



Invited Editorial

Physical Activity and Physical Fitness in Pediatric Obesity: What are the First Steps for Clinicians? Expert Conclusion from the 2016 ECOG Workshop

GRACE O'MALLEY^{1,2,3,4}, SUSANNE RING-DIMITRIOU^{2,5}, PAULINA NOWICKA^{2,6,7}, ANDREA VANIA^{2,8}, MARIE-LAURE FRELUT^{2,9}, NATHALIE FARPOUR-LAMBERT^{4,10}, DANIEL WEGHUBER^{2,11,12}, and DAVID THIVEL^{2,13,14,15}

¹Division of Population Health Sciences, Royal College of Surgeons of Ireland, Dublin, IRELAND; ²European Childhood Obesity Group, Brussels, BELGIUM; ³Department of Physiotherapy, Temple Street Children's University Hospital, Dublin, IRELAND; ⁴European Association for the Study of Obesity, London, UK; ⁵Department of Sport Science and Kinesiology, Paris Lodron-University, Salzburg, AUSTRIA; ⁶Department of Food, Nutrition and Dietetics, Uppsala University, Uppsala, SWEDEN; ⁷Division of Pediatrics, Department of Clinical Science, Intervention and Technology, Karolinska Institute, Stockholm, SWEDEN; ⁸Department of Paediatrics and Paediatric Neuropsychiatry, Sapienza University, Rome, ITALY; ⁹Pediatric Endocrinology Department, Bicêtre Paris Sud University Hospital, FRANCE; ¹⁰Obesity Prevention and Care Program Contrepoids, Service of Therapeutic Education for Chronic Diseases, Department of Community Medicine, Primary Care and Emergency, University Hospitals of Geneva and University of Geneva, Geneva, SWITZERLAND; ¹¹Department of Pediatrics, Paracelsus Medical University, Salzburg, AUSTRIA; ¹²Obesity Research Unit, Paracelsus Medical University, Salzburg, AUSTRIA; ¹³Laboratory of the Metabolic Adaptations to Exercise under Physiological and Pathological Conditions, Clermont Auvergne University, Clermont-Ferrand, FRANCE; ¹⁴Auvergne Regional Center for Human Nutrition, Clermont-Ferrand, FRANCE; ¹⁵CALORIS Obesity Clinical & Research Group, Clermont-Ferrand, FRANCE.

ABSTRACT

International Journal of Exercise Science 10(4): 487-496, 2017. One of the main aims of the European Childhood Obesity Group (ECOG) is to assist healthcare workers in delivering evidence-based assessment and treatment of childhood obesity. Every year the ECOG Congress includes working groups whose objective is to highlight concerns faced by clinicians and practitioners who work in the field of pediatric obesity. This year, a working group was devoted to the assessment of physical activity and physical fitness in this population. The present commentary attempts to summarize the main themes identified by practitioners during these workshops in order to provide the basic and essential first steps required to address physical activity and fitness in children with obesity.

KEY WORDS: Physical activity, physical fitness, clinical assessment, pediatric obesity

INTRODUCTION

Poor diet and a sedentary lifestyle with a lack of physical activity and suboptimal physical fitness play a pivotal role in the development of chronic diseases such as type 2 diabetes, cardiovascular diseases, some cancers and orthopedic complications. Obesity is a crucial determinant of these diseases. With more than 42 million children under the age of five with obesity worldwide (WHO), there is a pressing need to adequately address the multitude of driving forces at a global level. However, at the same time, state-of-the-art diagnostic and evidence-based therapeutic procedures have to be available for the individual patient.

A remit of the European Childhood Obesity Group Congress is to assist healthcare workers in delivering evidence-based assessment and treatment of childhood obesity. For the last number of years, specific ECOG working groups have been conducted addressing physical activity (PA) and physical fitness (PF). During the annual meeting in Thessaloniki, Greece (October 2016), a workshop was convened to address physical activity and fitness in the area of childhood obesity. The discussions that developed during the workshop clearly highlighted the major concerns faced by clinicians and practitioners who work in the field of pediatric obesity but who are not specialized in assessing or addressing physical activity and physical fitness.

