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**INSTRUMENTOS DE EDUCAÇÃO ALIMENTAR E NUTRICIONAL PARA CRIANÇAS EM IDADE PRÉ-ESCOLAR:
NECESSIDADES E DESAFIOS ATUAIS**

FOOD AND NUTRITION EDUCATION TOOLS FOR PRESCHOOL CHILDREN: CURRENT NEEDS AND CHALLENGES

**INSTRUMENTOS DE EDUCACIÓN ALIMENTARIA Y NUTRICIONAL PARA NIÑOS EN EDAD PREESCOLAR: NECESIDADES
Y DESAFÍOS ACTUALES**

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RESUMO

Introdução: Em Portugal, tem-se assistido à realização de diversos programas de educação alimentar dirigidos a crianças, com utilização de diferentes instrumentos e metodologias. Atualmente é consensual que a alimentação nos primeiros anos de vida tem um forte impacto na saúde futura, sendo uma janela de oportunidade para a modulação de hábitos alimentares para a vida adulta. A educação alimentar dirigida a crianças em idade pré-escolar constitui uma matéria bastante complexa pois envolve o desenvolvimento da criança, a pedagogia e a mudança comportamental.

Objetivos: Compreender o desenvolvimento da criança em idade pré-escolar, descrever os instrumentos de educação alimentar e nutricional mais utilizados nesta faixa etária e o seu possível impacto nos conhecimentos e comportamento alimentar.

Metodologia: Revisão narrativa da literatura através de pesquisa em bases de dados: Pubmed, ISI Web of Knowledge e Biblioteca do Conhecimento Online.

Resultados: Os instrumentos de educação alimentar e nutricional devem ser adequados às capacidades sócio-cognitivas e emocionais das crianças em idade pré-escolar. Os instrumentos mais utilizados para promover atitudes positivas ou hábitos alimentares saudáveis nesta faixa etária são os guias alimentares, as histórias infantis ou os jogos.

Conclusões: Os instrumentos de educação alimentar e nutricional a serem utilizados em idade pré-escolar deverão ser potenciadores de momentos lúdicos e significativos de aprendizagem. As histórias, os jogos tradicionais ou digitais deverão ser explorados por educadores para abordagem do tema da alimentação.

Palavras-chave: pré-escolar; educação alimentar e nutricional; saúde e educação; pedagogia; criança

ABSTRACT

Introduction: In Portugal there have been nutrition education programs aimed at children, using different instruments and methodologies. It is currently agreed that eating habits in early childhood have a strong impact on future health, being a window of opportunity for the modulation of eating habits for adult life. Nutrition education aimed at pre-school children is a very complex subject as it involves the child's development, pedagogy, and behavioral change.

Objectives: To understand the development of pre-school children and describe the nutrition education instruments most used in this age as well as their possible impact on knowledge and food behaviour.

Methodology: Narrative review of the literature using database search in Pubmed, ISI Web of Knowledge and the Online Knowledge Library.

Results: Pre-school children need nutrition education tools that are appropriate to their cognitive abilities and that stimulate their interest. The most used nutrition education tools are food guides, children's stories, or games.

Conclusions: Nutrition education instruments to be used at pre-school age should be tools for the realization of playful and meaningful moments of learning. Stories, traditional games, or digital games are thus valid instruments for this purpose and should be explored by educators to approach the topic of food.

Keywords: Preschool; food and nutrition education; health and education; pedagogy; child

RESUMEN

Introducción: En Portugal, ha habido varios proyectos de educación alimentaria dirigidos a los niños, utilizando diferentes instrumentos y metodologías. Actualmente se acepta que la alimentación en los primeros años de vida tiene un fuerte impacto en la salud futura, siendo una ventana de oportunidad para modular los hábitos alimenticios para la vida adulta. La educación alimentaria para niños en edad preescolar es un tema muy complejo, ya que implica el desarrollo infantil, la pedagogía y el cambio de comportamiento.

Objetivos: Comprender el desarrollo de los niños en edad preescolar y describir los instrumentos de educación alimentaria más utilizados en este grupo de edad, así como su posible impacto en el conocimiento y la conducta alimentaria.

Metodología: Revisión narrativa de la literatura. Búsqueda en las bases de datos Pubmed, ISI Web of Knowledge y Biblioteca de Conocimiento on-line.

