

CHILDHOOD OBESITY TREATMENT AND PREVENTION. PSYCHOLOGICAL PERSPECTIVES OF CLINICAL APPROACHES

QUATTROPANI MARIA C.¹, BUCCHERI TERESA ¹

¹ *Department of Human and Social Sciences, University of Messina, Messina (Italy)*
Email corresponding author: mquattropani@unime.it

Abstract: This work focuses on clinical psychologist' presence within childhood obesity prevention programmes in several countries. The Authors collected articles considering psychological, biological and social aspects linked to childhood obesity. Studies reveal that childhood obesity prevention programmes are based on biological, medical and educational aspects; clinical psychologists up until now have been engaged almost exclusively in the treatment of obesity. Alarming data about children's weight, difficulties in arranging integrated interventions and the limited success of educational programmes underline that it is necessary to consider every level (school, family, systems of communication, information and health education) and they reinforce the idea that a multidisciplinary approach is necessary to fight childhood obesity. There is a clear need to consider psychological aspects (emotional, cognitive and relational) related to the childhood obesity's causes and involve psychologists in its prevention projects.

Keywords: Childhood obesity, multidisciplinary approach, clinical psychology, prevention, treatment.

INTRODUCTION

Childhood overweight and obesity have been recognized as an increasing health problem worldwide. It has been shown that childhood obesity is a predictor of obesity during adulthood (Rolland – Cachera, 2000; Thorpe et al., 2004) and it has also been associated with cardiovascular, kidney, endocrine, pulmonary, gastrointestinal, psychological and social problems (Raj & Kumar 2010; Wabitsch, 2000).

Obese children usually feel so uncomfortable, embarrassed and guilty that they cut themselves off from social life and leisure activities. Problems linked to acceptance of body image and the inability to control hunger and satiety reinforce lack of self-confidence. Weight problems also seem to make children and adolescents more vulnerable to psychological diseases such as anxiety, depression, progressive withdrawal, expectation of rejection, low self-esteem and obsessive concern about body image.

Childhood obesity comes from a long term positive energy balance: i.e. more calories are introduced than those actually consumed over an extended period of time. BMI (Body Mass Index = Weight in Kg divided by Height in m²) is a specific measurement used to evaluate different levels of obesity and overweight. Children with a BMI equal to or exceeding the age-gender-specific 95th percentile are classified as obese. Those with a BMI equal to or exceeding the 85th but below 95th percentile are defined overweight and are at risk for obesity-related comorbidities.

Worldwide estimates for 2010 reported that around 43 million children under five years old are overweight. In the U.S. the prevalence of overweight children aged 5 – 14 years rose from 15% in 1973 to 32% in 1994, while that of obesity increased from 5% in 1973 to 22% in 1994 (Gonzalez-Suarez, Worley, Grimmer-Somers & Dones, 2009). Similar increases have been reported in countries such as Germany, Australia and China (Freedman, Dietz, Srinivasan & Berenson, 1999; Booth et al. 2003; Rolland-Cachera, 2000; Luo & Hu, 1992). A European study conducted by the WHO estimated 25-79% of adults to be overweight and 5-30% to be obese. Obesity is responsible for 2-8% of health care costs and for 10-13% of deaths.

The prevalence of childhood obesity in the UK has increased significantly, the 2007 Health Survey for England showed that the percentages of children between 2 and 15 years of age classified as overweight and obese were 31% for boys and 30% for girls (NHS Information Centre: Health Survey for England 2007. University College London Medical School: National Centre

for Social Research). Another study conducted in 2009/10 reported that 11.6% of children aged 4-5 years and 21.8% of those aged 10-11 years were at risk of being obese; 12.7% of children aged 4-5 years and 15.1% of those aged 10-11 years were reported to be at risk of being overweight (NCMP, National Obesity Observatory).

In Italy, the “Okkio alla salute” project and “Zoom8” study about monitoring eating behaviours under the European programme “Childhood Obesity Surveillance Initiative” found 22.9% of children aged 8-9 to be overweight and 11.1% obese. Percentages were lower for Northern Italy than for the South (www.salute.gov.it).

Considering literature on childhood obesity, sporadically it revealed complex and integrated intervention encompassing school, family and society, therefore we are promoting a clinical psychological method that should focus on inner and external psychological aspects, familial dynamics and society. It is evident that there is a clear need to gain a greater insight into the psychological aspects related to the phenomenon and involve more clinical psychologists in its treatment and in prevention projects.

The literature analysis also revealed that senior positions in government at international level also showed considerable interest: e.g. the U.S. First Lady Michelle Obama launched the campaign "Let's Move" with the aim of seeking interdisciplinary, complex and effective solutions to tackle childhood obesity.

Studies about body image

Rees, Oliver, Woodman and Thomas (2011) developed a systematic review of qualitative and quantitative research studies aimed at exploring the views of UK children about the meanings of obesity and body size, shape or weight and the children's own experiences of these issues. The review explored children's own perceptions under four main themes: how body size is or is not a matter of importance in the world; desirable and acceptable bodies; children's experiences of and feelings about their own body sizes and gender differences.