The available literature supports the central role for physical activity and play in child health and development. In addition, there is a large body of evidence addressing the beneficial effects of regular physical activity (in addition to healthy nutritional habits and behaviors and adequate sleep) for the prevention of pediatric overweight and obesity (25). By focusing on the physical activity levels of children and youth, not only do we intend to increase daily energy expenditure, but we also aim to maintain and improve physical fitness, i.e. functional capacities (motor skills, musculoskeletal, metabolic and cardiovascular structures and functions, etc.).

While public health recommendations for health-enhancing physical activity are largely aimed at maintaining and promoting general health and well-being in children and adolescents, it must be clearly noted that they are not aimed at inducing weight loss or for treating pediatric overweight, obesity and their associated metabolic and physical comorbidities. In essence, it is essential that clinicians consider the guidelines for physical activity as 'threshold' levels recommended for healthy childhood growth and development. Reaching these levels for any sedentary child is a key primary goal. In order to treat childhood obesity and its related comorbidities, moving beyond these thresholds may be necessary though achieving these may be challenging and will often require adapted techniques and therapeutic exercise strategies.

As part of its activities, the ECOG facilitates practical workshops during its annual scientific meeting, in an attempt to address the practical issues and barriers reported by clinicians and practitioners working in the field of pediatric obesity. The contemporary evidence together with national and international policies recommend that pediatricians and other healthcare practitioners promote appropriate behavior change within the family in an effort to prevent

and manage childhood obesity (5) (10). Key changes include limiting screen time, increasing physical activity and sleep and adopting healthy eating behaviors. Such targets should be an integral part of regular counseling, however practitioners report that encouraging such change is difficult to achieve in their daily practice.

Although pediatricians are perceived by most parents as valued advisors concerning their children's weight management (16) (18); they face a number of barriers which can limit their weight-related counseling and the referral to and delivery of lifestyle-based treatment.

Considering the very first step, most pediatricians and practitioners express difficulty explaining to parents that the existence of childhood obesity is a familial challenge which requires behavioral adaptations (16) (7) (17). In addition, the time needed to raise the issue sensitively and the resources required to address treatment effectively are often unavailable to practitioners. Practitioners are aware of the limits of their competencies but do not know how to improve this background: they report an actual lack of competence in delivering effective treatment (31) (15). Practitioners' confidence and competence are essential for establishing an authentic and trusting relationship and for preventing the stigma or discrimination that too often leads to iatrogenic effects in medical care (32) (14) (8) (19). Such barriers explain why pediatricians and practitioners often express a lack of effective counseling skills (23) (25) (33) (19). Indeed several authors have noted that there is a pressing need to increase the core treatment skills, self-confidence and efficacy related to pediatric obesity assessment and treatment (19).

Table 1. Self-assessment for obesity practitioners on physical activity and fitness.

Steps	
1	Determine how you define physical activity <i>What does health-enhancing physical activity mean to me?</i>
2	Identify a basic measure of the patients physical activity level <i>Does my patient reach the daily physical activity recommendation for his/her age (>60 minutes of mod-vigorous activity per day for those 6-18 yrs; 3 hours per day for those <6 years)</i>
3	Explore the determinants of physical activity for each patient <i>Family and peers: For how many days per week and for how many minutes each day does the child engage with family members or friends in active play, sport, exercise or active hobbies?</i> <i>Environment: Are there safe areas for the child to play (e.g. parks, cycling tracks or games areas near the home or school)? How far from school does the patient live? How does he/she go to school every day (cycling, walking, bus, car)?</i>
4	Identify the time devoted to sedentary behaviors <i>How many minutes/hours does your patient report sitting each day? For how many minutes/hours does the patient use screens (TV, laptop, smartphone, tablet, video console, Internet) per weekday and weekend day?</i>
5	Determine whether there are barriers to movement: <i>Does your patient report any difficulties in performing childhood activities of daily living (e.g. climbing stairs, tying shoe laces, showering, jumping, skipping, walking, running, playing team games, carrying bags, etc.)?</i>
6	Determine whether additional assessment and treatment will be required: <i>Do you have any indication that the child has physical or psychosocial barriers that might limit participation in physical play? Do you have access to a physiotherapist or exercise physiologist who can provide assessment and treatment? Are you aware of evidence-based childhood obesity treatments/interventions in your area?</i>

