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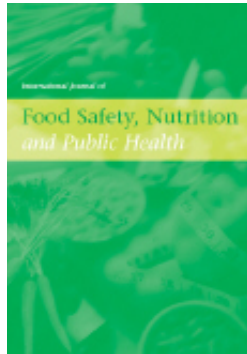


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## **Childhood obesity, food insecurity and climate change: a tale of two island groups**

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**Abstract:** The Canary Islands and Malta are two island groups currently experiencing high childhood overweight and obesity rates, with prevalence reported at over 40% for Malta and 44.2% for the Canary Islands [using World Health Organisation (WHO) cut-off criteria]. This study compares the childhood obesity situation in both islands, taking into consideration their specific vulnerabilities, the main initiatives to address obesity in both countries, and reports on progress achieved. Children's dietary and physical activity behaviours in both islands continue to be problematic, but other concerns such as the reliance on food imports and potential climate change impacts remain. Some strategies and initiatives are in place, but there are few progress indicators documented. Public health proposals should investigate the broader causes of obesity, and the potential link between childhood obesity and the specific vulnerabilities of small islands, to find more targeted solutions.

**Keywords:** childhood obesity; Canary Islands; Malta; vulnerabilities; climate change; food insecurity.

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## 1 Introduction

Obesity is a public health concern of pandemic proportions. Globally, many countries continue to report an increasing prevalence despite the adoption of numerous strategies to address this complicated, multi-factorial disease (Sahoo et al., 2015; Weihrach-Blüher and Wiegand, 2018). Childhood overweight and obesity has various health implications which persist into the adult years, and these include cardiovascular disease, type-2 diabetes, cancer and even psychological implications and stigma, amongst others (Sahoo et al., 2015; Weihrach-Blüher and Wiegand, 2018).

There are diverse risk factors for obesity, including childhood obesity. The Dahlgren and Whitehead model, developed in 1991, is one of the most commonly used models that uses a rainbow pictorial representation to describe the different causative factors and the link between the micro-environment (which includes personal and individual factors), the wider macro-environment, and health. The obesogenic environment (Swinburn et al., 1999) that children are exposed to plays a crucial role in shaping their dietary choices and eventual weight status. Cultural and socio-economic influences on eating and physical activity behaviours are also well evidenced. These could include parental nutrition

knowledge and literacy, which has been linked with weight status or increased weight in children (Gibbs et al., 2016).

Policies focusing or including dietary and nutritional aspects are crucial in any global or national programme to address and act on the prevention, management, and reduction of non-communicable diseases (NCDs), including obesity and overweight. In a global policy review published in 2013, the World Health Organisation (WHO) reported that over 90% of countries had initiatives or policies in place to tackle overnutrition, undernutrition, and child health, but that the execution of these programmes was generally inadequate (WHO, 2013).

The Canary Islands are an archipelago of seven islands located in the Atlantic ocean to the north-west of the Saharan coast in Africa (Troll and Carracedo, 2016). The archipelago is considered to be a European outermost region (OR) and forms part of Spain (European Commission, 2022). The prevalence of overweight and obesity in the Canary Islands has generally increased over the past decades, and it is now considered to be a public health priority. For example, in 2015, 24.3% and 19.9% of 6–9 year old children were reported to be overweight (defined as a body mass index or BMI of more than 25 kg/m<sup>2</sup>) and obese (BMI more than 30 kg/m<sup>2</sup>), respectively, according to the WHO BMI cut-offs by age (General Directorate of Public Health of the Canary Islands Health Service, 2014).

Similarly, the Maltese Islands are a small group of islands centrally located in the Mediterranean Sea (Cassar et al., 2008). A mapping study that investigated the obesogenic environment in Malta using the Analysis Grid for Environments Linked to Obesity (ANGELO) framework (Swinburn et al., 1999) identified various physical, economic, policy and socio-cultural dimensions that are key contributors to the high obesity prevalence on the islands (Cauchi et al., 2015).

A nationally representative study of a cohort of Maltese school children aged 4.7 to 17 years carried out in 2015/2016 reported that over 40% of boys and girls were overweight and obese, with boys exhibiting a higher prevalence. Regional (north-south) differences in weight status were also observed (Aquilina et al., 2019). Additionally, the Health Behaviour in School-Aged Children study (HBSC), a cross-national collaborative study on secondary school-aged children, also reported high rates for overweight and obesity. Around 44%, 38% and 41% of 11-, 13- and 15-year-old boys respectively, and 34%, 35% and 30% of 11-, 13- and 15-year-old girls respectively, are overweight or obese according to WHO BMI cut-offs (Inchley et al., 2020).