However, the studies did not fully represent children's variety and limited analysis of variations in perspective between children. The Authors (Rees, Oliver, Woodman, & Thomas, 2011) believe that research with children concerning their views on this topic needs to be far more rigorous and equitable than is currently the case.

Studies about biological aspects

Ventura and Mennella (2011) produced a review about innate and learned preferences for sweet-tasting food during childhood. The Authors stated that children's liking for all sweet things is not solely a product of modern day technology and advertising but reflects their basic biology as scientific literature hypothesises. According to these theories, a heightened preference for sweet-tasting foods and beverages during childhood is universal and evident among infants and children throughout the world. On the one hand, the innate preference for sweet tastes during childhood is linked to the instinct for survival; in fact a predisposition to reject bitter tastes in prehistoric times prevented man from consuming toxic foods. On the other hand, a liking for sweet tastes may ensure the acceptance of sweet-tasting foods such as mother's milk and fruits (Ventura & Mennella, 2011). It is also claimed that a liking for sweets may be further promoted by the pain-reducing properties of sugars. According to Ventura and Mennella (2011), studies on the basic biological mechanisms underlying preferences for sweet taste during childhood and about exposure to sweet taste are important as a means to develop new strategies to promote healthy eating. Studies conducted by University of Ancona on the cellular mechanisms linked to obesity show relevant results. According to Cinti (2000), adipose tissue is an endocrine organ composed of white adipose tissue (WAT) and brown adipose tissue (BAT); each type develops at the expense of the other to maintain the balance in the body. WAT is used as a store for the calories (energy) coming from food in order to provide fuel to all other cells of the organism between meals. It has the function of supporting and preserving internal organs and it acts as a thermal insulator, helping to maintain body temperature. There are many other factors that influence the metabolism of the whole organism; the most important of which is leptin. Leptin is a hormone that influences many important functions, the most important of which is eating behaviour (Zhang et al., 1994). BAT contains a much higher number of mitochondria (making it brown) and its primary function is to generate body heat in order to maintain body temperature (thermogenesis). Cinti (2002) states that the signal for brown adipocyte activation is a temperature below that of thermoneutrality (34°C for mice, 28°C for rats and 20°-22°C for humans); diet may similarly activate brown adipose tissue which is then responsible for diet-induced thermogenesis. This activity of brown adipose tissue influences eating behaviour and the energy balance. Cinti (2002) studied adipose tissue in mammals but concluded that the basic concepts regarding the adipose organ of small mammals were also

applicable to the human adipose tissue: white, brown and mixed adipose tissues are also present in the adipose organ of humans, with all the morphological and physiological characteristics described for murine adipose organ.

Furthermore, some studies have revealed that WAT can transform into BAT in the event of sustained heat requirement (i.e. chronic cold exposure), whereas, in case of chronic exposure to an “obesogenic environment”, BAT is able to transform into WAT to allow a greater amount of valuable energy molecules to be stored (Frontini & Cinti, 2010). Data from other studies support the notion that this process occurs through the direct transformation of adult cells, i.e. via physiological reversible transdifferentiation (Himms-Hagen et al., 2000; Granneman, Li, Zhu & Lu, 2005). White-to-brown-to-white transdifferentiation is not the only example of this phenomenon in the adipose organ. Results obtained in our laboratory have demonstrated the adipo-epithelial-adipo transformation of mammary gland adipocytes during pregnancy, lactation, and postlactation (Morrone et al., 2004; De Matteis et al., 2009).

White-to-brown adipocyte transdifferentiation could offer new therapeutic prospects for obesity and related disorders. Therapeutic strategies to treat obesity could include pharmacologic interventions aimed at facilitating brown adipocyte maintenance, stimulation of the growth of pre-existing brown precursors, and the induction of white-to-brown adipocyte transdifferentiation (Frontini & Cinti, 2010).

Other recent studies (Bostrom et al., 2012) discovered a new polypeptide hormone, irisin, which is secreted from muscle tissue into the blood and activates the thermogenic function in adipose tissues. Irisin is induced by exercise in mice and humans, and slightly increased irisin levels in the blood cause an increase in energy expenditure in mice despite no changes in movement or food intake. This results in improvements in obesity and glucose homeostasis. Irisin could be therapeutic for human metabolic disease and other disorders that are improved by exercise.

Prevention choices for children and families

Hughes et al. (2011) report that the development of overweight and obesity is greatest during mid-late childhood in the UK, thus future interventions to prevent child and adolescent obesity might target preschoolers. A study conducted in India showed 12.64% of children aged between 6 and 12 years old to be overweight and 3.39% obese. Results suggest that prevention policies and interventions need to be addressed to

