



## Childhood Adiposity – Solutions for a National Epidemic

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### Abstract

The problem of childhood adiposity has reached epidemic proportions in many parts of the world and has become a public health challenge. Obesity co-morbidities are expected to increase progressively in line with the recent observed increase in childhood adiposity. Unless a solution is found, adiposity trends will escalate increasing mortality. To date the understanding of why this is happening is rudimentary and it seems that no coherent and effective methods have been developed to overcome this condition. Biological influences, parental influences and societal influences need all to be addressed if childhood adiposity is to be managed appropriately. Effective policies and programmes are needed at both global and national levels in order to address childhood adiposity. In light of these findings this paper explores the literature to provide a comprehensive understanding of the cause and effect in childhood adiposity. This paper also provides recommendations and possible solutions/methods of intervention for what could be considered a National epidemic.

**Keywords:** Childhood obesity; Culture; Environment; Epigenetic changes; Familial influences; Genetics

### Background

It is a well-known fact that childhood adiposity has becoming a national epidemic in the Maltese population [1,2]. Obese children are at an increased risk of a number of preventable acute and chronic medical problems which in turn are associated with increased morbidity and mortality from ischaemic heart disease, stroke and cancers [3]. Furthermore childhood obesity has also been linked to psychosocial problems such as low self-esteem, lower quality of life and depression. The WHO describes obesity as 'a plurifactorial disease, its occurrence supposing multiple interactions among genetic, neuroendocrine, social, behavioural, psychological, or a combination of these metabolic, cellular and molecular factors that lead to changes of the energetic balance' [4].

Childhood adiposity and other related lifestyle-related chronic conditions could be preventable if addressed appropriately, however once developed obesity could prove difficult to cure. The aim of this paper is to evaluate the literature on childhood adiposity and to provide a comprehensive understanding on the cause and effect in childhood adiposity. This paper also provides recommendations and possible solutions/methods of intervention for what could be considered a national and global epidemic.

### Background Information to Childhood Adiposity in Malta

The Maltese population is a small island central Mediterranean community which has been identified as having particular geographical and cultural stressors that influence the risk for developing a spectrum of metabolic disease [5]. The International Obesity Task Force study showed that Maltese children aged 7-11

years topped the adiposity [overweight/obese] rate with figures of 32.7% of boys and 38.5% of girls [6,7]. A longitudinal follow-up study of a cohort of 3435 children born in 2001 showed that the adiposity rate at six years of age was 40.1% in boys and 31.5% in girls. The same cohort reassessed three years later showed a 17% higher adiposity rate [8].

Several studies have been undertaken to attempt identify the contributors to this growing epidemic. Breastfeeding appears to represent a protective factor for obesity in childhood, although evidence is still controversial and underlying mechanisms unclear (Marseglia et al.). Local studies have reported a definite correlation between childhood adiposity in Maltese children and decreased or increased intrauterine nutrition possibly through epigenetic determinants [9,10]. In addition, it appears that subsequent lifestyle practices relating to nutrition and physical exercise may further contribute to the development of adiposity in childhood. Postnatal feeding has also been shown to influence the predisposition to childhood adiposity so that breast-fed children showed a statistically significant lower prevalence of adiposity when compare to artificially-fed ones [11]. The initiation of artificial feeding in a child's life heralds the onset of a pattern of unhealthy nutritional practices that often persist in adulthood.

A nutritional survey carried out among a cohort of five-year old Maltese children whose overall adiposity rate was 30.8% showed that parents of adipose children reported different nutritional habits than those reported by parents of lean children, the former appeared to prefer energy-rich foods and consuming less fresh fruit/vegetables [11]. A recent nutritional survey carried out among young Maltese adults aged 18-26 years showed that the general diet score reflecting the frequency of resorting to health and unhealthy snacks, drinks, meals, and type of food preparation was far below the ideal score [12]. To compound the risks, Maltese adipose five children reported less mean active physical activity time than their leaner counterparts.

Conversely mean passive activity time increased minimally with increasing adiposity [11].

