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NARRATIVE-BASED STRATEGIES TO PROMOTE HEALTHY EATING BEHAVIOURS IN CHILDHOOD: A SYSTEMATIC REVIEW

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Obesity is becoming the global epidemic of the twenty-first century. Moreover, the number of obese or overweight children has increased during the last decades, resulting in negative physical and psychological health consequences during childhood, adolescence and in adults. Following the recommendations of the World Health Organization (WHO), a huge variety of obesity prevention and treatment programs have been introduced in the school setting to encourage healthy eating behaviours in childhood. The aim of our systematic review was to explore the use and efficacy of narrative-based strategies in promoting healthy eating behaviours in schoolchildren. *Materials and Methods.* We have carried out an updated systematic review on the following databases (PubMed, Psychinfo, ERIC and EBSCO) to assess papers published from the year 2000 to January 2018, which addressed the issue of narrative-based interventions in schoolchildren for the adoption of healthy food habits. *Results.* Our initial search found out 169 and 50 studies on PubMed and Psychinfo databases, respectively; 24 and 12 articles were found on ERIC and EBSCO datasets, respectively. After the application of the predefined exclusion criteria, we selected a total of 15 papers from PubMed and 12 articles from Psychinfo. Among these 27 papers, only six articles (two Randomized Controlled Trials and

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four Cohort studies) met the inclusion criteria and were considered for our systematic review because explicitly presenting nutrition school-based interventions that used narrative pedagogy or storytelling to promote healthy eating behaviours among children. *Conclusion.* Nutrition education in school setting is a key element in promoting lifelong healthy eating behaviours and should start from the early stages of life. Among all the possible interventions, narrative-based approaches (i.e. storytelling) seem to be at least as effective as other different educational programmes in encouraging the adoption of healthy food habits during childhood, especially when active involvement of the children is ensured.

1. Introduction

Overweight and obesity in paediatric population are becoming serious public health problems, reaching epidemic proportions in the world and being recognized as the "pandemic of the twenty first century" (Fleming et al., 2014; Malecka-Tendera & Mazur, 2005). The figures of obesity in children and adolescents aged 5-17 years old are provided per each country by the OECD (Organism for Economic Cooperation and Development) and show rates >30% for Greece, Italy, United States, Slovenia, and New Zealand, followed by Mexico, Chile, Portugal and Spain (>25%) (OECD, 2014). Overweight and obesity are specific conditions characterized by an excessive accumulation and storage of fat in the body, with Body Mass Index (BMI) being the most widely assessment tool (Cole, Bellizzi, Flegal & Dietz, 2000; Poskitt, 1995).

Obesity has negative physical and psychological health consequences during childhood and adolescence. Moreover, childhood obesity is a strong predictor of adult obesity, which results in negative health and economic effects both at individual and social level (Litwin, 2014; Nader, O'Brien, Houts, Bradley, Belsky & Crosnoe, 2006; WHO, 2016). Obesity itself is a direct cause of morbidities, including gastrointestinal, musculoskeletal and or-

thopaedic complications, sleep apnoea, early onset of cardiovascular diseases and type-2 diabetes (Lobstein & Jackson-Leach, 2006). Moreover, obesity in childhood can cause behavioural and emotional difficulties, such as depression; it can also lead to stigmatization and poor socialization, thus impacting on educational attainment levels and leaving negative permanent imprint on adult health, with serious and pervasive disadvantages (Kelsey, Zaepfel, Bjornstad & Nadeau, 2014; Miller, Lee & Lumeng, 2015; Pizzi & Vroman, 2013).

The World Health Organization (WHO) suggests that health and "nutrition literacy" should be included in the core curriculum as children enter school, and should be supported by a "health-promoting school environment" (WHO, 2008; 2016). Educational interventions specifically targeting nutrition in school setting have been shown to be useful in promoting healthy food habits and reducing risk factors for obesity (Waters, de Silva-Sanigorski, Hall, Brown, Campbell & Gao, 2011; Worsley, 2002).

Many different school-based approaches for the prevention and treatment of obesity have been explored, including diet, physical exercise, behavioural therapy, and medical support, but no single intervention was found to be effective enough in positively changing children nutritional habits. This has led to focus on multi-component programs and integrated strategies involving also families and communities, promoted by national, regional or local institutions and authorities (Flodmark, Lissau, Moreno, Pietrobelli & Widhalm, 2004; Summerbell et al., (2012).

A meta-analysis carried out by Gonzalez-Suarez et al. (Gonzalez-Suarez, Worley, Grimmer-Somers & Dones, 2009) aimed at evaluating the effectiveness of school-based programs in the prevention and management of childhood obesity, concluded that there was clear evidence about the effectiveness of school-based nutrition interventions in reducing the prevalence of childhood obesity, at least in the short-term.

In another metanalysis – performed by Katz et al. (Katz, O'Connell, Njike, Yeh & Nawaz, 2008) to assess the efficacy of school-based strategies for obesity prevention and control – the

combination of educational interventions addressing both healthy nutrition and physical activity was found to be effective in promoting healthy eating behaviours in school setting. These kind of combined interventions are particularly successful when families are involved (Amaya-Castellanos et al., 2015; Birch & Ventura, 2009; Brown & Ogden, 2004; Curtis, Stapleton & James; 2011; Gibson et al., 2012; Hunt et al., 2011; Ling, Robbins & Wen, 2016; Quarmby & Dagkas, 2015; Räihä, Tossavainen, Turunen, Enkenberg & Kiviniemi, 2012; Zhou, Emerson, Levine, Kihlberg & Hull, 2014).