Resultados: Los niños en edad preescolar necesitan herramientas de educación alimentaria que sean apropiadas para sus habilidades cognitivas y que estimulen su interés. Los instrumentos más utilizados son guías alimentarias, cuentos infantiles o juegos.

Conclusiones: Los instrumentos de educación alimentaria que se utilizarán en edad preescolar deberían ser herramientas para la realización de momentos de aprendizaje divertidos y significativos. Las historias, los juegos tradicionales o digitales son instrumentos válidos para este propósito y los educadores deben explorarlos para abordar el tema de la alimentación.

Palabras Clave: preescolar; educación alimentaria y nutricional; salud y educación; enseñanza; niños

INTRODUCTION

The first years of life are a critical period for creating healthy eating habits. The basis for the physical, cognitive and socio-emotional development of the individual is established early, with the first 1000 days of life (from conception to 2 years) being considered a window of opportunity for the modulation of future habits (Hoffman, Arts, & Bégin, 2019). There is currently a consensus that diet and nutritional status in the first years of life have a strong impact on future health, maximising the individual's genetic potential and also modulating the risk of chronic diseases such as obesity, cardiovascular diseases or certain types of cancer (Rêgo et al., 2019). The concept of metabolic and behavioural "programming" results from the recognition of this early influence of food and nutrition on future health, thus emphasising the importance of the first years of life in promoting healthy eating habits (Koletzko et al., 2017; Rêgo et al., 2019). Since eating habits formed during childhood tend to last until adulthood (Nicklaus & Remy, 2013), it is extremely important to create food education programmes that enhance the knowledge and skills necessary for children and carers to make healthy food choices. Considering this, food education programmes with appropriate design and methodology are an important help in implementing appropriate eating habits by facilitating motivation and preference for healthy foods (Murimi et al., 2018). This article aims to describe the development of the pre-school child and the food and nutrition education tools most used in this age group, as well as their possible impact on food knowledge and behaviour.

1. METHODOLOGY

In order to obtain an overview of the tools used in food education in pre-school age and the development of children in this age group, a narrative literature review was carried out. For this purpose, a bibliographic research was performed using the following databases: Pubmed, ISI Web of Knowledge and Biblioteca do Conhecimento Online (B-on) from October to December 2019. The keywords or terms used for the research were: child, vegetables, food education, games, gamification and children's stories, using research aids such as the Boolean operator AND and truncature *.

2. RESULTS

2.1 Theorisation of the development of the preschool child

A child's cognitive development translates the intellectual processes that enable him/her to understand, learn and give meaning to the world around him/her. According to Piaget's perspective (Piaget & Inhelder, 1979), cognitive development takes place in a four-stage sequence. Pre-school children are at the stage of preoperative thinking, characterized by their relationship with the world through mental, symbolic or representative actions, developing the ability to imitate, question, investigate, compare, serialize and classify objects. At this stage, the child is interested in practical results and has a great capacity for mental representation and symbolization. The actions are closely linked to perception and, therefore, it is difficult for the preschooler to understand and explain abstract concepts such as the definition of health or the importance of nutrition. Thus, the child is considered healthy if he/she can laugh, walk and run (Baskale, Bahar, Baser, & Ari, 2009). Piaget's theory defends a constructivist position of knowledge, having the individual an active role in its construction. Assuming this, knowledge is built through the interaction between the individual and objects or situations (Piaget & Inhelder, 1979). Thus, food education should encourage the child to use objects, to observe books or to use colour photographs of food, promoters of long-term visual memory. According to Zajonc's "mere exposure" theory (1968), consecutive exposure to the same visual, auditory or taste stimuli causes changes in the individual's behaviour, generating greater acceptance of the stimulus. In addition, the fact that repeated exposure to a food gives rise to a greater preference for it, seems to be associated with the mechanism of "learned safety". This mechanism suggests that repeated intake of a non-familiar food without negative gastrointestinal consequences leads to greater acceptance of the food. These theories support the importance of familiarity with the food for the child to accept it, and it is very relevant to create opportunities to contact with a wide variety of foods (Cooke, 2007). However, although simple visual exposure to food is associated with greater acceptance of food among children, physical contact with food and its associated flavours has been shown to be more effective when compared to visual exposure alone (Cooke, 2007; Osborne, & Forestell, 2012). In this way, food education activities such as drawing, listening to stories, playing games or observing food images, associated with the tasting of food to be promoted, will be crucial for learning food-related content. Likewise, food education messages should be simple, positive and focused on behaviour. Instead of using abstract concepts, concrete concepts should be used, such as the number of times a food should be eaten (Baskale et al., 2009). Scientific literature shows that children have difficulty understanding food classification systems. Observational studies with preschool children indicate that children classify food according to concrete qualities such as colour, shape and texture rather than through abstract concepts such as nutritional characteristics. At preschool age, children cannot spontaneously classify food according to its traditional classification (as it appears in the pyramid or food wheel). However, they are able to classify food as healthy or unhealthy, which suggests that the child may have the ability to relate food to health (Matheson, Spranger, & Saxe, 2002).