A number of studies have confirmed the adage that “obesity begets obesity” with the observation that obese parents often have children suffering from adiposity [13-15]. A number of genetic determinants have been identified as contributory towards the development of adiposity, insulin resistance and earlier susceptibility to develop T2DM [16,17]. This gene polymorphism seems to predominantly express itself in adipose tissue to regulate lipid metabolism and thermogenesis. [14,15]. The reported data however remains conflicting [14,18]. Maternal adiposity and excessive weight gain during pregnancy has been shown to predispose to foetal macrosomia probably through the mechanism of intrauterine over nutrition [19]. This relationship does not appear to have a transmittable genetic element since in three-generational studies, mean birth weight of 3rd generation children correlated to their mother’s adult BMI but not to the grandmother’s BMI [20].

The familiar predisposition towards developing adiposity may in fact reflect unhealthy lifestyle predisposed to by the socioeconomic status and general lifestyle habits of the family. An inter-relationship between childhood adiposity and state school attendance was observed in Maltese six and nine-year-old boys, but not girls [8]. This observation may reflect a socio-economic relationship.

Parents have further been shown to influence children by child-feeding practices they implement from birth to adolescence, by the foods they make available at home, by direct modelling of eating behaviour, and by the way they engage with the children during meal times. Moreover, parents can influence their child’s food preferences by adopting certain feeding strategies, such as the implementation of coercion, high levels of control, food rewards and bribery [13]. A three-generation study carried out in 2012 investigating the relationship between the young Maltese adult [18-26-year old] daughter’s eating habits and those of the mother and grandmother suggested that eating habits have changed significantly with a decline in healthy eating behaviour from mothers to daughters. Attitudes towards maternal autonomy increased with increasing age with a corresponding reversal in attitudes towards daughter’s autonomy. The study further confirmed that, in the Maltese family environment, the mother’s eating behaviour did appear to reflect positively the daughter’s eating behaviour. This was however tempered by attitudes towards parenting styles and control with high levels of parental control apparently contributing towards healthy eating in the young adults [12].

### **Role of Cultural Elements in Contribution to Childhood Adiposity**

The role of culture is important to consider when attempting to analyze and explain adiposity rates in any population. Maltese culture is broadly Mediterranean, but has distinct elements related to social life, family work and religious/secular feasts [5]. Malta’s climate, religion and culture have resulted in a people who value eating out with families especially in weekends, and participating in religious-oriented public or family-oriented feasts traditionally celebrated by large parties and an abundance of food.

The effects of behaviour, attitudes, and social factors must also be looked at if targets are to be set and interventions are to be evaluated [21]. Although many chronic health conditions are treatable, their successful control imposes behavioural and psychological demands on

the sufferers influenced by their understanding or beliefs about the disease and its symptoms.

Since the state of health depends on cultural, social and economic lifestyle factors [22], a systematic connection between cultural, social and individual aspects of human behaviour is imperative for improved care. Attitudes and beliefs are central to self-management behaviour. The psychosocial environment in which a person lives influences beliefs and attitudes, which are often manifested as the concepts of compliance or adherence to medical advice [23,24]. Cultural awareness means acknowledging and accepting differences which includes being knowledgeable about people’s health, social characteristics, beliefs, attitudes, values, skills and past behaviour [25]. Cultural competence in health care is defined as the ability of providers and organizations to understand and integrate these factors into the delivery and structure of the health care system. The goal of culturally competent health care services is to provide the highest quality of care to every patient, regardless of race, ethnicity, cultural background or literacy. Insensitivity to a patient’s cultural background implies that something important and valuable to that person is being missed. If the providers, organizations, and systems are not working together to provide culturally competent care, patients are at higher risk of having negative health consequences, receiving poor quality care, or being dissatisfied with their care [26]. Thus it is important to have an understanding of a patient’s culture in order for healthcare professionals to be truly effective at treating the patient’s health concerns [23] and achieving the desired outcomes.

### **Role of Parent/Grandparent Elements in Contribution to Childhood Adiposity – Familial Influences and Effects**

Children spend a large part of their time in their home surrounded by family, so that the relationship between the health/eating habits of the parents and the impact that this imposes on children’s weight development cannot be overlooked or underestimated and should be considered a first step in rectifying the current childhood obesity crisis in Malta. Parents are usually viewed as role models by their children and studies have confirmed that children whose parents are obese are more likely to become obese adults themselves [27]. Childhood adiposity has also been associated with grandparental obesity [28].