## **2 Small islands' vulnerability, childhood obesity and food insecurity**

Despite the differing geographical locations for the Canary Islands and Malta, it is interesting that both islands report similarly high obesity prevalence among children as well as a heavy reliance of food imports (Cauchi et al., 2015; Godenau et al., 2020). In 2018, Malta imported around 75% of its food requirements (FAOSTAT, 2018). This is pertinent because food imports, particularly processed foods, could contribute to higher obesity prevalence in small countries, whilst increasing the risk of acquiring NCDs such as diabetes and cardiovascular disease (Hawley and McGarvey, 2015).

The geographic vulnerability, economic context and food systems of both islands make comparisons particularly important to aid the identification of specific key

challenges such as food security (Godenau et al., 2020) and to guide future public health action. Food security and related concepts have been modified over the years from the widely accepted World Food Summit definition by the Food and Agricultural Organisation (FAO, 1996) that encompassed food accessibility, availability, and food utilisation together with food stability. The concept of food security now includes more contributing factors, such as cultural influences, inequity, and urbanisation (Havas and Salman, 2011).

These considerations are particularly relevant in light of the Sustainable Development Goals (SDGs) (United Nations, 2022) and climate change considerations for both countries. Many of the 17 SDGs are somehow linked to children's health, food, and nutrition, including SDG 1 (no poverty), SDG 2 (zero hunger), and SDG 3 (good health and wellbeing). A recent publication by the WHO-Lancet Commission, that focused on global progress achieved with respect to children's health including overweight and obesity, emphasised the importance of early intervention, the political commitment to develop child-friendly policies and the consideration of key focus areas such as urban planning, the provision of healthy diets and food (Clark et al., 2020).

Climate change, reflected in SDG 13, is expected to result in more severe weather events, sea level rise and compromised water resources. It is also expected to pose risks to farming and fish resources, whilst also undermining local food systems (Connell and Lowitt, 2020). Smaller countries, including small island states (Connell and Lowitt, 2020), may lack the necessary data on progress evaluation to properly tackle these challenges. Although it is difficult to foresee the full outcomes and effects of the climate crisis with certainty, it is likely to have detrimental consequences for both island groups.

The overall aims of this study were therefore to investigate and compare the current childhood obesity scenarios in two small island states, in an attempt to provide a different perspective on how to tackle the childhood obesity problem. This study will also provide an update on some of the obesogenic dimensions of the islands groups and report on any progress made to date.

### **3 Methods**

A literature search was carried out using MEDLINE (PubMed), EMBASE, PsychINFO and SCOPUS databases. In addition, Google Scholar was used to search for grey literature for both islands groups. Key terms related to obesity, overweight, BMI, culture, and environment were used. Information was also collected through hand-searching of reference lists of identified articles.

## **4 Results**

### *4.1 The physical environment*

The links between climate change and over- and under-nutrition have been described as a 'global syndemic' in a recent Lancet Commission's report, since they share multiple drivers and have a bi- or tri-directional relationship (Swinburn et al., 2019). The report calls for a comprehensive rethink with broader approaches to address the drivers of obesity, with new solutions for food systems and policy urgently required.

With respect to the overall physical environment, both island groups could be described as being highly urbanised with diminishing green urban spaces and vulnerable to climate change (Environment and Resources Authority, 2018; European Commission, 2022). Although 50% of the Canary Islands archipelago is predominantly rural, Tenerife and Gran Canaria islands are substantially urbanised (European Commission, 2021a).

Due to their proximity to the Saharan desert, the Canary Islands are highly susceptible to heatwaves and Saharan dust events. These have recently increased in frequency and are likely to become more severe in the future (Hernandez et al., 2018). The Mediterranean region, where Malta is centrally positioned, has also been classified as a climate change hotspot (Tuel and Eltahir, 2020). Extremely high ambient temperatures during the summer months, usually exceeding 35°C, are exacerbated by high levels of humidity that may negatively impact morbidity and mortality rates in vulnerable populations (Cramer et al., 2018), including obese individuals (Bettencourt Pires et al., 2016).