children to reduce obesity and overweight (Midha et al., 2011). A prevention model (Pratt, Stevens & Daniels, 2008) is considered the best strategy to fight this growing phenomenon rather than one based on trying to heal obesity (Wofford, 2008) (Fitzgibbon & Beech, 2009; Stolley et al., 2003). According to the literature, such a model should be built on a multidisciplinary framework (Montoya & Lobo, 2011), it should involve Health Organizations, psychologists and biopsychologists, doctors, families and teachers, educators, associations, school, etc. (Kuhne, 2011) and it should target children because studies show that overweight tends to arise mainly during childhood (Mtusik & Malecka-Tendera, 2011). This epidemic is evident in children as young as two years of age. Attempts to treat existing obesity have had limited success. This may be due to the fact that established patterns of eating and physical activity behaviour are difficult to modify. Early life nutrition and physical activity levels are positively correlated with obesity in childhood and later life. Moreover, parents with newborn children are highly receptive to advice and support about lifestyle changes for the whole family from a paediatrician. The prevention of obesity is an issue that clinical medicine and public health should tackle together (Kuhne, 2011). Promoting healthy foods, healthy diets, physical activity, parental involvement, parental and school awareness and public health initiatives are becoming aims of modern society. Although a huge presence of prevention studies, it seems that some studies took no notice of a clinical psychological prevention treatment centred on promoting healthy familial and relational dynamics and clinical psychologists could go in for it.

The importance of a multi-disciplinary approach

American obesity prevention measures through the work of the North Carolina Division of Public Health have highlighted the importance of community-based initiatives (Cousins, Langer, Rhew & Thomas, 2011). Prevention and treatment programs have to be further developed to involve the child's existential context and family (Reinehr & Wabitsch, 2011). Reinehr and Wabitsch (2011) believe that parents should be encouraged to adopt a healthy life style which could provide a model for children. Indeed, obesity in mothers predisposes their offspring to obesity, therefore, prevention programmes targeting parents, even potential mothers before pregnancy, could be useful. Many studies have stressed the importance of designing a complex and

integrated intervention targeting children (Lasater, Piernas & Popkin, 2011) to achieve more effective treatments against obesity and overweight; in particular some studies underlined the importance of school interventions (Johnson, Weed & Touger-Decker, 2011; Jansen et al., 2011; Tripodi, Severi, Midili & Corradini, 2011) and parental involvement (Rodriguez – Oliveros et al., 2011). Johnson, Weed & Touger-Decker (2011) highlighted the need to structure a specific school intervention targeting the whole community which could be significant from a socio-cultural point of view while Jansen et al. (2011) created a multi-component intervention targeting children aged between 6 and 12 years old. The latter was founded on behavioural and ecological models and aimed to improve physical activity through three sessions of physical education with expert teachers and with extra physical activities outside school hours. The study showed that the prevalence of overweight children in grades 3-5 increased by 4.3% in the control group and by 1.3% in the intervention group; no significant effects were found for BMI or for grades 6-8 (9-12 years old). The results highlight the importance of a multi-component intervention against obesity and overweight. Tripodi et al. (2011) wrote about the key-role of the school in promoting healthy habits and eating behaviours.

Some Authors have highlighted the importance of parental involvement (Rodriguez – Oliveros et al., 2011) considering parents to be models for healthy eating behaviours and physical activity. Watson et al. (2011) stated the need to explore familial factors associated with intervention success. Their study explored the relationship between adult BMI and child BMI changes following a community-based multifactorial intervention (*Getting Our Active Lifestyles Started GOALS*). 60 families with overweight children completed the GOALS intervention; BMI data were collected pre and post-intervention. The data collected suggest that the active involvement of adult family members in the weight loss process improves child treatment outcomes. Another study (Freeman et al., 2012) showed that children with overweight or obese fathers are at higher risk of becoming obese; suggesting treatment of overweight fathers to be a key strategy in the prevention and treatment of childhood obesity.

On the one hand, some Authors underlined the importance of a synergic approach between school, family and health experts such as paediatricians.

On the other hand, some Authors have developed programmes following a multidisciplinary approach such as Early STOPP (STockholm Obesity Prevention Program) (Sobko et al., 2011) and IDEFICS (*Identification and prevention of dietary- and lifestyle-induced health effects in children and*

infants) (Verbestel et al., 2011). The IDEFICS programme was aimed at children aged between 2 and 10 years old born in eight different countries, Sweden, Estonia, Germany, Belgium, Hungary, Italy, Spain and Cyprus. The overall duration of the intervention programme was 2 years but a longer-term follow-up programme is under development. It was composed of 10 modules: three at community level, six at school level and one for parents; the main focus was on diet, physical activity and stress-coping capacity. Preliminary results show that the development of an intervention is a long process that needs to be done systematically; furthermore, time, human resources and finances need to be planned beforehand to make interventions evidence-based and culturally relevant.

Outcomes of the 5-4-3-2-1 Go! (Evans, Christoffel, Necheles, Becker & Snider, 2011) project suggested that parental exposure to messaging at children's school events was associated with higher water consumption. Other Authors have stressed the importance of promoting physical activity (Hills Andersen & Byrne, 2011). A study conducted by Erinoshio et al. (2011) evaluated 40 child-care centres in New York and it showed that although many centres provided healthful beverages and foods to children, further efforts are needed to make water available as a beverage throughout the day and to improve children's dietary intake, especially vegetables and vitamin E-containing foods.