Practitioners, despite their commitment and willingness to be involved into the prevention or treatment of childhood obesity expressed a lack of knowledge regarding the physical

impairments and difficulties associated with obesity, and especially tools that would allow simple and effective assessment of them. These debates and discussions pinpointed the necessity to provide such professionals with the first necessary steps to facilitate a basic assessment of physical activity, physical fitness and physical function in children and adolescents with obesity. The present commentary attempts to summarize the main themes identified by practitioners during these workshops in order to provide the basic and essential first steps.

Importantly, it has to be noted that the objective of the commentary is not to provide practitioners without formal accredited training in the fields of physiotherapy, exercise science sports medicine or exercise physiology, the knowledge and skills to prescribe motor tests, physical activity programs or exercise training. Rather, we aim to ultimately reinforce the necessity for practitioners to adequately consider the role and importance of activity and fitness when it comes to assessing obesity in youth; and to encourage a greater understanding of when and to whom an onward referral may be necessary.

COMMON GAPS IN PRACTICE RELATED TO PHYSICAL ACTIVITY

When questioning practitioners on how they tend to assess a child's physical activity level it became evident that structured physical activities were usually considered as the main opportunity for energy expenditure in children. Practitioners reported questioning the child, the adolescent or parents about engagement in physical exercise sessions such as physical education classes or sport club sessions. On the other hand, very rarely practitioners elicited information regarding active free play, or active transport (walking or cycling to school). Similarly, very few explored whether their patients were at the very least reaching the age-related recommended levels for activity and sedentary behavior (20). From the initial discussion it became clear that a consensus understanding regarding the definition of physical activity was required.

While structured physical activity sessions (i.e. targeted games and exercise training sessions) are part of weight management programs to beneficially improve body composition, metabolic profile, psychological profile and functional capacities, daily physical activity and active play must be promoted in order to promote longer-term weight management and avoid the progression of co-morbidities. Any bodily movement that requires muscle work thus increasing energy expenditure above the resting metabolic level has to be encouraged in first instance. Before considering any specific physical activity intervention, practitioners must promote daily active play and movement by also setting goals aimed at reducing sedentary behavior. Although encouraging active play and movement in youth appears to be the first logical and natural step, it is important to keep the goal of activity recommendations in mind. While both parents and health care professionals assume that children are "naturally active" when young, the research indicates the opposite. At 4-years of age, children already engage in alarmingly high rates of sedentary behaviour (more than 7 hours/day) and very low levels of vigorous physical activity (average 7 min/day) (13).

Table 2. Template assessment for physical activity in childhood obesity.

Physical Activity Overview		
Does parent know that 60 mins of PA is needed for the child's health everyday (6-18 yrs) / 180 mins per day (<6 years)?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Is child getting recommended 60 mins of PA (that makes them breathe hard) everyday (6-18 yrs) / 180 mins per day for <6 years?*	Yes <input type="checkbox"/>	No <input type="checkbox"/>
*Use age-specific standardised questionnaires where possible.		
How does child get to school?	Car <input type="checkbox"/> Bus <input type="checkbox"/> Walks <input type="checkbox"/> Cycles <input type="checkbox"/>	
	Other:	
Is active transport to school possible?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Is child active at break times in school? For how many mins?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Does child engage in physical activity after school?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Hours per week in planned activity (details: type frequency, duration of activity/sport and time spent in play)		
<hr/>		
Does child have:	A safe place to play? Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Games / equipment? Bicycle Y <input type="checkbox"/> N <input type="checkbox"/>	Scooter Y <input type="checkbox"/> N <input type="checkbox"/>
	Trampoline Y <input type="checkbox"/> N <input type="checkbox"/>	Garden Y <input type="checkbox"/> N <input type="checkbox"/>
	Exergame Y <input type="checkbox"/> N <input type="checkbox"/>	Balls Y <input type="checkbox"/> N <input type="checkbox"/>
Barriers to physical activity (detail)	Pain <input type="checkbox"/>	Safety concerns <input type="checkbox"/>
	Falls <input type="checkbox"/>	No Time <input type="checkbox"/>
	Inclement Weather <input type="checkbox"/>	No friends <input type="checkbox"/>
	Self-conscious <input type="checkbox"/>	Enuresis <input type="checkbox"/>
	Breathlessness <input type="checkbox"/>	Other: <input type="checkbox"/>