The expected rise in sea level as a consequence of climate change could also have devastating consequences, because it dramatically changes the terrain. Coastal buildings, sea ports and highways in low-lying areas will be at the mercy of intense winds and storm swells (Sauter et al., 2013). Malta is forecast to lose 12% of its land mass due to coastal flooding if strategic adaptation measures are not implemented (Bosello et al., 2012).

The tourism industry significantly contributes to both islands groups' gross domestic product (GDP), equivalent to around 35% of GDP for the Canary Islands (Exceltur, 2019) and 28.1% of GDP for Malta (Croes et al., 2018). Both figures indicate a heavy reliance on this sector, even as adverse effects of climate change such as heat stresses, water shortages, damaged infrastructure, loss of beaches and indigenous species etc are likely to negatively impact tourism (Sauter et al., 2013). The tourism market further impacts the food supply: dwindling local food production due to smaller areas dedicated to farming, reduced fishing and limited agricultural supplies further exacerbate a reliance on food imports in the Canary Islands, contributing to food insecurity (Godenau and Nuez Yanez, 2013). Water insecurity is present in Malta due to agricultural practices heavily reliant on underground sources of freshwater and an arid climate, both of which cause further reliance on food imports and compound existing food and water insecurity (Cassar, 2016). These issues also form part of the multi-faceted problem of water, food, and energy security in both island groups, leading to further reduced economic activity and increased climate change adaptation costs (Parliamentary Secretary for Agriculture Fisheries and Animal Rights, 2018; European Commission, 2021a).

#### *4.2 Physical activity and sedentary behaviours in children*

High levels of sedentary behaviour and low levels of physical activity (PA) in children were recorded in recent studies. The Canary Islands Health Survey (Canary Islands Institute of Statistics, 2015) showed that only 30.4% of children aged one to 15 years in the Canary Islands participated in sports activities several times a week, while 23.6% of children did not take part in any sports activities.

At the same time, only 47% of children aged 1–15 years spent more than two hours watching television during weekdays (Mondays to Fridays), although this increased to 70% during the weekend (Canary Islands Institute of Statistics, 2015). Other reported

sedentary behaviours included internet time, playing computer games, or watching TV, all of which seem to have replaced time spent outdoors in the Canary Islands.

For Malta, the most recent Childhood Obesity Surveillance data (COSI) data which compares data on weight and height measurements, school physical environments, diet, PA and sedentary habits of primary schoolchildren from participating member states of the WHO European region, reports the lowest levels of PA for Maltese schoolchildren, reporting that 61.7% of 6–9 year olds played at least an hour a day (WHO, 2021). With regards to sedentary behaviours, the same study reported that just under half (42%) of Maltese girls and 37% of boys aged 6–9 years old had at least 2 hours of screen time daily. HBSC data for older children in Malta also indicates low frequency of PA behaviours, with only 19% and 29% of 11-year-old girls and boys; 14% and 22% of 13-year-old girls and boys; and 5% and 15% of 15-year-olds girls and boys respectively performing medium to vigorous physical activity (MVPA) on a daily basis (WHO, 2020).

### *4.3 Dietary behaviours and socio-cultural factors*

A national study carried out in children and young adults aged between two and 25 years documents that the typical traditional diet of the Canary Islands is being slowly replaced, and is now characterised by high fat, sugar and salt (HFSS) foods, reduced consumption of fresh fruit and vegetables and a general abandonment of a healthier, Mediterranean diet (García Cabrera et al., 2015). Breads/cereals and dairy products are consumed daily by 80.6% and 78.2% of children (aged up to 16 years), respectively. Notable daily consumption of sausages, butter, cold cuts, or bacon (28.3%) and packaged fruit juices (25%) was reported.

There is also a clear relationship between socioeconomic status and diet documented for the Canary Islands. The consumption of vegetables on a daily basis was reported to be higher in social class I (the most affluent groups) at 50.9% than in social class VI (least affluent group) at 33.7%. A similar trend is reported for daily fruit consumption (65.7% for social class I and 51.4% for social class VI respectively). Higher overweight and obesity levels were noted among low-income families (46.6%), when compared to the most affluent ones (37.6%). In the ALADINO study (General Directorate of Public Health of the Canary Islands Health Service, 2014) for the Canary Islands, gender differences were noted for different lifestyle behaviours. Other family and socio-economic factors associated with overweight and obesity were reported, including an inverse correlation between family income, parental education and obesity (General Directorate of Public Health of the Canary Islands Health Service, 2014).