A huge variety of school-based obesity prevention and treatment programs have been introduced to increase healthy eating behaviours in childhood (Blom-Hoffman, Kelleher, Power & Leff, 2004; Burgermaster, Koroly, Contento, Koch & Gray, 2017; Drapeau, Savard, Gallant, Nadeau & Gagnon, 2016; Delgado-Noguera, Tort, Martinez-Zapata & Bonfill, 2011; Evans, Christian, Cleghorn, Greenwood & Cade, 2012; Han, Kim & Park, 1997; Howerton, Bell, Dodd, Berrigan, Stolzenberg-Solomon & Nebeling, 2007; Jones et al., 2012; Kim, Choi & Kim, 2011; Knai, Pomerleau, Lock & McKee M, 2006; Sahota, Rudolf, Dixey, Hill, Barth & Cade, 2001; Shannon, Graves & Hart, 1982; Silveira, Taddei, Guerra & Nobre, 2011; Van Cauwenberghe, Maes, Spittaels, van Lenthe, Brug & Oppert, 2010) including: curriculum-based activities (Graziose, Koch, Wang, Lee Gray & Contento, 2017; Lakin & Littledyke, 2008), behavioural interventions (Başkale & Bahar, 2011; Räsänen 2004; Tanas, Pedretti, Gilli, Gagnayre & Marcolongo, 2011), sensory education (Mustonen & Tuorila, 2010; Reverdy, Chesnel, Schlich, Köster & Lange, 2008; Reverdy, Schlich, Köster, Ginon & Lange, 2010), classroom cooking experiences or involvement in meal preparation (van der Horst, Ferrage & Rytz, 2014; Walters & Stacey, 2009), playful approaches such as videogames, card games and computer-based activities or educational videos/DVD (Cecchetto, Pena & Pellanda, 2017; Gabrielli et al., 2017; Lee et al., 2017), school gardening (Sarti, Dijkstra, Nury, Seidell & Dedding, 2017), motivational theatre and storytelling (Amresh, Sinha, Birr & Salla, 2015;

Haines, Neumark-Sztainer, Perry, Hannan & Levine, 2006; Joronsen, Rankin & Åstedt-Kurki, 2008; Neumark-Sztainer et al., 2009; Perry, Zauner, Oakes, Taylor & Bishop, 2002). Among those, it seems that narrative-based strategies or storytelling, that use books or digital resources, represent a less frequently implemented nutrition intervention at school. The aim of our systematic review is to explore the use and the efficacy of narrative-based strategies in promoting healthy eating behaviours in childhood.

2. Materials and Methods

We have carried out an updated systematic review on the following databases: PubMed, Psychinfo, ERIC and EBSCO. We searched for all the articles published in literature from 01/01/2000 up to 31/01/2018, which were addressing the issue of narrative-based interventions and storytelling to encourage the adoption of healthy food habits in childhood. The systematic review has been carried out according to the PRISMA checklist 2009 (Moher, Liberati, Tetzlaff & Altman, The PRISMA Group, 2009).

All the papers concerning narrative-based nutrition interventions in school setting – reporting experiences of narration, reading, storytelling, informal/family pedagogy, experiential pedagogy, outdoor pedagogy – were considered to meet inclusion criteria, with the option of defining specific exclusion criteria after the analysis of the characteristics and quality of the studies.

The search on PubMed database was performed by using the keywords and Boolean operators reported in Table 1, with the adoption of a specific filter for age 0-18, which represents the paediatric range. Methodological quality of the studies was evaluated according to the Levels of Evidence defined by the Centre for Evidence Based Medicine (CEBM) (CEBM Levels of Evidence, 2009), as reported in Table 2.

After methodological quality assessment, we excluded from the analysis all the studies regarding: psychiatric issues; eating disorders (anorexia and bulimia); alcoholism and other "behavioural

disorders"; inflammatory bowel diseases; autism treatment; food allergy; malnutrition; vegan or vegetarian studies; food neophobia; breastfeeding; policies for infant and young child feeding; symbolic food memories; relationship between sleep duration and childhood obesity; eating behaviours and attitudes following prolonged exposure to television; impact of television on disordered eating. Moreover, we removed all the articles presented in language other than English, Italian, French, and Spanish.

Exploration of heterogeneity of the studies was performed by assessing their quality (i.e. level of evidence). Interpretation of the findings has been conducted in the frame of current knowledge.

3. Results

The initial search on PubMed and Psychinfo databases found out 169 and 50 studies (published from 2000 to 2018), while on ERIC and EBSCO datasets were found 24 and 12 articles, respectively. After the application of the predefined exclusion criteria, we selected a total of 15 papers from PubMed and 12 articles from Psychinfo. Among these 27 papers, only six articles (two Rando-mized Controlled Trials and four Cohort studies, all resulting from our search on Pubmed database) (Griffith, Griffith, Cobb & Oge, 2016; Jones, Madden & Wengreen, 2014; Nicklas, Lopez, Liu, Saab & Reiher, 2017; Ríos-Cortázar, Gasca-García, Franco-Martínez & Tolentino-Mayo, 2014; Wang, Lemon, Clausen, Whyte & Rosal, 2016; Weigensberg et al., 2014) met the inclusion criteria and were considered for our systematic review because explicitly presenting nutrition school-based interventions that used narrative pedagogy or storytelling to promote healthy eating behaviours in children.