Recommendations for childhood physical activity in children 5-18 years are a minimum of 60 minutes per day of moderate to vigorous physical activity (24) and children under 6 years should engage in physical activity (play and exercise) for at least 3 hours daily (WHO guidelines). Similarly sedentary guidelines suggest a maximum screen time of 2 hours per day in children over 5 years, not more than 1 hour of supervised screen-time in those 2-5 years. In those under 2 years, it is recommended that screens are only used for supervised communication (video-conferencing) with parents. Although these recommendations are encouraged by scientific societies and public health bodies, data clearly show that few children and adolescents meet them and that a large proportion of the population are not aware or do not understand these recommendations (30). It is definitely a challenge to effectively promote structured physical activity in children and adolescents with obesity as highlighted by the high dropout rates reported in the literature. Similarly, activity promotion is even more difficult for children who are largely sedentary and who may have low perceived confidence and competence in movement. Adapted and structured physical activity interventions designed to treat pediatric obesity must be implemented in addition to advising on activity recommendations in a counseling-style session (21). Similarly, children should be encouraged and supported to stay active (achieving activity recommendations) outside and upon completion of their weight-management exercise intervention. This is the only way to avoid any potential compensatory responses in energy balance regulation (for more details about

these energetic and nutritional compensatory responses see Thivel et al., (28) and Thivel et al. (29). Where activity recommendations are given as passive information by practitioners to keep children healthy, adapted physical activity interventions are designed and delivered actively and through physical practice in order to promote motor confidence for the ongoing successful treatment of childhood overweight and obesity. It should be noted that parents and other family members demonstrate less concern about children’s lack of physical activity and screen-time habits than about their food habits (3) (6). Research suggests that family’s attitudes toward children’s screen-time are influenced by parents’ own television viewing practices (26), as well as by the perceived utility of television viewing in „babysitting“ or calming children (3), particularly when parents are engaged in household chores (9), or when their sleep schedules do not align with their children’s (4).

Table 3. Template assessment for sedentary time in childhood obesity.

Sedentary Time Overview		
<i>Does child spend most of their free time sitting/doing inactive hobbies ?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>Does the child have a smartphone or tablet?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>Does the child have a TV in the bedroom?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>Are screens left on when the child is sleeping (e.g. phone /tablet /TV)?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>On an average schoolday how many hours does the child spend doing the following:</i>	Homework/ study	_____
	Watching TV	_____
	Talking on phone	_____
	Texting	_____
	Using a PC/laptop/tablet	_____
	Video/online games	_____
	Watching movies (in theatres or online)	_____
	Reading for leisure	_____
	Listening to music	_____
	Other :	_____
<i>On an average weekend day how many hours does the child spend doing the following:</i>	Homework/ study	_____
	Watching TV	_____
	Talking on phone	_____
	Texting	_____
	Using a PC/laptop/tablet	_____
	Video/online games	_____
	Watching movies (in theatres or online)	_____
	Reading for leisure	_____
	Listening to music	_____
	Other :	_____
<i>Are there house rules around use of screens?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>Are screens on when the child is eating?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>When watching TV do you skip/mute the advertisements?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>Is child’s use of the Internet supervised?</i>	Yes <input type="checkbox"/>	No <input type="checkbox"/>