Furthermore, a decrease in household income has been described as a driver of dietary modifications, leading to the increased consumption of high carbohydrate products by families (Hernández-Yumar et al., 2019).

In Malta, contributing socio-cultural factors have also been reported within the childhood obesity context. The importance of the home environment was described in a study which identified mothers in particular (and grandparents to a lesser degree) as having important roles in promoting healthy food choices in their pre-adolescent children, and outlined the difficulties they faced. Socio-cultural influences regarding aesthetics and the health implications of attitudes towards body weight or shape could also be at play, with more negative connotations being demonstrated in older pre-adolescent children (Martin, 2015). The link between parental obesity, knowledge and childhood obesity in 200 pre-school Maltese children was reported in another Maltese study (Buttigieg et al.,



2012) which assessed weight status and maternal awareness of health promoting behaviours. There was a significant association reported between children's weight status (using weight-for-height centiles) and parental BMI status ( $r = 0.2$ ,  $p < 0.0001$ ). High maternal awareness also appeared to have a protective effect on children's BMI (odds ratio = 0.38, 95% CI = 0.20 to 0.70).

With respect to children's dietary behaviours, the most recent self-reported data obtained from the cross-national HBSC report (Inchley et al., 2020) indicates high levels of consumption of sugar-sweetened beverages (SSBs) and sweets among Maltese children when compared to children in other participating countries. For example, 43% and 42% of 15-year-old adolescent girls and boys respectively consumed sweets (including chocolate) on a daily basis. Table 1 summarises and compares some of the main factors contributing to obesity for both islands.

**Table 1** A comparison of similar obesity contributory factors for both island states

	<i>The physical environment</i>	<i>Physical activity and sedentary behaviours</i>	<i>Dietary behaviours and socio-cultural factors</i>
The Canary Islands	Possible negative consequences due to vulnerability of small islands, urbanisation and climate change.	Low participation rates in sports activities.  High levels of sedentary behaviours..	An inverse relationship noted between parental education, income and obesity levels.  An overall shift towards more processed foods, less fruit and vegetable consumption.  An association between social class and dietary patterns.
Malta	Possible negative consequences due to vulnerability of small islands, urbanisation and climate change.	Low levels of physical activity.  High levels of sedentary behaviours.	An association between parental BMI and children's weight status levels and parental knowledge and children's BMI levels.  High intakes of sugary foods in older children.

#### 4.4 Childhood obesity initiatives in the Canary Islands and Malta

Recent policies and initiatives relevant to childhood obesity prevention or management for both islands are outlined and compared in the following section.

The recent PIPO programme (Canary Societies of Pediatrics and the General Directorate of Public Health of the Canary Islands Health Service, 2021), a framework for action at the individual, family, school and community levels, promotes healthy diet and physical activity in homes and schools in the Canary Islands. Two activities directly related to schools were developed under the programme: 'The School Canteen Program' which started in 2013, and 'Healthy Eating Workshops' at schools for children which were developed to emphasise the importance of a healthy diet and to encourage physical activity (Canary Societies of Pediatrics and the General Directorate of Public Health of the Canary Islands Health Service, 2021). Similarly, the ALIPA programme consists of nutritional, cooking and physical exercise workshops for six to 16-year-old schoolchildren and adults within the school environment (Canary Islands Health Service and the Government of the Canary Islands, 2019). The Canary Islands have implemented

regulations around physical activity and sport, including sport facilities, and around the formal education of professionals who are involved in the promotion of a healthy lifestyle (Official Gazette of the Canary Islands, 2019). The EU's Fruit and Vegetables Scheme was adopted by the Canary Islands as an intersectoral initiative to increase fruit and vegetables intake among the school population and to contribute to the promotion of healthy eating (Suárez López de Vergara et al., 2017). Similarly, the Fruit and Vegetables Scheme (Agriculture and Rural Payments Agency, 2014) co-funded by the European Union together with the Milk Scheme (Ministry for Agriculture, Fisheries, Food and Animal Rights, 2021), provide free fruit and/or vegetables and fresh milk to primary school children in Malta.