Conclusions

Obesity is an increasingly common pathology which has already reached alarming levels in children and adolescents. The phenomenon is worrying because childhood obesity is a predictor of obesity during adulthood and it has also been associated with physical and psychological problems.

Childhood obesity has been linked to cardiovascular diseases such as high blood pressure (Wabitsch, 2000), early onset of atherosclerosis, left ventricular hypertrophy; adipose tissue around the lungs produces breathing problems and worsens pulmonary diseases such as asthma (Wabitsch, 2000, Gopalakrishnan & Tak 2011), bronchial hyperactivity and obstructive sleep apnoea. Overweight overloads the body and the bones and leads to orthopaedic diseases such as slipped capital femoral epiphysis, tibia vara and osteoarthritis, which compromise physical activity. Adipose tissue seems to increase the percentage of sex hormones considered to be causes of cervical and prostate cancer and it has been also associated with endocrine diseases such as insulin resistance and early-onset diabetes mellitus; with

gastrointestinal diseases such as gallstones, non alcoholic steatohepatitis, hepatic fibrosis and cirrhosis and with neurological diseases e.g. pseudotumor cerebri.

Overweight and obese children may also develop psychological problems. Weight problems seem to make children and adolescents more vulnerable to psychological diseases including anxiety, depression, progressive withdrawal, expectation of rejection, low self-esteem and obsessive concern with body image. Studies reveal that a social context in which a fat body is regarded as something wrong, sick and ugly influences psychological problems; obese children usually feel slow and lazy and this sensation drives them into progressive withdrawal, developing into a lack of self-confidence. Feeling rejected prevents children from developing social skills. This literature review highlights the importance of a multidisciplinary approach linking different areas: first medical and, psychological aspects, global health and society (Kuhne, 2011); second the promotion of healthy food, healthy eating habits, physical activity, public health initiatives, awareness; and lastly school interventions (Johnson et al., 2011; Tripodi et al., 2011) and parental involvement (Rodriguez – Oliveros et al., 2011). The Authors' review are aware of the difficulties in considering all different aspects and involving different experts. However, if it is not possible to follow a multidisciplinary approach, the task in hand becomes harder and clinical activity could be negatively affected by a poorly integrated programme. Experts tend to focus on their specific tasks without succeeding in considering childhood obesity from a holistic point of view (Gremigni & Letizia, 2011). In addition to treatment and prevention, the clinical psychologist's task could be the organization and integration of experts in childhood obesity projects.

Recent studies (Waters et al., 2011) support older ones (Pratt et al., 2008) about prevention, they confirm the idea that a prevention model is the best way to fight against the growing phenomenon rather than trying to cure obesity (Wofford, 2008; Fitzgibbon et al., 2005; Stolley et al., 2003).

According to the literature, an obese patient has to be evaluated from a medical point of view, from a general point of view (eating habits, physical activity) and from a psychological point of view through a psychodiagnostic evaluation.

As far as eating habits are concerned, Ventura and Mennella's research (2011) is important because it deals with innate preferences for sweet tastes and exposure to food with sweet tastes.

It seems a popular and widely accepted view that an intervention project has

to be flexibly structure, i.e. it can be adapted according to subjects' age and to take into account people's specific characteristics. Moreover, prevention and intervention projects should be aimed at preschoolers and school-age children; Hughes et al. (2011) show that overweight tends to arise mainly during childhood (Mtusik et al., 2011).

Reinehr and Wabitsch (2011) believe that prevention and treatment programs have to be developed further to involve the child's existential context and family. These programmes should also make reference to a psychologist. The Authors view is that parents should show a healthy life style which could provide a model for children; parents have to be helped to understand the importance of changing eating habits and their role in the psychophysical development of their children.

Before an intervention is implemented, it is necessary to start with an eating, motor and behavioural medical history to identify the specific areas to be targeted by it and to decide together with parents what changes have to be made to their lifestyle. The work undertaken with parents should aim to modify their behaviours because they are models for their children (Gremigni & Letizia, 2011).

Taking into account the bio-psycho-social model of health (Engel, 1977) which states that wellbeing is linked to biological, psychological and social aspects, the research undertaken by the University of Ancona (Frontini & Cinti, 2010) could open up new horizons. These studies on brown and white adipose tissue showed that white adipose tissue could be transformed into brown adipose tissue through exposure to cold weather while exposure to hot weather would produce the opposite effect. This phenomenon suggests that an apprehensive family environment could represent a risk factor since mollycoddled children who do not play sport and who are not exposed to cold weather could transform their brown adipose tissue into white adipose tissue which is one of the causes of obesity.

Following this line of reasoning, aim of the review is to show whether there is any significant relation between educative styles, dysfunctional familial relations and biological modifications.

Alarming data about children's weight, difficulties in arranging integrated interventions and the limited success of educational programmes underline that it is necessary to consider every level (school, family, systems of communication, information and health education) and they reinforce the idea that a multidisciplinary approach is necessary to fight childhood obesity. Prevention programmes based only on awareness campaign show limited effectiveness because they only provide information about the

phenomenon and risk factors without dealing with problems arising familial and social context.