INTRODUCING REGULAR ASSESSMENT OF PHYSICAL FITNESS

Themed discussions with ECOG participants revealed the necessity to clarify the differences and similarities between physical activity and physical fitness. Obviously activity and fitness are highly dependent and inter-related, however they are two distinct constructs that should also be considered in isolation. It was understood by participants that fitness relies on the level of physical ability (e.g. being able to participate in a mainstream PE class would rely on being able to walk or run) however it was more difficult for attendees to identify the principal components of overall fitness. Similarly, clearly identifying the importance of evaluating such components and their physical indicators was a challenge for the group. Although it appeared obvious to our practitioners to evaluate physical activity or at least to introduce its beneficial effects to children and their parents, the important role of fitness as a facilitator of or a barrier to activity and long-term health remained confusing.

Physical fitness represents the ability of an individual to perform daily activities with no excessive pain or energy expenditure (1). It was interesting to observe that our audience was surprised that the definition of fitness rests on activities of daily-living and not specifically structured and controlled exercise, play or sport activities. Participants considered fitness as a concept related to sports and fitness training rather than to the everyday functional needs of a healthy child like playing active skipping games with friends, being able to run or to kick a ball or being able to self-propel a wheelchair to school. Similarly, the group was challenged when encouraged to identify appropriate indicators and methods of assessing physical fitness. Since it is not the purpose of this paper to detail all the available recommended methods of assessing fitness, from laboratory-based tests to field tests, we do recommend the reader to become acquainted with supplementary reading in the area (22, 29). Briefly, cardiorespiratory fitness, muscle function, agility, balance, and flexibility are the main health-related and skill-related components of fitness which should be screened in youth with obesity. Assessment and subsequent treatment for these is indicated due to the ample evidence which describes the multitude of obesity-related physical comorbidities. Such comorbidities include: impaired cardiorespiratory health; impaired muscle strength; impaired motor competence and balance; orthopedic impairments and impaired gait and posture (27) (11) (12).

As part of a staged-treatment approach every practitioner assessing a child for obesity should introduce the theme of physical activity and fitness at initial assessment.

Simple age-appropriate questions can be posed to the child, adolescent and their parents to briefly identify any potential physical difficulties in their daily living (i.e. "can you sit down on the floor and get up again on your own and can you do this without feeling any pain?"). A simple functional test such as this can be very helpful in identifying physical strengths and difficulties. Beside that basic trait, assessing the child's capacity to perform physical tasks provides both qualitative (motor development) and quantitative (level of performance) information, identifying not only whether the child can perform the task properly but also how he/she can complete it. Pediatric movement specialists such as physiotherapists, exercise physiologists, sports physicians, occupational therapists and adapted-PA teachers are

trained to identify and address the barriers to efficient movement which can often impede the effectiveness of attempts to increase energy expenditure through active play and movement (2).

DISCUSSION

Following the 2016 ECOG workshop it was concluded that there is variation in the understanding of practitioners regarding the definition, measurement and prescription of physical activity for the promotion of fitness and management of co-morbidity in pediatric obesity. It was agreed that simple tools are needed by practitioners across Europe in order to develop a standardized approach to assessing and promoting physical activity and fitness in children attending for obesity treatment. Table 1 provides a framework for the practitioner to self-reflect on his/her understanding of activity and fitness in obesity and Table 2 and 3 provide an assessment template for inclusion in clinic assessment forms. For a detailed discussion of physical activity and fitness in childhood obesity (including standardized measurement of these domains) the reader is directed to the ECOG eBook at <http://ebook.ecog-obesity.eu>.