According to Erik Erikson's Theory of Psychosocial Development (1976), pre-school children fall into the stage of development called initiative *versus* guilt (from 3 to 6 years). It is during this stage that children develop more skills and independence, getting

involved in social interactions. They thus learn to balance a great sense of responsibility with the need to control sudden impulses. The importance of giving children the opportunity to act autonomously, but under firm guidelines and boundaries, is stressed at this stage. Food education during this stage enables the child to gain a great sense of initiative in choosing healthy foods. At the same time, if the child experiences eating without punishment and without being forced to eat food they do not want, feelings of guilt or disappointment for not being able to please their parents or caregivers will disappear (Fuller, Keller, Olson, & Plymale, 2005).

According to the Bioecological Theory of Human Development (Bronfenbrenner & Morris, 2006), in the development process it is important to attend to four fundamental components: process, person, context and time and the dynamic and interactive relationships that are established between them. In this regard, development is a dynamic process of biopsychological changes of individuals during their life journey, and also, through generations, being necessary to consider the whole bioecological system that involves it. The child's awareness and active involvement in their social and physical environment are the primary mechanisms through which they establish their learning. Thus, it is assumed that pre-school children learn about food and nutrition through experiences with food in their daily lives and not through formal instructions. According to this theory, it becomes truly important to understand the experiences that the child takes from his or her food environment and incorporates into his or her eating habits. In this context, a food education intervention aimed at optimising the development of the individual must involve the whole community and all the personal and social structures that are in contact with it (Matheson et al. 2002).

2.2 Food education tools better suited to pre-school age

Food and nutrition education for pre-school children is a major challenge as it is necessary that the strategy and educational materials adopted are appropriate to the development phase and that, at the same time, they capture their interest and stimulate their participation and the acquisition of knowledge (Baskale et al., 2009; Juzwiak, 2013). In this age group it is fundamental to use playful activities to promote learning, since the act of playing is a natural act, being the child's motivation for the same learning facilitator, enhancing the senses stimulation, the creativity and the systematization of experiences (Juzwiak, 2013).

2.2.1 Children's stories

One of the activities carried out in preschool education consists of reading stories and exploring books. This activity allows the child to acquire values that will be important for his or her development because, at the moment the child hears the story, he or she is attentive to the details of the text and illustrations, allowing them to develop their capacities of memorization and attention and stimulate logical thinking. The reading of stories promotes the child's creativity and critical spirit, giving him or her the possibility to make a comparison with reality and to add new plots to the story presented. It is an activity of great importance for the transmission of values, traditions and customs, including those related to food. Stories, through their narrative or illustrations, allow the transmission of information and emotions that may be related to the eating process, from the origin of the food to its contribution to a healthy life (Rodari, 2017). As food is a part of a child's daily life, it is common to find children's stories that address this issue. Some traditional tales, such as "Little Red Riding Hood", "Goldilocks and the Three Bears" or "Hansel and Gretel", introduce food-related aspects, transmitting implicit messages to the act of eating (Juzwiak, 2013). Social Learning Theory, and its later reformulation into Cognitive Social Theory of Bandura (Bandura, Azzi & Polydoro, 2008) helps to explain how the content of stories can affect a child's perception of food. According to this theory, the child learns behaviours, attitudes and emotions from observing his/her surroundings and the consequences of observed actions, tending to imitate the behaviours he/she observes. In this way, by reading stories the child becomes familiar with the food he/she observes in books, allowing to regulate attitudes and emotions associated with food consumption (Goldman, & Descartes, 2016).