Table 3 synthetizes the number of studies included in our analysis according to their Level of Evidence. Table 4 reports the authors of the papers, the summary of the studies and their Level of Evidence.

Weigensberg et al. (2014) have tested the efficacy of an innovative nutritional intervention based on Guided Imaging ap-

proach (GI) versus Digital Storytelling (DS) to promote healthy lifestyle behaviours and prevent the early onset of type 2 diabetes and cardiovascular diseases. This Randomized Controlled Trial (RCT) involved 35 obese adolescents (BMI > 95th percentile) for 12 weeks assessing the eating behaviours and physical activity levels, and specific quantitative outcome indicators such as adiposity, insulin resistance and stress biomarkers. The intervention group receiving lifestyle education plus guided imagery program (GI) showed a higher efficacy compared to the second intervention group, which was following lifestyle education plus a digital story-telling (DS) with computer program. However, the effect of the intervention in this latter group was not neutral – even though lower than the first treatment group – thus suggesting positive results also for digital storytelling approach.

Wang et al. (2016) have published the results of a behavioural intervention (named H2GO!) – based on the Social Cognitive Theory and the Social Ecological Model – which was aimed at assessing the efficacy of integrated narrative-based strategies to reduce sugar-sweetened beverage (SSB) consumption and promote water intake among 108 schoolchildren (aged 9-12 years old) and their parents. The intervention consisted of six weekly sessions addressing beverage knowledge, attitudes, and behaviours through youth-produced messages and narratives. The use of narrative-based approaches – i.e. the presentation of specific messages within the context of a story – was shown to facilitate the understanding of the target health messages and «empower children as behaviour-change agents within their families» (Wang, Lemon, Clausen, Whyte & Rosal, 2016, p. 67). The study compared children and parental SSB or water consumption (primary outcomes) in addition to their beverage knowledge and attitudes (secondary outcomes) as measured by self-reported surveys. Further outcomes included children's anthropometric data, supplementary dietary behaviours, and physical activity (data collected at baseline, with two and six months of follow-up). Each intervention session included an one-hour narrative module with schoolchildren involved in creating their own messages and narratives

through print, audio or video materials that focused on the identification of SSB. The authors concluded that narrative-based strategies «hold potential for decreasing SSB consumption and associated obesity risk among young people and families» (Wang, Lemon, Clausen, Whyte & Rosal, 2016, (Wang, Lemon, Clausen, Whyte & Rosal, 2016, pp. 67-68)., particularly among socioeconomically disadvantaged and ethnic minority populations characterized by high obesity rates. Thus, narrative-based interventions are recognized as presenting «high potential for dissemination across youth-based settings, to serve as a community-based intervention model addressing SSB and water consumption in childhood obesity» (Wang, Lemon, Clausen, Whyte & Rosal, 2016, p. 56).

Nicklas et al. (2017) have evaluated the impact of a creative approach based on motivational theatre, in order to promote vegetables consumption in 253 children randomized either to the intervention (n = 128) or the control group (n = 125). The intervention (based on theory of "transportation into a narrative world") was carried out for five consecutive days prior to lunch at school and at least once at home. For the purpose of the study, the authors specifically developed three puppet characters, with original stories and repetitive songs, incorporated into four 20-min DVDs (puppet shows). Quantitative assessment was accomplished by digital cameras used in the school to assess consumption of vegetables at lunchtime. Children belonging to the intervention group significantly increased ($p < 0.0001$) their vegetables intake from the baseline to the follow-up compared to the control group, which did not show any change. During the follow-up, the intervention group continued to present significantly higher consumption of vegetables compared to the controls ($p = 0.022$).

Ríos-Cortazar et al. (2014) have described a process of capacity building of an elementary school in Mexico City to promote healthy diet, physical activity and obesity prevention (Health Promoting School initiative, HPS). Within the frame of a participatory design and a model of collaborative/group learning, the use of narrative was defined as «main strategy being successful in enhancing the development of individual and collective capacities

of school-children» (Ríos-Cortazar et al., 2014, p. 154). The narrative allowed participants to achieve positive performances for their health, including diet and physical activity. More specifically, pupils were involved in creating their own narratives concerning health, nutrition, and physical activities through the production of a school-magazine. The stories were subsequently presented to different classrooms and the results of these presentations were also published in the magazine.

Griffith et al. (2016) have described the main findings of a "storied education program", based on presentations for students of various ages in their classrooms and in other community settings. The intervention started with a live narration with direct listening and active participation of the pupils. The interactive storytelling was aimed at improving nutrition knowledge with a focus on obesity prevention through the story of "Jumper and the Thumper", two original characters specifically developed as "mediators", who experienced different outcomes because of their dietary habits and physical activity. The authors presented true examples during the narration of the stories about these two characters. In addition, cartoons and photographs were used during the storytelling to maximize the involvement of the children. Moreover, pupils were provided with the storybook of "Jumper and the Thumper" to strengthen what was learnt through the live narration at school. After the moment of storytelling and the reading, children were encouraged to experience positive nutritional choices through games and exercises from the workbook.