The literature provides the evidence for parental modeling where a child’s attitude towards healthy living habits is significantly related to those of their parents. Parents’ beliefs about children’s nutritional needs and their attitudes toward mealtimes have also been identified as possible factors which could make a difference in children’s weight. The home environment set by the availability of food, food choices, portion size, food preparation, cultural values, mealtime structure and feeding styles are all pre-determined for the child by parental influences [29]. Familial effects have dual origins which include both the genetic and behavioural mechanisms common to parents and their children [30]. All parents need to understand the important role they play in socializing children’s healthy eating habits. Parents need to be educated on good nutrition as well as provide healthy food choices and encourage physical activity amongst their children. This change must be an entire family process for it to be adopted and adhered to.

### **Genetic Influence on Childhood Adiposity**

The “Thrifty genotype” hypothesis holds that the expression of ancestral genes, which evolved in response to the need to store energy

as fat, provided a powerful survival advantage during periods of famine or natural disaster; in today's environment of calorific abundance and sedentary lifestyles, such genes are maladaptive and promote obesity and diabetes [31].

According to the "thrifty-genotype" hypothesis [32], diseases of civilization such as obesity, type-2 diabetes mellitus and hypertension result from a discordance between certain features of our present-day environment and our genetic make-up which evolved to fit the life of humans. This concept implies that while affected individuals harbor the original ancestral version of the relevant genes, healthy or unaffected individuals have picked up recent mutations leading to a loss of thriftiness of these genes [33]. Populations with a Thrifty Genotype predisposition are to be encouraged to maintain healthy diets and increase their physical activity to control obesity and the eventual predisposition towards developing type-2 diabetes [34].

### Epigenetic epidemiology of adiposity

The rapid increase in the incidence of both childhood and adult adiposity cannot be explained solely by genetic and lifestyle changes. There is considerable evidence suggesting that fetal and early postnatal environments strongly influence the risk of developing obesity [35]. Recent findings have confirmed that transient environmental influences during development, such as under and over-nutrition of the mother during pregnancy, can cause permanent changes in epigenetic gene regulation [36,37]. The epigenetic changes, which alter the function of the DNA without changing the actual DNA sequence inherited from the parents' can influence how a person responds to lifestyle factors such as diet or exercise.

### Recommended Guidelines towards a Healthy Lifestyle Program for Children

It is being recommended that, in light of the current increase in childhood adiposity in Malta, a national campaign must be implemented with urgency addressing all the possible factors which are contributing to this national epidemic. Recommendations and guidelines to implement a holistic change should be based on current practice patterns and global health recommendations on healthcare taking into account the uniqueness of cultural behaviour, attitudes, and social factors. Thus health authorities need to review any current or planned policies with a view to bringing them into line with the needs of people using their current health care service. It is proposed that a thorough examination of the current policies needs to be undertaken in light of accreditation documentation which details the responsibilities of organizations in relation to providing care and implementing change [38]. Awareness campaigns in favour of proper nutrition and regular exercise are the most cost-effective strategy to help combat the growing problem of adiposity. Biological influences, parental influences and societal influences need however to be further addressed if childhood obesity is to be managed appropriately.

With the increasing demands on health services engendered by increasing longevity, it is critical imperative that new models of healthcare are developed in an effort to provide fair and equitable access to care and improve culturally appropriate outreach strategies. Culturally competent care is an important component of overall excellence in health care delivery. Improved care could mean better quality of life, improved health outcomes, lesser health-related complications and less expenditure from healthcare budgets. It would be very unrealistic to expect cultural change strategies to be effective in

a very short period of time. Successful strategies require realistic time frames to implement the complex and multi-level changes required inside any healthcare system [26].

A number of approaches exist for setting priority areas for action in obesity prevention and management. A first step should be problem identification and needs analysis. This should be followed by the identification of potential solutions as listed below. Once these are identified an assessment and prioritization of the potential solutions needs to be agreed upon. An action plan or strategy should be developed and possibly implemented with specific activities and timelines.

### Policies aimed at maternal health

Since the mother's nutrition while she is pregnant can influence adiposity risk in her offspring, women of reproductive age should be provided with correct nutritional, lifestyle and educational support before and throughout their pregnancy.