Healthy eating habits are also promoted in Maltese schools, with the Healthy Eating Lifestyle Plan (HELP) (Ministry for Education Youth and Employment, 2007) first issued in 2007 and further reinforced by the updated Healthy Eating and Physical Activity Policy (Ministry for Education and Employment, 2015), which then progressed to the regulation of food and drink standards in schools (Government of Malta, 2018). These initiatives are supported further by the Free Breakfast Club Services in primary state schools (Ministry for the Family Children's Rights and Social Solidarity, 2016).

Outside the school setting, the General Directorate of Public Health of the Canary Islands Health promotes breastfeeding as part of the 'Initiative for the Humanisation of Birth and Breastfeeding Assistance' (IHAN) that was launched by the WHO and the United Nations Children's Fund (UNICEF) (Canary Islands Health Service and the Government of the Canary Islands, 2016). Likewise, the Maltese National Breastfeeding Policy (Attard et al., 2015) was drafted to encourage breastfeeding practices across multiple stakeholders to improve infants' nutritional patterns.

The Food and Nutrition Policy and Action Plan for Malta 2015–2020 was drafted with the broad aim of encouraging healthy lifestyles in the Maltese population, including children. The policy document describes a life course approach and focuses on a healthy diet and promotion of physical activity, specifically identifying obesity prevention as one of its main objectives across the different age groups (Health Promotion and Disease Prevention Directorate, 2014). Revised Maltese National Dietary Guidelines specifically aimed at improving the dietary patterns of infants and young children (Health Promotion and Disease Prevention Directorate, 2011) and children aged three to 12 years (Health Promotion and Disease Prevention Directorate, 2018) within the Mediterranean context were published.

Currently, fiscal incentives or taxation of HFSS foods at a population level are lacking in both the Canary Islands and Malta. European Union (EU) food and nutrition labelling legislation is in force in both countries but there is no specific legislation with an emphasis on children's foods (The European Parliament and the Council of the European Union, 2011).

Other broader policies such as the most recent Agricultural Policy for Malta (2018–2028) and the 2014–2022 Rural Development Programme for the Canary Islands makes reference to more sustainable agricultural practices, food quality, health and well-being and describes the need for adaptation to climate changes (Parliamentary Secretary for Agriculture Fisheries and Animal Rights, 2018; European Commission, 2021a). However, there is no specific mention of obesity prevention and management.

## 5 Indicators of success for policies and initiatives

To our knowledge, there is a lack of published data that document progress on specific, and timely measures to counter obesity outcomes for both countries. In the absence of these data, and for the purpose of this study, indicators including obesity prevalence, initiative participation rates and documented improvements in dietary behaviours were considered. Table 2 provides a comparative summary for both countries.

### 5.1 *Canary islands*

The Encuesta de Salud de Canarias (ESC) health surveys carried out in 2009 and 2015 reported on children and adolescents aged 2–17 years (Canary Islands Institute of Statistics, 2015). The latest figures still show a high prevalence of childhood overweight and obesity, but suggest an overall decrease in prevalence from 31.2% to 26.9% (Canary Islands Institute of Statistics, 2015). The 2015 ESC survey reported an increase in the consumption of vegetables from the previous survey held in 2009, while there was a slight decrease in the consumption of fresh fruit, milk derived products, bread and cereals and sweets.

During the same time period, a reduction in overall physical activity levels was also observed. Despite small improvements in levels of PA among those who exercised occasionally or performed some form of PA several times a week, an overall increase in sedentary behaviour was reported.

The ESC surveys also reported on infants aged 6 weeks to less than 3 months, where a decrease in natural breastfeeding and a consequent increase in artificial feeding was observed between 2009 and 2015 (Canary Islands Institute of Statistics, 2015). A reduction in breastfeeding and concomitant increase in artificial feeding was also observed among infants over 6 months of age (Canary Islands Institute of Statistics, 2015). There was a clear association between the use of formula milk for infant feeding in the first 6 weeks and social class: with people in lower social classes using formula milk less frequently compared to those in higher social classes (Canary Islands Institute of Statistics, 2015).