The authors concluded that narrative-based strategies «could have a meaningful impact on obesity by creating behavioural changes in schoolchildren thanks to their enthusiastic involvement in such programs» (Griffith et al., 2016, p. 97) and suggesting that these experiences could be also extended to other community settings (i.e. medical meetings, forums, churches).

Jones et al. (2014) have tested reward approaches based on gamification (the FIT program), specifically designed to increase fruit and vegetables intake as short-term outcome. Authors used an on-field approach (with fruit or vegetables as alternative daily

targets) to evaluate the effects of their "FIT Game" on the consumption of fruit and vegetables in a group of primary schoolchildren (n=251). Each day, a target food (fruit or vegetable) was randomly chosen with the limitation that the same food could not be selected on more than three consecutive days. The consumption of the targeted food at school was supposed to increase on that day.

The game provided "rewards" in the framework of a fictional narrative with teachers involved in the reading; pupils were asked to help their heroic characters by ensuring them the energy coming from fruits or vegetables consumed by themselves at the school cafeteria. Moreover, children who documented a higher consumption of the daily-targeted food were rewarded with small prizes (i.e. temporary tattoo, mechanical pencil, flying disc and others). Storytelling was conducted by teachers using science-fiction adventure story that was written for the purpose of the study by one of the principal investigators. Each episode described the exploits of the heroic characters and it concluded by encouraging students to eat more fruit or vegetables than normal, «so that the heroes would have enough energy to continue their struggles against evil» (Jones et al., 2014). If the school failed to meet the daily goal about the targeted fruit or vegetable, no new episode was provided to the teachers for the storytelling in that day. A poster of the game was put on the wall of the cafeteria and pupils were directly involved in choosing (by voting) how to continue the "open" story (i.e. which planet should be made free from enemies). On intervention days, fruit and vegetable consumption increased by 39% ($p<0.01$) and 33% ($p<0.05$), respectively. Moreover, teachers reported that students enjoyed the game, recommending its use in other schools.

4. Discussion

Paediatric obesity is a growing epidemic and it has reached alarming levels (1, 2). An increasing prevalence of childhood and adolescence obesity in Europe and in USA has been docu-

mented, but the problem is not restricted to industrialized nations (Lissau, Overpeck, Ruan, Due, Holstein & Hediger, 2004).

The Body mass index (BMI, calculated by dividing a person's weight in kilograms by the square of height in meters) is the measure commonly used to determine childhood overweight and obesity. Overweight is defined as a BMI at or above the 85th percentile and below the 95th percentile for people of the same age and sex. Obesity corresponds to a BMI at or above the 95th percentile for children and teens of the same age and sex (CDC, Center for Disease Control, Atlanta, 2016).

Our systematic review found out six articles (Griffith, Griffith, Cobb & Oge, 2016; Jones, Madden & Wengreen, 2014; Nicklas, Lopez, Liu, Saab & Reiher, 2017; Ríos-Cortázar, Gasca-García, Franco-Martínez & Tolentino-Mayo, 2014; Wang, Lemon, Clausen, Whyte & Rosal, 2016; Weigensberg et al., 2014), reporting experiences where narrative-based approaches have been used to promote healthy eating behaviours in childhood, even though each study used different strategies such as: digital storytelling and interactive guided imagery (Weigensberg et al., 2014); narrative modules with schoolchildren creating their own stories (Wang, Lemon, Clausen, Whyte & Rosal, 2016); motivational theatre (Nicklas, Lopez, Liu, Saab & Reiher, 2017); creation of narratives concerning health, nutrition, and physical activity on a school magazine and subsequent live presentation to other classrooms (Ríos-Cortázar, Gasca-García, Franco-Martínez & Tolentino-Mayo, 2014); interactive storytelling with live narration of stories concerning original characters specifically developed as "mediators" (Griffith, Griffith, Cobb & Oge, 2016); "gamification approach" based on a science fiction narrative, specifically created for this purpose, with the associated use of rewards (Jones, Madden & Wengreen, 2014).

In addition to the various narrative-based strategies, the studies selected for our systematic review (Griffith, Griffith, Cobb & Oge, 2016; Jones, Madden & Wengreen, 2014; Nicklas, Lopez, Liu, Saab & Reiher, 2017; Ríos-Cortázar, Gasca-García, Franco-Martínez & Tolentino-Mayo, 2014; Wang, Lemon, Clausen,

Whyte & Rosal, 2016; Weigensberg et al., 2014) had different endpoints: the generic promotion of healthy eating and lifestyle behaviours; the prevention of early onset of type 2 diabetes and cardiovascular diseases; the reduction of sugar sweetened beverage intake; the increase in fruit and vegetables consumption; the reduction of obesity-related "stigma", and the enhancing of public awareness about this topic. The selected studies (Griffith, Griffith, Cobb & Oge, 2016; Jones, Madden & Wengreen, 2014; Nicklas, Lopez, Liu, Saab & Reiher, 2017; Ríos-Cortázar, Gasca-García, Franco-Martínez & Tolentino-Mayo, 2014; Wang, Lemon, Clausen, Whyte & Rosal, 2016; Weigensberg et al., 2014) have involved different school settings (with the target of overweight and obese preschool, primary and secondary schoolchildren), but also community setting and families. Finally, it must be pointed out that these studies were testing narrative-based strategies mostly in underserved children and ethnic minorities (i.e. Hispanic or African-Americans), representing low socio-economic categories, which are already known to be at higher risk for obesity. Actually, social and cultural influences on eating habits have been deeply investigated (Belon, Nieuwendyk, Vallianatos Candace & Nykiforuk, 2016; Yee, Lwin & Ho, 2017; Yip, Gates, Gates & Hanning, 2016).