Data collected concerning treatment projects (Jansen et al., 2011) underline the importance of working with different figures such as experts, institutions, parents and young persons. An effective intervention should be targeted on the individual and aimed at promoting healthy social behaviours such as effective communication, proper diet and physical activity as well as supporting psychological aspects such as the development of identity, management of emotions and coping attitudes. An integrated approach engaging family, school and Institutions could also involve the individual's existential context; working with families could be a valuable method because parents are models for their children (Gremigni & Letizia, 2011) and because it could allow new clinical perspectives to be found. The Authors of the review believe that it could be useful working with family stories, with the dynamics and attachment relations. It is important to consider every microsystem a person belongs to, from family to group of pairs (Bronfenbrenner, 1979).

The family is the first system that a person joins and it allows a personal identity be created through a sense of belonging and differentiation. This sense of belonging is built through learning and acquisition of a relational model that exists in that specific family; thus family constitutes the first learning environment for people.

The school is another microsystem the child joins where he learns about relationships, therefore health education and learning about healthy eating habits might prevent children from being stigmatized and rejected. Moreover, school is a source of knowledge and it could act as a filter against the negative stimuli coming from the outside world. School is an advantaged environment where learning processes develop.

Lastly, Health Organizations and society (school, family, sport centres) (Cousins et al., 2011) are necessary because they are part of the child's existential context (Reinehr & Wabitsch, 2011). Institutions, coaches, doctors, paediatricians need to be well-informed about childhood obesity, risk factors and effects because they have to monitor, to distinguish between healthy and unhealthy behaviours, to identify risk factors and to devise treatments. Educational programmes need to teach healthy eating behaviours and importance of physical activity, studies from the University of Ancona (Cinti et al., 2012) showed how physical activity is important to fight obesity because exercise increases irisin hormone levels in the blood and this could be used to treat human metabolic disease and other disorders.

In conclusion, the literature analysis highlights that, although experts agree on the importance of prevention, it is extremely difficult to create well-structured, integrated and multifaceted prevention programmes. Clinical psychologists, who up until now have been engaged almost exclusively in the treatment of obesity, could coordinate and integrate the skills and work of the different experts and organize prevention programmes. A clinical psychologist should focus on risk factors, integrate the different tasks undertaken by different experts and look at the macrosystem and microsystems to which subjects belong (Bronfenbrenner, 1979) to involve families and make parents aware about familial dynamics, to promote healthy eating habits and physical activity, to highlight negative conditioning by media and advertising. In a previous work we proposed specific guidelines in childhood obesity treatments (Quattropani, Buccheri 2012) that indicate that a psychologist should develop multidisciplinary projects through a bio-psycho-social model of health and through multifactorial theory which states that the aetiopathogenesis of childhood obesity is considered multifactorial (AAP, 2003). Genetic, neuroendocrine, metabolic, psychological, environmental and socio-cultural factors (Manu & Krishna, 2010; Raj & Kumar, 2009), sedentary lifestyle, poor dietary habits, limited health education, breakdown of the family unit could all contribute to the development and increase in childhood and adolescent overweight and obesity. From these perspectives body and mind seem to be strongly linked; studies by Riggs, Spruijt-Metz, Chih-Ping and Pentz (2010) uphold the idea that brain and mind are the results of a complex interweaving between social, psychological and biological aspects. *“The interactions are not simply mechanical repetitions but dynamic processes in development and change turned towards more complexity”* (Peat, 2004). The Authors stress that compromise of executive cognitive functions could be linked to behavioural dysregulation and food intake, thus they hope that future studies consider assessing the potential of enhancing executive cognitive function in health promotion interventions. Executive cognitive functions are a complex system of functional modules of the mind which are anatomically related to different areas of the prefrontal cortex and cortico-subcortical circuits to its members: the dorsolateral prefrontal area involved in abstraction and action planning, the orbitofrontal area involved in the regulation of emotion and decision making, the anterior cingulate area involved in the control of motivation and of interfering stimuli. Improving executive cognitive functions could help people to control behaviours regarding food intake.

According to an environmental, integrated, multidisciplinary and multifaceted perspective, clinical psychologists should aim to promote specific prevention and treatment programmes that can be applied in different countries.

References

Booth, M.L., Chey, T., Wake, M., Norton, K., Hesketh, K., Dollman, J. & Robertson, I. (2003). Change in prevalence of overweight and obesity among young Australians, 1969-1997. *American Journal of Clinical Nutrition*, 77(1), 29-36.

Bostrom, P., Wu, J., Jedrychowski, M.P., Korde, A., Ye, L., Lo, J.C., Rasbach, K.A., Bostrom, E.A., Choi, J.H., Long, J.Z., Kajimura, S., Zingaretti, M.C., Vind, B.F., Tu, H., Cinti, S., Hojlund, K., Gygi, S.P. & Spiegelman, B.M. (2012). A PGC1- α -dependent myokine that drives brown-fat-like development of white fat and thermogenesis. *Nature*, 11, 481.

Bronfenbrenner, U. (1979). *Ecologia dello sviluppo umano*. Il Mulino, Bologna.