### 5.2 *Malta*

Despite numerous initiatives, the prevalence of self-reported obesity and overweight for secondary school aged children increased between 2014 and 2018 according to HBSC data. The percentage of overweight students rose from 32% to 34% and from 38% to 44% among 11-year-old girls and boys respectively (Inchley et al., 2014, 2020). Similarly, there was a 2% increase among 13-year-old boys and girls. More recent COSI data also revealed an increased prevalence of overweight and obesity in younger children aged six to nine years: from 33% among both girls and boys in the third round of the study to 35% and 37% respectively in the fourth round (WHO, 2021).

With regards to physical activity behaviours, data from the fourth round of the COSI survey in 2015–2017 revealed that only 19% of 6–9-year-old children in Malta travel to and from school by bicycle or on foot (WHO, 2021), down from 23% according to data from the third round of the survey in 2012–2013 (WHO, 2018). However, during the same period there was a reduction in the proportion of Maltese children reporting screen

time of at least two hours daily from over 50% in the third round to 39% in the fourth round (WHO, 2021).

With regards to breastfeeding, the 2018 Malta Assessment Report indicated that only 9.6% of mothers were still exclusively breast feeding their babies by the age of 6 months, although a small interim study noted that there was a lack of national data around breast feeding indicators (Borg, 2017; Borg Buontempo and Vassallo, 2018). In the absence of published national food consumption survey data, self-reported HBSC survey data showed overall reductions in soft drink consumption between 2014 and 2018 (Inchley et al., 2014, 2020) across all three age groups for Maltese older children. However, consumption of sweets consumption increased across all age groups during this period. One of the objectives outlined in the Food and Nutrition Policy and Action Plan 2015–2020 for Malta referred to updating of dietary guidelines which was achieved. A mid-term review (in 2017) and end of term review were also projected, but to our knowledge these have not yet been published.

### 5.3 *Both island groups*

Higher participation rates for breakfast in schools, and for the fruit, vegetable and milk schemes, are reported for both island groups (Canary Islands Health Service and the Government of the Canary Islands, 2011; European Commission, 2021b).

**Table 2** Policies and other initiatives to reduce childhood obesity for both island states

<i>Country</i>	<i>Initiatives</i>	<i>Launch year</i>	<i>Indicators reported (year)</i>
Canary Islands	The PIPO programme incorporating the school canteen programme and healthy eating workshops	2013	A downward trend observed in the prevalence of childhood overweight and obesity (31.2% in 2009 and 26.9% in 2015).
	ALIPA Programme	2019 (ongoing)	No indicators available.
	Regulation on Physical activity and sport in the Canary Islands	2019	No indicators available.
	Programme for addressing Childhood and Adolescent Obesity	2012	No indicators available.
	EU Fruit and Vegetable scheme	2009/2010 (ongoing)	Increased children and adolescents' participation in the EU Fruit and Vegetable scheme since 2018 to date (Canary Islands Health Service and the Government of the Canary Islands, 2011).
	Breast feeding promotion through WHO and UNICEF schemes	2011	A decrease in the percentage of natural breastfeeding and the consequent increase in artificial feeding for babies aged 6 weeks to 3 months, and also for infants over 6 months of age (Canary Islands Institute of Statistics, 2015).

**Table 2** Policies and other initiatives to reduce childhood obesity for both island states (continued)

<i>Country</i>	<i>Initiatives</i>	<i>Launch year</i>	<i>Indicators reported (year)</i>
Malta	Healthy Eating Lifestyle Plan (HELP)	2007, 2012 and 2015	Increased prevalence in childhood overweight and obesity.
	The National Curriculum Framework (Ministry of Education and Employment, 2012)		Mixed results for dietary behaviours including reduced soft drinks consumption, increased sweet consumption; overall low vegetable consumption (WHO, 2018, 2021; Inchley et al., 2014, 2020).
	A whole School Approach to a Healthy Lifestyle: Healthy Eating and Physical Activity Policy		
	Free Breakfast Club Service	2014 (ongoing)	Increased uptake of breakfast between scholastic years 2014/5 to 2018/9 (Government of Malta, 2019).
	Food and Nutrition Policy and Action Plan for Malta	2015-2020	Mixed results for dietary behaviours including reduced soft drinks consumption, increased sweet consumption; overall low vegetable consumption (WHO, 2018, 2021; Inchley et al., 2014, 2020).
			Updating of food-based dietary guidelines achieved.
	Dietary Guidelines for Children	2018	National dietary data not available to assess progress.
	National Breastfeeding Policy and Action Plan	2015–2020	Lack of surveillance data overall.
			Very low breast feeding rates the age of 6 months (Borg, 2017).
	EU School Fruit, Vegetables and Milk Scheme – Malta	2009/2010 (ongoing)	Higher school and children participation rates from 2018/2019 to 2019/2020 (European Commission, 2021b).
	Procurement of Food for Schools Regulations	2018	Initiation of regulations around food advertising within schools and procurement of food by schools (Government of Malta, 2018).

