children of the same age, using a 5-point Likert scale. The questionnaire consists of 15 items grouped into three distinct factors: control during movement; fine motor and writing; and general coordination. Finally, based on a total of 75 points, the participants will be classified according to their developmental coordination status, including detection of probable developmental coordination disorder (DCD).

*Item 11 - description of internal facilitators and barriers potentially influencing the delivery of the intervention as revealed by the process evaluation*

There are various internal factors, both facilitators and barriers, that can impact the execution of an exercise programme. Some of these factors are related to the physical location of the welcoming entity and its internal rules and pedagogical didactic programmes. The "Children+" programme is adaptable for schools and sports settings. In these contexts, the institution's strategy and vision can either support or hinder its implementation, such as the provision of physical and temporal resources.

The child adherence to the programme primarily relies on the informed consent of her/ his guardian. Therefore, the extent that a guardian values her/his participation may also influence the delivery of the intervention (Sanz-Arazuri et al., 2012; Suen et al., 2015).

*Item 12 - description of external conditions or factors occurring during the study which might have influenced the delivery of the intervention or mode of action (how it works)*

The application or replication of the programme will also be subject to external factors. Some of these factors are associated with the impossibility of conducting sessions due to coinciding with holidays (e.g., Christmas, Easter), public holidays (local or national), or even educational field tours. In these cases, the session should be rescheduled as close as possible to its original date, with no more than a three-day interval between sessions.

*Item 13 - Description of costs or resource requirement for the delivery of the intervention*

The exercise programme is available to professionals via a digital manual and video tutorials of the choreographies will also be made available. The programme is designed to be carried out in a common room and only requires a speaker to play music. It has been planned and structured to be taught by exercise professionals who deal with children on a daily basis and have experience in teaching hip hop classes.

As such, it does not require specific additional costs for materials and facilities compared to those normally available in schools or sports centers. Its application must take into account the cost of human resources, which must be properly qualified for the purpose.

## Discussion

Recent studies support the importance of involving preschool children in physical exercise programme complementary to school curricula to develop their foundational motor skills (Bernardino et al., 2023; Díaz et al., 2020; Fowweather et al., 2008; Massri et al., 2022; Sales et al., 2024). The presence of only one prior hip-hop intervention for preschool children may present a limitation to a thorough evaluation of the effectiveness of such programmes (Fitzgibbon et al., 2006, 2011). Nevertheless, it's important to note that this previous program "Hip-Hop to Health Jr." was found to be effective in reducing subsequent increases in BMI in schools with black children. This data reinforces that dance, in this case hip hop, is one of the most effective strategies for combating physical inactivity and obesity in children (Cain et al., 2015; Sánchez et al., 2011). However, physical exercise interventions require homogeneous methods of development, delivery and assessment, due to their complexity (Santos-Rocha et al., 2020).

When adapted to a specific population and context, an exercise programme can become a complex intervention, being essential to develop and validate well-defined and replicable exercise protocols (Santos-Rocha et al., 2020). Taking this into account, the "Children+" programme underwent the three stages proposed by Möhler et al. (2015): development, piloting, and evaluation, using the development and validation checklists CREDECI 2 (Möhler et al., 2015) and CERT (Slade et al., 2016). The completion of these various stages and the use of specific methodologies lead us to consider that the validation of the "Children+" programme has been successfully concluded and that it is replicable by hip-hop professionals.

From the conducted research, we understand that this is the first validation study that followed the CREDECI 2 guideline by Möhler et al. (2015) to validate a hip-hop exercise programme, aimed to increase physical activity and to improve motor skills in preschool children. The previous absence of validated programmes further emphasises the importance and relevance of developing and validating the

"Children+" programme, which is not only pioneer in its origin but also in its target population. It is also noteworthy that the positive feedback received from the children who participated in the pilot intervention and from exercise professionals, as indicated in the survey, reinforces the relevance and suitability of the "Children+" programme.

### Conclusions

The CReDECI2 and CERT guide and assist the development and planning of complex interventions, such as exercise programmes. This study presents a project for the development and validation of a hip hop programme for preschool children. This programme has the potential to enrich and promote children's holistic development (e.g., physical abilities, coordination skills and moments of socialisation), and is pioneer to the target audience, and, not least, may be replicated by other exercise professionals.

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