Cinti, S. (2002). Adipocyte differentiation and transdifferentiation: plasticity of the adipose organ. *Journal of Endocrinological Investigation*, 25, 823-835.

Cinti, S. (2000). Anatomy of the adipose organ. *Eating and Weight Disorders*, 5(3), 132-42.

Cousins, J.M., Langer, S.M., Rhew, L.K. & Thomas, C. (2011). The Role of State Health Departments in Supporting Community-Based Obesity Prevention. *Preventing Chronic Disease: Public Health research, practice and policy*, 8(4), 1-10.

De Matteis, R., Zingaretti, M.C., Murano, I., Vitali, A., Frontini, A., Giannulis, I., Barbatelli, G., Marcucci, F., Bordicchia, M., Sarzani, R., Raviola, E. & Cinti, S. (2009). In vivo physiological transdifferentiation of adult adipose cells. *Stem Cells*, 27(11), 2761-8.

Ebbeling, C.B., Feldman, H.A., Osganian, S.K., Chowmitz, V.R., Ellenbogen, S.J. & Ludwig, D.S. (2006). Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study. *Pediatrics*, 117, 673–80.

Engel, G.L. (1977). The need for a new medical model. A challenge for biomedicine. *Science*, 196, 129-136.

Erinosho, T.O., Oh, A.Y., Moser, R.P., Davis, K.L., Nebeling, L.C. & Yaroch, A.L. (2012). Association between perceived food environment and self-efficacy for fruit and vegetable consumption among US adults. *Prevention of Chronic Diseases*, Jan;9:E10. Epub 2011 Dec 15.

Erinosho, T.O., Berrigan, D., Thompson, F.E., Moser, R.P., Nebeling, L.C. & Yaroch, A.L. (2011). Dietary Intakes of Preschool-Aged Children in Relation to Caregivers' Race/Ethnicity, Acculturation, and Demographic Characteristics: Results from the 2007 California Health Interview Survey. *Maternity Child Health Journal*, Dec 10. [Epub ahead of print].

Evans, W.D., Christoffel, K.K., Necheles, J., Becker, A.B. & Snider, J. (2011). Outcomes of the 5-4-3-2-1 Go! Childhood obesity community trial. *American Journal of Health Behaviour*, 35(2), 189-98.

First Lady Michelle Obama launches Let's Move: America's move to raise a healthier generation of kids. The White House; 2010. <http://www.whitehouse.gov/>

Fitzgibbon M.L. & Beech, B.M. (2009). The role of culture in the context of school-based BMI screening. *Pediatrics*, 124 Suppl 1, S50-62.

Freedman, D.S., Dietz, W.H., Srinivasan, S.R. & Berenson, G.S. (1999). The relation of overweight to cardiovascular risk factors among children and adolescents: The Bogalusa Heart Study. *Pediatrics*, 103, 1175-1182.

Freeman, E., Fletcher, R., Collins, C.E., Morgan, P.J., Burrows, T. & Callister, R. (2012). Preventing and treating childhood obesity: time to target fathers. *International Journal of Obesity (Lond.)*, 36(1), 12-5. doi: 10.1038/ijo.2011.198. Epub 2011 Oct 18.

Frontini, A., Cinti, S. (2010). Distribution and development of brown adipocytes in the murin and human adipose organ. *Cell Metabolism*, 11(4), 253-6.

Gonzalez-Suarez, C., Worley, A., Grimmer-Somers, K. & Dones, V. (2009) School-based interventions on childhood obesity: a meta-analysis. *American Journal of Preventive Medicine*, 37(5), 418-27.

Gopalakrishnan P. & Tak T. (2011). Obstructive sleep apnea and cardiovascular disease. *Cardiology in Review*, 19(6), 279-90.

Granneman, J.G., Li, P., Zhu, Z. & Lu, Y. (2005). Metabolic and cellular plasticity in white adipose tissue I: effect of beta-3-adrenergic receptor activation. *American Journal Physiology - Endocrinology and Metabolism*, 289, E608–E616.

Gremigni, P. & Letizia, L. (2011). Il problema obesità. Manuale per tutti i professionisti della salute. Maggioli Editore.

Green J., Waters E., Haikerwal, A., O'Neill C., Raman S., Booth M.L. & Gibbons K. (2003). Social, cultural and environmental influences on child activity and eating in Australian migrant communities. *Child Care Health Development*, 29(6), 441-8.

Hedley, A.A., Ogden, C.L., Johnson, C.L., Carroll, M.D., Curtin, L.R. & Flegal, K.M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA*, 291, 2847–50.

Himms-Hagen, J., Melnyk, A., Zingaretti, M.C., Ceresi, E., Barbatelli, G. & Cinti, S. (2000). Multilocular fat cells in WAT of CL-316243-treated rats derive directly from white adipocytes. *American Journal of Physiology Cell Physiology*, 279, C670–C681.

Hills, A.P., Andersen, L.B. & Byrne, N.M. (2011). Physical activity and obesity in children. *British Journal of Sports Medicine*, 45(11), 866-70.