## 6 Discussions

To our knowledge, this paper offers a wider perspective to childhood obesity than previous local studies by comparing specific vulnerabilities, childhood obesity scenarios

and progress on obesity-related policy initiatives of two small island groups, the Canary Islands and Malta.

The Canary Islands have reported a small reduction in childhood obesity prevalence in recent years, but this has not happened in Malta. These results merit further investigation and discussion.

Given the physical constraints of small islands, sustainable urban planning needs to be embedded within the decision-making process around reducing childhood obesity. This is strongly encouraged within the discourse around the SDGs. Potential concerns regarding the impact of climate change in both island states and how this could further contribute to the obesity epidemic needs further consideration and research. It is recommended that the Canary Islands and Malta tackle the public health issues of climate change and obesity in parallel.

Other influencing factors common to both islands, include sociocultural factors such as parental attitudes towards obesity, lack of awareness of their children's weight status and familial dietary choices. Although stand-alone educational interventions are likely to have little effect, these factors suggest that health education and health literacy considerations should still be core components of any national strategies to address obesity. This comparative study also noted a lack of data regarding vulnerable populations in both these islands, such as food security data for different population sub-groups. The need to significantly reduce the overall prevalence of obesity in both islands, and reverse the trend in Malta, requires an interdisciplinary and multisectoral approach that strengthens the link between the home and school environments and builds bridges between government, various institutions, and the food industry. The health-for-all policies approach needs to be further encouraged and adopted as standard practice, since stand-alone policies seem to have little effect on tackling this problem sustainably and efficiently.

Both countries are still reliant on food imports, so any implemented strategies need to be backed up by supportive food systems, ideally with trade agreements and policies that promote importation or production of 'healthier' foods in place. The harmonisation of such procedures and procurement systems, in combination with national incentives to promote the availability and purchase of healthy foods is encouraged in Malta, with an emphasis on childhood obesity prevention and management (Government of Malta, 2018). On a positive note in this regard, there has been the introduction of regulations around food advertising within schools and procurement of food by schools in Malta (Government of Malta, 2018) in line with procurement guidelines developed during Malta's Presidency of the EU (Maltese Presidency of the EU and European Commission, 2017). Furthermore, national or international nutrient profiling systems such as the 5-Colour Nutrition Label (Ducrot et al., 2016) could also be adopted and applied in the food sector, as well as for regulation of advertising of unhealthy foods for children in various settings. There is also an urgent need to define, and report on measurable diet and other lifestyle indicators at targeted intervals to improve food and nutrition surveillance systems in both islands.

## **7 Conclusions**

In conclusion, it is crucial to understand the specific drivers and patterns of childhood obesity at both national and global levels within a broader context, with a need to

continuously update and monitor the various influences that keep contributing to high obesity and overweight prevalence, bearing in mind the specific vulnerability of both island groups. This would require ongoing nutrition surveillance systems which monitor the progress and impact of policies, with a greater focus on medium-term and longer-term sustainability. Care should be taken not to adopt solutions that worsen inequity. Further research is needed to gain with a better understanding of individual behaviours and the complex obesity drivers in action in small island communities, to guide, inform and update policies established through local governance, and at a regional and municipality level. This could then lead to more targeted public health strategies at the regional and national level.

## 8 Key points

- Malta and the Canary Islands are two small island groups experiencing a high prevalence of childhood obesity.
- A shift away from a Mediterranean diet in addition to low rates of physical activity and high levels of sedentary behaviour are still being reported among children in these islands despite efforts to counter obesity.
- Both islands may be considered vulnerable with respect to their size, geographic position, impact of climate change and potential association of these factors with childhood obesity.
- A number of obesity policies and strategies are in place for both island groups, but surveillance systems are inadequate.
- Targeted measures which take into account the broader causes of childhood obesity and the specific needs of small islands are needed.

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