Many international studies suggest that school-based nutrition education is an accessible effective tool in health promotion programs with a focus on the development of healthy eating practices (13, 76, 77). Several initiatives have been developed both by public and private stakeholders to foster healthy food habits; the available evidence points out their relevant potential in promoting healthier choices among consumers (6, 78).

The European Childhood Obesity Group (ECOG) has highlighted «a surprising lack in the awareness of childhood obesity as being a major health problem» and the need for additional researches on this topic (Flodmark, Lissau, Moreno, Pietrobelli & Widhalm, 2004, P. 87). Schools represent a critical setting where risk factors for chronic diseases can be positively impacted (Flynn, McNeil, Maloff, Mutasingwa, Wu, Ford &

Tough, 2006; Warren, Henry, Lightowler, Bradshaw & Perwaiz, 2004). A Cochrane review of 55 studies, concerning programmes aimed at improving physical activity and nutrition, found "strong evidence in favour of beneficial effects" of child obesity preventive interventions, particularly for actions involving children aged six to twelve years old (Waters, de Silva-Sanigorski, Hall, Brown, Campbell & Gao, 2011).

However, given the heterogeneity and the likelihood of bias in small-size studies, these findings must be interpreted carefully: as a broad range of approaches are used, it is not possible to understand which intervention contributed most to the observed positive effects. Despite that, the above mentioned Cochrane review (Waters, de Silva-Sanigorski, Hall, Brown, Campbell & Gao, 2011) shows that school-curricula which include interventions addressing healthy eating, physical activity and body image represent the most promising strategies. These programs usually consist of specific actions such as: increased weekly sessions for physical activity; better quality of the food supplied at schools; teachers training to implement health promotion activities; parental support in home activities that encourage children to be more active, eat healthy foods and spend less time playing with videogames, smartphones, tablets and computers. Moreover, the designs of the studies in this field need to be developed on more reliable basis, and assessed about how effective the proposed interventions can generate long-term positive and sustainable impacts.

Actually, the consumption of fruit and vegetables observed at the end of the interventions tends to return to baseline levels and longer-running programmes were found to be more effective than shorter approaches, as confirmed by a meta-analysis aimed at evaluating the effectiveness of school-based interventions for the prevention and management of childhood obesity (Gonzalez-Suarez, Worley, Grimmer-Somers & Dones, 2009).

Concerning the above discussed meta-analyses, it must be also taken into account that the consistency of such researches depends on the similarity of magnitude of the treatment effects in the trials included in the analysis. So, to critically appraise

these findings, the presence of any underlying potential source of heterogeneity has to be explored. Heterogeneity of the studies is definitely associated with: reporting bias; differences in the intensity or duration of interventions; the underlying risk; the effect size and irregularities of data. However, a meta-analysis carried out by Katz et al. (2008) specifically addressed the uncertainty about the efficacy of school-based interventions to prevent childhood obesity, and concluded that most of behavioural programs addressing the issue of weight control in schools have proved to be successful. Despite this evidence, no systematic school policies aimed at promoting health behaviour changes are usually implemented.

The results of a systematic review from NICE (National Institute for Clinical Excellence) – focused on changing food behaviours and physical activity levels to prevent childhood obesity – suggest that combined school-based interventions may help children in preventing overweight also in the long term, even taking into account the limitations due to the heterogeneity of the studies included in the review (Brown & Summerbell, 2009).

These results are confirmed by a metanalysis (Flodmark, Lissau, Moreno, Pietrobelli & Widhalm, 2004) of 24 studies involving about 26.000 schoolchildren, showing that it is possible to prevent obesity through school-based programs that combine the promotion of healthy dietary habits and physical activity. According to on-field official governmental experiences – mainly consisting of school-based educational programs for healthy children diet – also short-term changes have been observed among pupils (i.e. increased consumption of fruit and vegetables), thus indicating great potential for progressive improvements (Friel, Kelleher, Campbell & Nolan, 1999; Manios, Moschandreas, Hatzis & Kafatos, 1999; Spiegel & Foulk, 2006).

As already discussed, a huge variety of school-based approaches have been proposed and tested to measure if school-based interventions are effective in reducing risk factors for obesity.

Personalized interventions such as computer-based strategies are maybe more effective than generic knowledge-based class-

room curricula in encouraging short-term dietary habits changes among schoolchildren (Kordaki & Gousiou, 2016; Oenema, Tan & Brug, 2005). Also smartphones may represent an opportunity for nutrition educational interventions that can significantly impact and change attitude and knowledge regarding healthy diet and exercise, as resulting from an experience with «comic book style interactive storytelling mobile applications» (Amresh, Sinha, Birr & Salla, 2015, P. 32).