### Policies addressing Culture

Since healthcare services and professionals are providing care to multicultural communities' new initiatives need to be launched to meet such demands. A healthcare system that addresses just one ethos of care cannot satisfy the needs of diverse populations who are continually seeking help. Different meaning of health, different ways of communicating with people and the provision of different methods of care need to be considered for better provision of care. Cultural issues are however receiving insufficient priority in the training programmes of many healthcare professionals [24]. Training should include the necessary mechanisms for enhancing cultural competent care and exposure to the clinical and ethical issues which might arise in such situations and might compromise patient care. Healthcare policy makers need to adopt appropriate policies and structures to ensure culturally competent care [26] especially when addressing the problem of childhood adiposity.

### Addressing parental/grandparental influence

Since parental influence is a key risk factor for childhood weight gain and obesity and since parents provide the contextual environment for their children, it is important to address this issue. Primary care physicians may find it helpful to consider grandparents' and parents' weight status in judging risk of childhood obesity since the majority of children are of normal weight in the early years. Engaging families in discussions about generational patterns of weight to assess children's risk of overweight can affect the health of multiple generations. Furthermore, it is useful to empower parents to play an equal role in the design and implementation of family-centered obesity prevention programmes.

### Developmental models of eating behaviour

Childhood obesity must be tackled at two levels. Primary prevention should be directed towards children who are not overweight in order to prevent this at later stages in life especially if a familial tendency is recognised. Secondary prevention should be directed towards adipose children with particular attention to reinforcement and follow-up visits even after the child has lost weight in order to prevent recurrence.

## Encouraging physical activity

A Maltese study reported that a quarter of 10-11 year old children spent large amounts of time engaged in screen time; with only 39% of boys and 10% of girls meeting the recommendation of one hour of daily physical activity. Obese children were found to be less active than non-obese children (Decelis, et al.) [39]. The authors recommend an increase of physical activity in schools amongst school-age children as a possible important strategy. They also mention the importance of targeting discreetly the less active and obese children.

## Models of Behaviour Change in Obesity Education and Health Promotion

Education and health promotion are two closely related but non-interdependent paradigms which are fundamentally required [40] to provide the individual with information about the condition in order that he/she is empowered to become more actively involved in its management. People often behave in accordance with their understanding or beliefs about their disease and symptoms. Educational research has suggested that it is important not to contradict existing beliefs but rather to expand upon them [41]. The complexity of behavioural change in health promotion and education strategies is well known. In general, a strategy where information is simply imparted is unlikely to bring about lasting change [42,43].

Health is a highly complex human issue and it should not be understood only in biological terms, but individual behaviour, attitudes, and social factors must also be considered if interventions are to be effectively evaluated [21]. Effective learning should move from a 'receptive-transmission model' where the teacher is believed to be the expert giving information to a passive recipient to a 'constructivist approach' where knowledge is constructed by the learner through discussions and open-ended questioning and a 'co-constructivist approach' where there is further recognition of the importance of emotional, social, cultural and group inter-relationships [44]. It is argued that an approach to learning – where learners construct meaning and understanding from reflecting on their experiences and dialogue with others brings about better behavioural changes. A sense of security, belonging, membership to a group, co-operation, and sharing is vital to a person's ability to learn effectively about a condition.

There have been numerous attempts to develop models and theories to help understand the complexity of health behaviour [45]. Effective health promotion and health education practices depend on sound theories [40]. While behavioural change models focus on the individual determinants of health risk and protective behaviour, health promotion models focus on the role of social, economic, cultural and environmental influences on health and illness [46].

Current models and theories aiming to explain human behavioural changes are directed at intrapersonal, interpersonal or community levels. At an intrapersonal or individual level the four most influential models applied to eating and dietary behaviour include the Health Belief Model [47], the Theories of Reasoned Action and Planned Behaviour [48], the Trans-theoretical Model [49], and the Social Cognitive Theory [50,51]. All attempt to explain health behavioural change by focusing on the individual [52]. They emphasise the importance of knowledge and beliefs about health in health education and the importance of developing personal skills and self-confidence by the patient. They also highlight the importance of the influence of social role models in family and peer groups, the importance of

recognizing that individuals in a population may be at different stages of change, and the importance of shaping or changing the environment of people's perception of the environment as an important element of programmes. No single explanatory model dominates our understanding of behavioural change [45]. Many of the concepts in each model overlap each other and some aspects of behavioural change models have a stronger evidence base than others. The most appropriate approach is to combine concepts from more than one theory to address the problem. Application of these theories in the healthcare setting and obesity educational programmes should bring about better compliance by those who seek care. From a practical perspective, attempting to understand how obese children perceive this condition and its potential complications can be a first step to developing a more effective, educational intervention strategy [22]. Given that obesity is escalating in Malta there is an urgent need for an effective health education strategy to be established.