Note. *Physical activity assessment, promotion and performance in relation to child and adolescent obesity is a field new to medicine and should be taught to undergraduates and practitioners. The complexity of the field and the overlap with several fields such as physiotherapy, psychology, sleep medicine and cardiology, require development of appropriate practical tools. The ECOG has published free online tools (www.ecog-obesity.eu) that are intended as a basis for the next steps: establishing practical courses and detailed recommendations.*

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REFERENCES

1. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep* 100(2):126-131, 1985.
2. Cattuzzo MT, Dos Santos Henrique R, Re AH, de Oliveira IS, Melo BM, de Sousa Moura M, de Araujo RC, Stodden D. Motor competence and health related physical fitness in youth: A systematic review. *J Sci Med Sport* 19(2):123-129, 2016.
3. De Decker E, De Craemer M, De Bourdeaudhuij I, Wijndaele K, Duvinage K, Koletzko B, Grammatikaki E, Iotova V, Usheva N, Fernandez-Alvira JM, Zych K, Manios Y, Cardon G. Influencing factors of screen time in preschool children: an exploration of parents' perceptions through focus groups in six European countries. *Obes Rev* 13 Suppl 1:75-84, 2012.
4. Dwyer GM, Higgs J, Hardy LL, Baur LA. What do parents and preschool staff tell us about young children's physical activity: a qualitative study. *Int J Behav Nutr Phys Act* 5:66, 2008.

5. Eisenmann JC. Secular trends in variables associated with the metabolic syndrome of North American children and adolescents: a review and synthesis. *Am J Hum Biol* 15(6):786-794, 2003.
6. Eli K, Howell K, Fisher PA, Nowicka P. A question of balance: Explaining differences between parental and grandparental perspectives on preschoolers' feeding and physical activity. *Soc Sci Med* 154:28-35, 2016.
7. Gerards SM, Dagnelie PC, Jansen MW, De Vries NK, Kremers SP. Barriers to successful recruitment of parents of overweight children for an obesity prevention intervention: a qualitative study among youth health care professionals. *BMC Fam Pract* 13:37, 2012.
8. Grow HM, Hsu C, Liu LL, Briner L, Jessen-Fiddick T, Lozano P, Saelens BE. Understanding family motivations and barriers to participation in community-based programs for overweight youth: one program model does not fit all. *J Public Health Manag Pract* 19(4):E1-E10, 2013.
9. He M, Irwin JD, Sangster Bouck LM, Tucker P, Pollett GL. Screen-viewing behaviors among preschoolers parents' perceptions. *Am J Prev Med* 29(2):120-125, 2005.
10. Kimm SY, Glynn NW, Obarzanek E, Kriska AM, Daniels SR, Barton BA, Liu K. Relation between the changes in physical activity and body-mass index during adolescence: a multicentre longitudinal study. *Lancet* 366(9482):301-307, 2005.
11. Landauer F, Weghuber D., G. OM. Orthopaedic Complications. In: ML Frelut editor. *The ECOG's eBook on Child and Adolescent Obesity*; 2015.
12. Lazzer S., O'Malley G., M. V. Metabolic And Mechanical Cost Of Sedentary And Physical Activities In Obese Children And Adolescents. . In: ML Frelut editor. *The ECOG's eBook on Child and Adolescent Obesity*; 2015. Retrieved from ebook.ecog-obesity.eu
13. Leppanen MH, Nystrom CD, Henriksson P, Pomeroy J, Ruiz JR, Ortega FB, Cadenas-Sanchez C, Lof M. Physical activity intensity, sedentary behavior, body composition and physical fitness in 4-year-old children: results from the ministop trial. *Int J Obes (Lond)* 40(7):1126-1133, 2016.
14. Lucas PJ, Curtis-Tyler K, Arai L, Stapley S, Fagg J, Roberts H. What works in practice: user and provider perspectives on the acceptability, affordability, implementation, and impact of a family-based intervention for child overweight and obesity delivered at scale. *BMC Public Health* 14:614, 2014.
15. Mazur A, Matusik P, Revert K, Nyankovskyy S, Socha P, Binkowska-Bury M, Grzegorzczak J, Caroli M, Hassink S, Telega G, Malecka-Tendera E. Childhood obesity: knowledge, attitudes, and practices of European pediatric care providers. *Pediatrics* 132(1):e100-108, 2013.
16. Minck MR, Ruitter LM, Van Mechelen W, Kemper HC, Twisk JW. Physical fitness, body fatness, and physical activity: The Amsterdam Growth and Health Study. *Am J Hum Biol* 12(5):593-599, 2000.
17. Moyers P, Bugle L, Jackson E. Perceptions of school nurses regarding obesity in school-age children. *J Sch Nurs* 21(2):86-93, 2005.
18. Nelson JM, Vos MB, Walsh SM, O'Brien LA, Welsh JA. Weight management-related assessment and counseling by primary care providers in an area of high childhood obesity prevalence: current practices and areas of opportunity. *Child Obes* 11(2):194-201, 2015.
19. Newson L, Povey R, Casson A, Grogan S. The experiences and understandings of obesity: families' decisions to attend a childhood obesity intervention. *Psychol Health* 28(11):1287-1305, 2013.