A review concerning a total of 120 experimental studies (DeCosta, Møller, Bom Frøst & Olsen, 2017) has evaluated different types of nutrition interventions: parental control, reward-approach, social facilitation, cooking programs, school gardens, sensory education, availability and accessibility, nudging, branding or food packaging, preparation, serving style and variety of choice. According to these studies, hands-on approaches, such as gardening and cooking programs, seem to more promptly increase vegetables consumption and may have a larger effect compared to generic nutrition education. Providing children with free, accessible fruits and vegetables has also shown to positively affect long-term eating behaviors. In a review of 11 studies, it was shown that computer-tailored personalized education in the classroom produced better results than a generic curriculum (De Bourdeaudhuij et al., 2011). Another systematic review carried out by Dudley et al. (2015) synthesizes the research evidence concerning some key questions about the implementation of healthy eating education, particularly in primary schools: what strategies does the evidence indicate as the most effective in promoting healthy eating among primary school children? What do the experts say are the most effective approaches and strategies in fostering healthy eating to primary school-aged children? Dudley and colleagues focused on studies that have recognized the effectiveness of a broad range of strategies in teaching healthy eating to primary schoolchildren. The dominant teaching strategies across the 49 studies selected in this latter review were: curriculum and cross-curricular approaches; parental involvement; experiential learning approaches; contingent reinforcement approaches; literary abstraction

(literature red by/to children whereby a character promoted positive eating behaviours); games-based and web-based approaches.

As it represents a major public health problem, the issue of childhood obesity should be addressed at various levels (family, school, community and institutional setting), by introducing comprehensive policies with a specific commitment of different stakeholders. Schools have already been a popular setting for the implementation of health promotion interventions, as they offer continuous and intensive contact with children and taking into account that lifelong health and wellbeing begins with the promotion of healthy behaviors early in life. There is no doubt that school infrastructures, physical environment, policies, curricula, teaching, learning, and staff have the potential to positively influence child health (Lobstein, 2017; Micha, Karageorgou, Bakogianni, Trichia & Whitsel, 2018).

Moreover, it should be taken into account that school-based nutrition education has to consider the needs and interests of students and teachers. Furthermore, in order to empower educational strategies, it is necessary to increase health awareness, critical thinking, communication and skill building. Finally, low-cost interventions will be more appealing to schools, while sustainable long-term interventions may be needed to really impact public health.

Our systematic review could be considered an exploratory research aimed at providing insights into and an understanding of the problem for further examinations and a subsequent causal research based on experimental design (with intervention and control groups).

5. Conclusion

Nutrition education in school setting is a key element in promoting lifelong healthy eating behaviours in childhood and should start from the early stages of life. Several studies have showed that nutrition education intervention can impact student knowledge acquisition, and that behavioural eating change

is possible. Among all the possible interventions, narrative-based approaches (i.e. storytelling) seem to be at least as effective as other different educational practices in encouraging the adoption of healthy food habits during childhood, especially when an active involvement of the children is guaranteed.

Database	PubMed	Psychinfo, ERIC and EBSCO
Query	("Feeding Behavior" [Mesh] OR (eating AND (behaviour* OR behavior* OR intention*)) OR "food habit" OR "food habits") AND ("Narration"[Mesh] OR "Narrative Therapy"[Mesh] OR narrat* OR storytelling)	(DE "Eating Behavior" OR (eating AND (behaviour* OR behavior* OR intention*)) OR "food habit" OR "food habits") AND (pedagog* OR paedagog* OR narrat* OR storytelling)
Filters	age 0-18 years from 2000 to January 2018	age 0-18 years from 2000 to January 2018

Tabella 1. Research Query

Level	Therapy/ prevention, etiology/ harm	Prognosis	Diagnosis	Differential diagnosis/ symptom prevalence study	Economic and decision analyses
1A	SR of RCTs with homogeneity	SR of inception cohort studies; (with homogeneity); Clinical Decision Rule (CDR) validated in different populations	SR of Level 1 diagnostic studies (with homogeneity); CDR with 1b studies from different clinical centres	SR of prospective cohort studies (with homogeneity)	SR of Level 1 economic studies (with homogeneity)
1B	Individual RCT (with narrow Confidence Interval)	Individual inception cohort study with> 80% follow-up; CDR validated in a single population	Validating cohort study with good reference standards; or CDR tested within oneclinical centre	Prospective cohort study with good follow-up	Analysis based on clinically sensible costs or alternatives; SR(s) of the evidence; and including multi-way sensitivity analyses
1C	All or none	All or none case-series	Absolute SpPins and SnNouts	All or none case-series	Absolute better-value or worse-value analyses

Tabella 2a. Levels of evidence set up by CEBM [64]

Level	Therapy/ prevention, etiology/ harm	Prognosis	Diagnosis	Differential diagnosis/ symptom prevalence study	Economic and decision analyses
2A	SR (with homogeneity) of cohort studies	SR (with homogeneity) of either retrospective cohort studies or untreated control groups in RCTs	SR (with homogeneity) of Level >2 diagnostic studies	SR (with homogeneity) of 2b and better studies	SR (with homogeneity) of Level >2 economic studies
2B	Individual cohort study (including low quality RCT; e.g., <80% follow-up)	Retrospective cohort study or follow-up of untreated control patients in an RCT; Derivation of CDR or validated on split-sample	Exploratory cohort study with good reference standards; CDR after derivation, or validated only on split-sample or data	Retrospective cohort study, or poor follow-up	Analysis based on clinically sensible costs or alternatives; limited review(s) of the evidence, or single studies; and including multi-way sensitivity analyses
2C	Outcomes Research; Ecological studies	Outcomes Research		Ecological studies	Audit or outcomes research

Tabella 2b. Levels of evidence set up by CEBM [64]