## Working as a team

Since a collaborative approach is required to address and change diet and physical activity habits effectively, the identification of key stakeholders is an essential step. Strong leadership is required here to ensure that all stakeholders are working towards common aims and objectives. The Government is pivotal in achieving a comprehensive approach to the prevention of childhood obesity. Funding for training, provision of programmes, research monitoring population health and evaluation of strategies is essential. It is recommended that representatives from multiple government sectors are included such as from ministries of Health, Education, Transport, Agriculture, Finance etc. In addition representatives from relevant NGO's and the private sector [food manufactures] are also included [53]. Both clinicians and families need to work hand in hand and reinforcement is critical since the literature highlights that 90% of obese children who lose weight will eventually return to their original weight percentile if they are not closely followed up and monitored at regular intervals [54]. Civil society and non-governmental organizations can also have an influential role by acting as a 'voice for the people'.

## Designing an intervention program

Since this should be personalized to the individual, the programme should commence with a thorough assessment of the patient including cultural, lifestyle socioeconomic behaviours. This should be followed by a treatment plan which has to be negotiated between the healthcare professional and the patient. Realistic goal-setting is imperative at this point. Follow-up visits are important and the patient must be monitored both physically and psychologically to ensure that the change imposed upon the patient is beneficial.

## Societal messages about food

Since society provides some consistent messages about food, there should be specific guidelines for the period before and after the child is born. Mothers should be advised not to eat anything that may be harmful to the growing foetus and should be sure that they are eating the required nutrients for optimal foetal health. Societal messages should also be available with regards to feeding infants and toddlers [55]. Unfortunately current societal messages about food change dramatically once the child is over two years of age with a drastic increase in the promotion of unhealthy food exposing children to fast foods, candy, sugared cereal, salty snacks and soft drinks [56]. Television is the most popular medium for commercial companies to

promote their products. Soft drinks and snack foods machines are also available in schools. Whilst the media clearly promotes unhealthy food, it is usually the parents who are held responsible for not feeding their children properly. However the parents are also vulnerable to the same societal pressures thus making them face several challenges when it comes to promoting good nutrition to their children in the current environment. The locus of responsibility for childhood adiposity needs to shift away from individuals and focus more towards the environment [56]. Modelling healthy food and changing the food environment for the whole family is an important start. As a child grows older, the influence of peers and adults other than parents as well as cues from the media become responsible in shaping a child's eating and physical activity habits. Schools need to become involved in proactive ways, advertising unhealthy foods should be limited; parents, teachers and all those who work with children should be encouraged to attend educational programmes on the prevention of obesity; and on a legislative level legal steps should be taken when unhealthy products are advertised to children.

### Policies to restrict food marketing to children

Since television advertising influences children's food preferences, purchase requests and consumption patterns, governments should set clear definitions of the policy components. It is important to design new and/or to strengthen existing policies on food marketing communications to children in order to reduce the impact on children of marketing of foods high in saturated fats, sugars and salt. Important definitions should include age group restrictions, viewing audience, timing of advertisements, placement and content of the marketing message.

### The need for more local research

Since any designed interventions need to be evaluated, further research in the field of childhood adiposity and its consequences is needed particularly focusing on the monitoring of secular trends and examining the psychosocial consequences of childhood adiposity. Furthermore studies on the various environmental, social and cultural drivers which could influence behaviour are needed in order to be able to implement effective anti-obesity strategies.

### Conclusion

This paper has highlighted the importance of addressing childhood adiposity. It has highlighted the fundamental importance of sensitivity to the historical and cultural identity of specific populations that may contribute to the tendency towards developing adiposity. Successful management of childhood adiposity requires an understanding of the history, religion, culture and family and social networks of the people concerned. Such holistic interventions will undoubtedly go a long way towards alleviating, to some extent, the costs and burden regarding the management of adiposity and its' complications.

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