Studies by Byrne and Nitzke (2000), England, Linchey, Madsen and Patel (2015) and Goldman and Descartes (2016) sought to identify the most frequently mentioned food groups in a set of stories aimed at preschool age. These studies are consensual for the most mentioned food group in the children's stories, with the fruit group being the most mentioned in the samples of books analysed. However, regarding the position of the vegetable group, there was some discrepancy between the books analysed, with this group tending to be less mentioned in the children's stories. In addition, the authors found that the vegetable or fruit groups were not a central element of the story and were not associated with positive emotions, as was the case with the group of cakes, cookies and ice cream.

In children's stories for pre-schoolers there are three main elements that should be taken into account when trying to convey a message: the type of message (positive or negative), the illustrations, and the social interaction with those who read the story. Some studies that assessed the impact of reading a story on a child's behaviour or attitude towards a food found that mere visual exposure to the food presented in the story results in increased consumption by the child. However, when comparing the impact of a negative and a positive message, consumption is higher when the message is positive ("if you eat vegetables you get healthy") rather than a negative message ("if you don't eat vegetables you get sick") (Juzwiak, 2013; Nekitsing, Blundell-Birtill, Cockroft, Fildes, & Hetherington, 2019). The illustration of the story is also one of the central elements in this type of learning because pre-school children are not literate. Considering this, studies (Juzwiak, 2013; Nekitsing) et al., 2019) point to the need to use iconic images, close to reality, in order to have a greater impact on learning and identifying food. Finally, the interaction between the

person reading the story and the child will be decisive for the transmission of the message. Most children enjoy listening to stories because it is an interactive moment, being able to actively participate and interact with the adult (Nekitsing et al., 2019). In this way, the cognitive processing of the content of a picture book can be increased and facilitated through interactive shared reading. Compared to passive reading (where children only listen to the story), interactive reading is more effective in understanding content and behavioural change (De Droog, Buijzen, & Valkenburg, 2014).

2.2.2 Games

The game is another very useful learning tool in preschool age. According to Piaget (1979), playful activity is one of the pillars of the intellectual activities of the child and is therefore indispensable for educational practice. Play, in addition to promoting fun and the imagination of children, is also important in promoting the development of social and cognitive competence. Through play, children experiment, invent, discover, learn and confirm their abilities, developing attention and concentration. Nowadays, games are widely used as educational resources, and digital solutions with educational objectives are becoming more and more frequent, which overlap with traditional game formats. Therefore, digital educational supports have been gaining notoriety because they meet current needs and interests.

Despite in-depth research on children's cognitive development and learning process, teaching has still been based on traditional formats for the transmission of knowledge. Knowledge is known to be necessary but not sufficient for effective learning or behaviour change in health (Jarvin, 2015). Some food education programmes based on knowledge transmission have already shown that they are ineffective for behaviour change, but that knowledge is probably a necessary condition for effective behaviour change (Baranowski, 2005), Ryan, Hoyos-Cespedes, & Lu, 2019). In this way, technology has been a very important driving force for changing the current paradigm. In post-industrial society, when computer games began to be used for educational purposes, the term *edutainment* arose, relating to education through technology based on the motivational aspects of a game but more focused on learning and memorization of facts than on the analysis or involvement of other higher order cognitive processes in Bloom's taxonomy (Jarvin, 2015). Thus, *edutainment* has been shown to be more effective in learning lower order cognitive skills or in raising awareness (e.g., in health promotion campaigns) and at the level of social change (Jarvin, 2015). At least six types of digital educational tools are identified in the health promotion area: web-based educational programs; individualized motivational messaging systems; data collection and feedback systems; active electronic games (also known as *exergames*, e.g. Nintendo Wii or Microsoft Kinect)(Santos & Santos, 2017); diverse interactive multimedia and diverse games (Baranowski et al., 2019). One of the categories of games that has been widely included in health promotion is the category of *serious games* that have emerged to address the limitations identified by *edutainment*. In this sense, *serious games* are created specifically with an educational purpose and in order to promote a deeper learning, possible to reach the highest levels of Bloom taxonomy (Jarvin, 2015). *Serious games* are assigned to games that are applied in non-playing contexts (e.g. schools) and that contain motivational and fun characteristics (Holzmann et al., 2019). These have been proposed as effective means of achieving behavioural change and as an attractive way of conveying educational messages (Hermans et al., 2018).