Level	Therapy/ prevention, etiology/ harm	Prognosis	Diagnosis	Differential diagnosis/ symptom prevalence study	Economic and decision analyses
3A	SR (with homogeneity) of case-control studies		SR (with homogeneity) of 3b and better studies	SR (with homogeneity) of 3b and better studies	SR (with homogeneity) of 3b and better studies
3B	Individual Case-Control Study		Non-consecutive study; or without consistently applied reference standards	Non-consecutive cohort study, or very limited population	Analysis based on limited alternatives or costs, poor quality estimates of data, but including sensitivity analyses incorporating clinically sensible variations.
4	Case-series (and poor quality cohort and case-control studies)	Case-series (and poor quality prognostic cohort studies)	Case-control study, poor or non-independent reference standard	Case-series or superseded reference standards	Analysis with no sensitivity analysis
5	Expert opinion without explicit critical appraisal, or based on physiology, bench research or first principles	Expert opinion without explicit critical appraisal, or based on physiology, bench research or first principles	Expert opinion without explicit critical appraisal, or based on physiology, bench research or first principles	Expert opinion without explicit critical appraisal, or based on physiology, bench research or first principles	Expert opinion without explicit critical appraisal, or based on economic theory or first principles

Tabella 2c. Levels of evidence set up by CEBM [64]

Level of Evidence	Number of studies included in the SR
1°	0
1B	2
1C	0
2A	0
2B	1
2C	3
3A	0
3B	0
4	0
5	0

Tab. 3. Level of evidence of studies

Database Source	Authors and design of the study	Level of Evidence & Study Design	Summary
Medline Pubmed	Weigensberg M.J., Lane C.J., Ávila Q., Konersman K., Ventura E., Adam T., Shoar Z., Goran M.I. & Spruijt-Metz D., *Imagine HEALTH: results from a randomized pilot lifestyle intervention for obese Latino adolescents using Interactive Guided Imagery SM.* BMC Complementary and Alternative Medicine. 2014 Jan 17;14:28 [65]	1B RCT	*Background/ Objective.* There is an urgent need for innovative and developmentally appropriate lifestyle interventions to promote healthy lifestyle behaviors and to prevent the early onset of type 2 diabetes and cardiovascular disease risk in obese Latino adolescents. Guided imagery offers promise to reduce stress and promote lifestyle behaviour change to reduce disease risk in obese adolescents. Our objectives were: 1) To pilot test a new 12-wk lifestyle intervention using a randomized trial design in obese Latino adolescents, in order to determine the effects of the mind-body modality of Interactive Guided Imagery SM (IGI), over and above those of a didactic lifestyle education, on insulin resistance, eating and physical activity behaviours, stress and stress biomarkers; and 2) To explore the role of intervention-related changes in stress and stress biomarkers on changes in metabolic outcomes, particularly insulin resistance. *Methods*: Obese (BMI > 95th percentile), Latino adolescents (n = 35, age 14-17) were randomized to receive either 12 weekly sessions of a lifestyle education plus guided imagery program (GI), or lifestyle education plus a digital storytelling computer program (DS). Between-group

			differences in behavioural, biological, and psychological outcomes were assessed using unpaired T-tests and Ancova in the 29 subjects who completed the intervention. *Results:* The GI group demonstrated significant reductions in leisure sedentary behavior ($p < .05$) and increases in moderate physical activity ($p < .05$) compared to DS group, and a trend toward reduced caloric intake in GI vs DS ($p = .09$). Salivary cortisol was acutely reduced by stress-reduction guided imagery ($p < .01$). There were no group differences in adiposity, insulin resistance, perceived stress, or stress biomarkers across the 12-week intervention, though decrease in serum cortisol over the course of the intervention was associated with improved insulin sensitivity ($p = .03$) independent of intervention group and other relevant covariates. *Conclusions*: The improvements in physical activity and stress biomarkers following this pilot intervention support the role of guided imagery in promoting healthy lifestyle behaviour change and reducing metabolic disease risk in obese Latino adolescent populations. Future investigations will be needed to determine the full effects of the Imagine HEALTH intervention
Medline Pubmed	Wang M.L., Lemon S.C., Clausen K., Whyte J., & Rosal M.C., ***Design and methods for a community-based intervention to reduce sugar-sweetened beverage***	1B RCT	*Background/ Objective*: Reducing sugar-sweetened beverage (SSB) intake is an important dietary target among underserved children at high risk for obesity and associated morbidities. Community-

			The specific aims included the collection of data to assess feasibility and efficacy of the intervention. ***Methods.*** Both qualitative and quantitative assessments were conducted. Qualitative data was used for development of the intervention and for program feedback at post assessments. Two hundred fifty-three preschool children (49%boys; 66% Hispanics and 34%African-Americans; mean age 4.4 years) were randomized either to the intervention (n= 128) or the control group (n= 125). The teacher/parent intervention group showed the children videotaped (DVD) puppet shows. Based on the theoretical framework "transportation into a narrative world", three professionally developed characters, unique storylines and an engaging, repetitious song were incorporated in four 20-min DVD puppet shows. Prior to lunch each show was shown for five consecutive days in school and a minimum of once in the home. Digital photography was used in school to assess consumption of vegetable dishes at the lunch meal (quantitative assessment). At home parents were asked to complete the booklet questions corresponding to each DVD; questions could be answered correctly only if parents watched the DVD with their child. A multilevel mixed-effectmodel was used to analyze the data, adjusting for age, gender, and ethnicity. ***Results.*** Children in the intervention group significantly (p< 0.0001)