Hughes, A.R., Sherriff, A., Lawlor, D.A., Ness, A.R. & Reilly, J.J. (2011). Timing of excess weight gain in the Avon Longitudinal Study and Children (ALSPAC). *Pediatrics*, 127(3), 730-6.

Jansen, W., Borsboom, G., Meima, A., Zwanenburg, E.J., Mackenbach, J.P., Raat, H. & Brug, J. (2011). Effectiveness of a primary school-based intervention to reduce overweight. *International Journal of Pediatric Obesity*, 6(2-2), e70-7. Epub 2011 May 24.

Johnson, T., Weed, L.D. & Touger-Decker, R. (2011). School-Based Interventions for Overweight and Obesity in Minority School Children. *Journal of School Nursing*, Oct 24 (Epub ahead of print).

Kosti, R.I. & Panagiotakos, D.B. (2006). The epidemic of obesity in children and adolescents in the world. *Central European Journal of Public Health*, 14, 151–9.

Kühne, G. (2011). Aspect of prevention of obesity in children and adolescents- a European perspective. *Deutsche Medizinische Wochenschrift*, 136(31-32), 1613-5.

Lasater, G., Piernas, C. & Popkin, B.M. (2011). Beverage patterns and trends among school-aged children in the US, 1989-2008. *Nutrition Journal*, 10, 103.

Luo J, & Hu, F.B., (2002). Time trends of obesity in pre-school children in China from 1989 to 1997. *International Journal of Obesity and Related Metabolic Disorders*, 26(4), 553-8.

Manu, R. & Krishna, K. (2010). Obesity in children & adolescents. *Indian Journal of Medical Research*, 132(5), 598–607.

Midha, T., Nath, B., Kumari, R., Rao, Y.K. & Pandey, U. (2011). Childhood obesity in India. A Meta – Analysis. *Indian Journal of Pediatrics*, October 15 (Epub ahead of print).

Montoya, C. & Lobo, M.L. (2011). Childhood Obesity: a Wilsonian concept analysis. *Journal of Pediatric Nursing*, 26(5), 465-73 Epub 2011 July 1.

Morrone, M., Giordano, A., Zingaretti, M.C., Boiani, R., De Matteis, R., Kahn, B.B., Nisoli, E., Tonello, C., Pisoschi, C., Luchetti, M.M., Marelli, M. & Cinti, S. (2004). Reversible transdifferentiation of secretory epithelial cells into adipocytes in the mammary gland. *Proceedings of the National Academy of Sciences of United States*, 101, 16801–16806.

Murano, I., Barbatelli, G., Giordano, A. & Cinti, S. (2009). Noradrenergic parenchymal nerve fiber branching after cold acclimatisation correlates with brown adipocyte density in mouse adipose organ. *Journal of Anatomy*, 214, 171–178.

Mtusik, P. & Malecka-Tendera, E. (2011). Overweight prevention strategies in preschool children. *International Journal of Pediatric Obesity*, 6 Suppl 2, 2-5.

NHS Information Centre: Health Survey for England 2007. University College London Medical School: National Centre for Social Research.

Pereira, M.A., Kartashov, A.I., Ebbeling, C.B., Van Horn, L., Slattery, M.L. & Jacobs, D.R. (2005). Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. *Lancet*, 365, 36–42.

Pratt C.A., Stevens, J. & Daniels, S. (2008). Childhood obesity prevention and treatment: recommendations for future research. *American Journal of Preventive Medicine*, 35(3), 249-52. Epub 2008 Jul 10.

Puhl, R.M., Luedicke, J. & Heuer, C. (2011). Weight-based victimization toward overweight adolescents: observations and reactions of peers. *Journal of School Health*, 81(11), 696-703.

Quattropani, M.C., Buccheri T. (2012). When obese children are bullied: guidelines for school and society. Acts of Congress 6th Conference of Mediterranean Society of Comparative Education (MESCE). In press

Raj, M. & Kumar, K.R. (2010). Obesity in children & adolescents. *Indian Journal of Medical Research*, 132(5), 598-607.

Ray, J.W. & Klesges, R.C. (1993). Influences on the eating behavior of children. *Annals of New York Academy of Sciences*, 699, 57–69.

Rees, R., Oliver, K., Woodman, J. & Thomas, J. (2011). The views of young children in the UK about obesity, body size, shape and weight: a systematic review. *BioMed Central Public Health*, 11, 188. Review.

Reilly, J.J., Armstrong, J., Dorosty, A.R., Emmett, P.M., Ness, A., Rogers, I.,

Steer, C. & Sherriff, A. (2005). Avon Longitudinal Study of Parents and Children Study Team. Early life risk factors for obesity in childhood: cohort study. *British Medical Journal*, 330(7504), 1357.

Reinehr, T. & Wabitsch, M. (2011). Childhood Obesity. *Current Opinion in Lipidology*. 22(1), 21-25. Review

Riggs, N.R., Spruijt-Metz, D., Chih-Ping, C. & Pentz, M.A (2010). Executive Cognitive Function and Food Intake in Children. *Journal of Nutrition Education and Behavior*, 42(6), 398-403.