Research suggests that games are being widely recognised as a valid teaching strategy, with increasing emphasis on the concept of gamification (Baranowski et al., 2019). Gamification uses social mechanisms such as interaction or social influence through the application of gaming mechanisms (point attribution, competition, feedback) (Azevedo et al., 2019). Gamification strategies have gained great recognition in the health promotion area given their validity for the promotion of healthy behaviours, as they use strategies of motivational reinforcement, personalized pedagogical approaches and social interaction. The use of gamification leads to a pleasurable learning experience by its users, motivational and adjusted to current living standards (Azevedo et al., 2019). In Portugal, the Nutriscience project (Azevedo et al., 2019) is an example of the use of gamification techniques to promote nutritional literacy in families with children aged 3 to 5 years, with the use of multiple technological platforms to disseminate content and involve participants.

2.2.3 Other educational strategies to promote healthy eating habits at preschool age

School-based food education projects should be designed to create an environment for learning healthy eating preferences, either through repeated and sustained exposure to healthy foods, consistent and comprehensive meal standardization, and food education activities aimed at literacy and skills promotion of children, teachers and food service staff.

A systematic review study and meta-analysis (Nekitsing et al., 2018) identified nine central strategies for promoting the consumption of vegetables in preschool children: educational interventions (activities to pass on knowledge to parents, children and school staff; performing gardening, cooking and games activities); repeated exposure to the taste of food; pairing technique (complementing the vegetable to be promoted with another food already appreciated by the child); changes in food services (increasing the accessibility of vegetables or changing the way they are served to children); use of rewards (social or tangible, such as stickers or toys); *modelling* strategy (parents or cartoon figures eating the food being promoted); possibility of choosing between two vegetables; variety of offer (the child can choose to eat only one vegetable or a mixture of several vegetables); appealing visual presentation (in the form of a drawing of figures known to the child). The results of this meta-analysis revealed that strategies that include repeated exposure to the taste of food are more effective than those in which there is no repeated

exposure to taste and that the increase in consumption is proportional to the number of exposures to the food the child is subjected to. Another conclusion is that consumption is higher when vegetables are unfamiliar to the child and no flavour or ingredient is added.

A review study (Hodder et al., 2018) which evaluated food education interventions undertaken to promote the consumption of fruit and vegetable in children under 5 years of age highlights that strategies of repeated exposure to fruit and vegetable with a combination of tangible rewards (stickers) or social rewards are effective in increasing the consumption of these foods. This review also indicates that future interventions should assess their cost-effectiveness and should take into account extended *follow-up* periods to assess the effectiveness of interventions in the long term.

2.4 The role of kindergarten teachers in food education

In food education actions carried out in a pre-school context, teachers are key players in transmitting educational messages. Taking into account the Cognitive Social Theory (Bandura, Azzi & Polydoro, 2008), which indicates that children learn by observing the people and events around them, kindergarten teachers assume a preponderant role as models for healthy eating. Knowing that pre-school children spend a lot of time with kindergarten teachers is indeed a significant contribution of these professionals in their food education. In this way, the concepts of nutrition and food should constitute mandatory contents of the academic training of the kindergarten teacher as well as the continuous training of these professionals, through seminars or short courses (Ward, Bélanger, Donovan, Horsman, & Carrier, 2015). In Portugal, the courses that give access to the profession of childhood educator do not yet contain a specific curricular unit for the teaching of these subjects. However, food is a content included in curricular units that integrate other topics such as hygiene or sleeping.

The Health Education Benchmark (Carvalho et al., 2017) published in 2017 by the Ministry of Education and the Directorate General of Health frames food education as one of the five global themes to be worked on at all levels of education, including pre-school. This document allows teachers to know the themes and sub-themes to be explored at this level of education, as well as the objectives and all the knowledge, skills, attitudes, values and behaviours for their achievement in each theme indicated.

The curricular guidelines for pre-school education, published by the Portuguese Ministry of Education, indicate food as a theme to be explored in the "area of knowledge of the world", for "the articulation of knowledge related to health and safety, as a way of sensitizing children to health care" (Silva, Marques, Mata, & Rosa, 2016). In this way, each kindergarten teacher is free to carry out his or her classroom project in which food should be a topic to be explored in the most convenient way for the group in question.

CONCLUSIONS

The development of the pre-school child is marked by the learning done in the family and school system, where experimentation through the five senses has a great impact on the knowledge acquired. The food education tools to be used at pre-school age should be tools to enhance playful and meaningful learning moments. Stories or games are therefore valid tools for this purpose and should be explored by educators to address the issue of food. The continuous training of kindergarten teachers in the field of food becomes extremely important, given that they are one of the main protagonists in the food education of pre-school children.

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