			increased consumption of vegetable dishes from baseline to follow-up compared to no change in the control group. At follow-up, the intervention group continued to have significantly (p= 0.022) higher intake of vegetable dishes compared to the control group. Sixty percent of the mothers completed the booklet's questions with 76 to 98% correct responses. Using theory-based motivational theater with multiple exposures may be an effective behavioural intervention to increase consumption of vegetable dishes by preschool children that can be easily disseminated to a large sample.
Medline Pubmed	Ríos-Cortázar V., Gasca-García A., Franco-Martínez M., & Tolentino-Mayo L., ***Child narrative in school settings: A strategy for health promotion.*** Salud Publica Mex. 2014; 56 Suppl 2:s130-8. [68]	2B/2C Cohort and Ecological Study	***Background/ Objective.*** To describe the process of capacity building of an elementary school in Mexico City to promote healthy diet, physical activity and obesity preventive measures, within the Health Promoting School (HPS) initiative, underpinned by a human functioning approach. ***Methods.*** The project of HPS had a methodological design of participatory action research, which was adapted and integrated to a participatory method of planning- action-evaluation with a model of collaborative and group learning; thus narrative was defined as a strategy. ***Results***: The participation of children in the process contributed to the development of a set of capabilities related to school performance, socialization, coexistence, diet,

			physical activity and others related to health in general. *Conclusions.* The HPS enhances the development of individual and collective capacities of school-aged children that allows them to achieve favourable performances for their health, including diet and physical activity.
Medline Pubmed	Griffith M, Griffith J, Cobb M, & Oge V., *The Use of Narrative as a Treatment Approach for Obesity: A Storied Educational Program Description*, The Permanente Journal 2016 summer; 20(3):102-6. [69]	2B/2C Cohort and Ecological Study	*Background/ Objective.* Childhood obesity is a health care crisis according to the leading pediatric advocacy groups (National Medical Association, American Academy of Pediatrics, and American Diabetes Association) and the White House. The problem has reached epidemic proportions for all children, but it has an even greater impact on racial minorities. The subject of childhood obesity can lead to a host of medical, psychological, and social problems, including low self-esteem and discrimination. We wrote an interventional children's book and workbook (The Tale of Two Athletes: The Story of Jumper and The Thumper) and developed a three-step intervention based on the narrative. The intervention's purpose is to increase public awareness, reduce stigma, and to help members of underserved communities become more comfortable discussing obesity. *Methods.* In classrooms and other community settings, a storied education program is presented to students of various ages. Interactive storytelling is the first step: live narration with direct listening and active participation. Didactic information on

			obesity is shared, including a sociocultural explanation for why the issue is more problematic among racial minorities. The audience is then introduced to the story of Jumper and The Thumper, two larger-than-life characters who experience different outcomes as a result of their choices about diet and exercise. True examples are described during the narration about these two young men, accompanied by cartoons and photographs for visual emphasis. The next step is reading: audience members are provided with a book to reinforce what was learned. Readers are allowed to more closely examine the importance of making healthy choices. Practicing positive behaviours and decision making through games and exercises from the companion workbook is the final step. These activities help children and their families live a healthier lifestyle. The goal is that these three steps, linked to a common narrative, will have a meaningful impact on obesity by creating behavioural change. *Results.* Children, parents, and health care professionals have stated their enthusiastic response to the information and message and that they have made positive changes in children's eating and exercise habits. The program has been presented in community forums, churches, medical meetings, and elementary schools in at-risk communities. *Conclusions.* New strategies must be developed to lead, uplift, and empower through

			health and wellness education and through community collaboration if we are to change the direction of course toward this devastating condition that affects our most valuable commodity-our children. This community-based educational approach is a means to help recognize and treat obesity in underserved communities.
Medline Pubmed	Jones B.A., Madden G.J., & Wengreen H.J., *The FIT Game: preliminary evaluation of a gamification approach to increasing fruit and vegetable consumption in school.* Preventive Medicine, 2014, 68,76-9 [70]	2B/2C Cohort and Ecological Study	*Background/ Objective*: Incentive-based interventions designed to increase fruit and vegetable (FV) consumption tend to yield positive, short-term outcomes. Because consumption most often returns to baseline levels when incentives are removed, sustainable long-duration interventions may be needed to impact public health. Anticipating that low-cost interventions will be more appealing to schools, the present study explored a low-cost, game-based intervention. *Methods*: An alternating-treatments design was used to evaluate the effects of the FIT Game on objectively measured FV consumption in one elementary school (n=251) in Utah. During the Fall 2013 semester, game-based rewards were provided to heroic characters within a fictional narrative read by teachers on days when the school, as a whole, met a fruit or vegetable consumption goal in accord with the alternating-treatments design. *Results*: On intervention days, fruit and vegetable consumption increased by 39% and 33%, ($p<0.01$, $p<0.05$; binomial tests), respectively. Teacher

			surveys indicated that students enjoyed the game and grade 1-3 teachers recommended its use in other schools. ***Conclusion.*** This game-based intervention provides a promising step towards developing a low-cost, effective, and sustainable FV intervention that schools can implement without outside assistance.

Tab. 4. Characteristics (authors, title, level of evidence, design of the study) and summary of the studies included in the SR.

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