Robinson, T.N. (1999). Reducing children's television viewing to prevent obesity: a randomized controlled trial. *JAMA*, 282, 1561-7.

Rodriguez -Oliveros, G., Haines, J., Ortega-Altamirano, D., Power, E., Taveras, E.M., Gonzalez-Unzaga, M.A. & Reyes-Morales, H. (2011). Obesity determinants in mexican preschool children: parental perceptions and practices related to feeding and physical activity. *Archives of Medical Research*, 42(6), 532-9. Epub 2011 Oct 21.

Rolland-Cachera, M.F. (2011). Childhood obesity: current definitions and recommendation for their use. *International Journal of Pediatric Obesity*, (5-6), 325-31.

Smiciklas-Wright, H., Mitchell, D.C., Mickle, S.J., Goldman, J.D. & Cook, A. (2003). Foods commonly eaten in the United States, 1989-1991 and 1994-1996: are portion sizes changing? *Journal of American Dietetic Association*, 103, 41-7.

Sobko, T., Svensson, V., Ek A., Ekstedt, M., Karlsson, H., Johansson, E., Cao, Y., Hagstromer, M. & Marcus, C. (2011). A randomised controlled trial for overweight and obese parents to prevent childhood obesity--Early STOPP (STockholm Obesity Prevention Program). *BMC Public Health*, 11, 336.

Stolley, M.R., Fitzgibbon, M.L., Dyer, A., Van Horn, L., KauferChristoffel, K. & Schiffer, L. (2003). Hip-Hop to Health Jr., an obesity prevention program for minority preschool children: baseline characteristics of participants. *Preventive Medicine*, 36(3), 320-29.

Strauss, R.S. & Knight, J. (1999). Influence of the home environment on the development of obesity in children. *Pediatrics*, 103, e85.

Strauss, R.S. & Pollack, H.A. (2001). Epidemic increase in childhood overweight, 1986-1998. *JAMA*, 286, 2845-8.

Thorpe, L.E., Lit, D.G., Marx, T., May, L., Helgeson S.D., & Frieden, T.R. (2004). Childhood obesity in New York City elementary school students. *American Journal of Public Health*, 94(9), 1496-500.

Tripodi, A., Severi, S., Midili, S. & Corradini, B. (2011). "Community projects" in Modena (Italy): promote regular physical activity and healthy nutrition habits since childhood. *International Journal of Pediatric Obesity*, 6 Suppl 2, 54-6.

Ventura, A.K. & Mennella, J.A. (2011). Innate and learned preferences for sweet taste during childhood. *Current Opinion Clinical Nutrition and Metabolic Care*, 14(4), 379-84.

Verbestel, V., De Henauw, S., Maes, L., Haerens, L., Marild, S., Eiben, G., Lissner, L., Moreno, L.A., Frauca, N.L., Barba, G., Kovacs, E., Konstabel, K., Tornaritis, M., Gallois, K., Hassel, H. & Bourdeaudhuij, I. (2011). Using the intervention mapping protocol to develop a community-based intervention for the prevention of childhood obesity in a multi-centre European project: the IDEFICS intervention. *The International Journal of Behavioral Nutrition and Physical Activity*, 8,82.

Wabitsch, M. (2000). Overweight and obesity in European children: definition and diagnostic procedures, risk factors and consequences for later health outcome. *European Journal of Pediatrics*, 159 Suppl 1, S8-13.

Wang, L., Kong, L., Wu, F., Bai, Y. & Burton, R. (2005). Preventing chronic diseases in China. *Lancet*, 366, 1821-4.

Watson, P.M., Dugdill, L., Pickering, K., Bostock, S., Hargreaves, J., Staniford, L. & Cable, N.T. (2011). A whole family approach to childhood obesity management (GOALS): relationship between adult and child BMI change. *Annual Human Biology*, 38(4), 445-52. Epub 2011 Jun 17.

Waters, E., de Silva-Sanigorski, A., Hall, B.J., Brown, T., Campbell, K.J., Gao, Y., Armstrong, R., Prosser, L. & Summerbell, C.D. (2011). Interventions for preventing obesity in children. *Cochrane Database Systematic Review*, 12, CD001871.

Wofford, L.G. (2008). Systematic review of childhood obesity prevention. *Journal of Pediatric Nursing*, 23(1), 5.

Zenzen, W. & Kridli, S. (2009). Integrative review of school-based childhood obesity prevention programs. *Journal of Pediatric Health Care*, 23 (4), 242-58. Epub 2008 Jun 26. Review.

Zhang, Y., Proenca, R., Maffei, M., Barone, M., Leopold, L. & Friedman G.L. (1994). Positional cloning of the mouse obese gene and its human homologue. *Nature*, 372, 425-32.

Paper presented April 2013; published online: May, 2013

© 2013 by the Author(s); licensee *Mediterranean Journal of Clinical Psychology*, Messina, Italy. This article is an open access article, licensed under a Creative Commons Attribution 3.0 Unported License.

Mediterranean Journal of Clinical Psychology, Vol. 1, No. 1, Doi: 10.6092/2282-1619/2013.1.887 (2013)