20. Nowicka P. Dietitians and exercise professionals in a childhood obesity treatment team. *Acta Paediatr Suppl* 94(448):23-29, 2005.
21. Nowicka P, Flodmark CE. Physical activity-key issues in treatment of childhood obesity. *Acta Paediatr* 96(454):39-45, 2007.
22. O'Malley G, Thivel D. Physical Activity And Play In Children Who Are Obese. In: ML Frelut editor. *The ECOG's eBook on Child and Adolescent Obesity*; 2015. Retrieved from ebook.ecog-obesity.eu
23. Rowlands AV, Eston RG, Ingledeew DK. Relationship between activity levels, aerobic fitness, and body fat in 8- to 10-yr-old children. *J Appl Physiol* (1985) 86(4):1428-1435, 1999.
24. Strong WB, Malina RM, Blimkie CJ, Daniels SR, Dishman RK, Gutin B, Hergenroeder AC, Must A, Nixon PA, Pivarnik JM, Rowland T, Trost S, Trudeau F. Evidence based physical activity for school-age youth. *J Pediatr* 146(6):732-737, 2005.
25. Summerbell CD, Waters E, Edmunds LD, Kelly S, Brown T, Campbell KJ. Interventions for preventing obesity in children. *Cochrane Database Syst Rev* (3):CD001871, 2005.
26. Tandon PS, Zhou C, Sallis JF, Cain KL, Frank LD, Saelens BE. Home environment relationships with children's physical activity, sedentary time, and screen time by socioeconomic status. *Int J Behav Nutr Phys Act* 9:88, 2012.
27. Taylor ED, Theim KR, Mirch MC, Ghorbani S, Tanofsky-Kraff M, Adler-Wailes DC, Brady S, Reynolds JC, Calis KA, Yanovski JA. Orthopedic complications of overweight in children and adolescents. *Pediatrics* 117(6):2167-2174, 2006.
28. Thivel D, Duche P. Physical activity for weight loss in children: is there any compensatory mechanism? *Pediatr Exerc Sci* 26(2):121-123, 2014.
29. Thivel D, O'malley G, Aucouturier J. Exercise and Childhood Obesity. In: DF M editor. *Pediatric Obesity: Etiology, Pathogenesis and Treatment*; 2017.
30. Trigwell J, Murphy RC, Cable NT, Stratton G, Watson PM. Parental views of children's physical activity: a qualitative study with parents from multi-ethnic backgrounds living in England. *BMC Public Health* 15:1005, 2015.
31. Turner KM, Shield JP, Salisbury C. Practitioners' views on managing childhood obesity in primary care: a qualitative study. *Br J Gen Pract* 59(568):856-862, 2009.
32. Visram S, Hall TD, Geddes L. Getting the balance right: qualitative evaluation of a holistic weight management intervention to address childhood obesity. *J Public Health (Oxf)* 35(2):246-254, 2012.
33. Williams HG, Pfeiffer KA, O'Neill JR, Dowda M, McIver KL, Brown WH, Pate RR. Motor skill performance and physical activity in preschool children. *Obesity (Silver Spring)* 16(6):1421-1426, 2008.

