



HEALTH PROMOTION

Addressing childhood obesity through policy: A cross-sectional study in Malta

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Keywords

Paediatric obesity • Health policy • Obesogenic environment • Intersectoral collaboration

Summary

Introduction. Childhood overweight and obesity are major public health challenges, with Malta having one of the highest prevalences among European countries. The COVID-19 pandemic may further worsen this epidemic. The food and physical activity environments impact children's behaviours. This study looks at barriers to maintain a healthy weight, responsibility to address obesity, and assesses parental support for 22 policies aimed at addressing childhood obesity. Public support for policy is key because it influences which policies are adopted and their success.

Methods. A cross-sectional, paper-based, quantitative survey was conducted amongst parents of primary school-aged children in Malta in 2018-2019. Ethical approval was obtained. Statistical analysis was performed using SPSS.

Results. 1,169 parents participated. The food environment was

more commonly identified as a barrier to maintain a healthy weight than the physical activity environment. Parents were least supportive of taxation policies, and most in favour of increasing spaces available for safe physical activity (94.0%), followed by providing free weight management services for children (90.8%). The level of support varied significantly by various socio-demographic/economic characteristics; parents with a higher educational level were significantly more supportive of most policies. Most findings were consistent with the international literature.

Conclusions. Most policies supported are trans-sectoral; a health-in-all policies approach is needed to address the obesogenic environment. The strong public support identified for several policies should embolden policymakers to consider policy options that were not previously considered.

Introduction

Overweight and obesity in children is a major public health challenge in many developed countries, with Malta being no exception. The COVID-19 pandemic may further worsen the childhood obesity epidemic through a worsening obesogenic environment characterised by school closures, home confinement resulting in physical inactivity and altered food intake behaviours, thus addressing childhood obesity has become a top priority for policymakers [1]. Maltese children and adolescents were amongst the most overweight and obese from the World Health Organisation (WHO) European Region countries that participated in the 2018/2019 Childhood Obesity Surveillance Initiative (COSI) study [2] and the 2017/2018 'Health Behaviour in School-Aged Children' (HBSC) survey [3]. A local study which measured the weight and height of students showed that 42.1% of boys and 37.1% of girls in primary schools were overweight or obese and highlighted significant inequality around their socio-economic status; children in State (non-fee paying) schools were the most obese, while children in fee-paying Independent schools were the least obese [4]. Childhood overweight and obesity are likely to track into adulthood [5]. In the 2019 European Health Interview Survey, Malta reported the highest proportions of overweight and obesity in the EU (64.8%), with 28.7% of adults being obese [6]. Obesity affects the physical, psychological and social health of the individual [5] and

causes a substantial economic burden on society through direct and indirect costs [7, 8].

It is likely that an overall 'obesogenic environment' is driving the childhood obesity epidemic [9]. In Malta, children's behaviours are affected by easy access to processed, energy-dense food and beverages (F&B), coupled with a built environment that offers limited opportunities for active transport or play [10].

Interventions that target individual physical activity (PA) and dietary behaviours are increasingly being recognised as having limited effectiveness, hence a multi-level environmental approach is needed to address the obesity epidemic [11]. The EU Action Plan on Childhood Obesity 2014 -2020 called for a shared commitment of member states to address childhood obesity by setting out priority areas for action [12]. In Malta, a number of initiatives to address the obesity problem were launched in the past decade, focusing mainly on the school setting with the 'Whole School Approach to a Healthy Lifestyle: Healthy Eating and Physical Activity Policy' published in 2015 establishing a curriculum on healthy eating and PA [13]. However, most schools cater for much less than 1 hour of PA per day, the daily recommended amount of PA for 5 to 17 year old children and adolescents by the WHO [14]. In August 2018, subsidiary legislation on the 'Procurement of Food for Schools Regulations' was enacted [15] in an effort to improve the quality of food available in schools. A national obesity strategy was launched in 2012 [16], however thus far action outside

the school setting in Malta has been limited despite an increase in the prevalence and burden of obesity.

Public support for policy is key because it influences which policies are adopted and makes policy implementation more effective [17]. Some policy options are more acceptable to the public than others. The dominant narrative around who is responsible for addressing obesity is also an important consideration when determining policy. Although responsibility for addressing obesity is often attributed to the individual or family unit, the narrative of collective societal responsibility – where the government, schools and the food industry are also regarded as key stakeholders – is increasingly gaining more support [17].

The aim of this cross-sectional study was to assess the level of support expressed by the parents or guardians of a representative sample of primary school-aged children for a range of policies that could address childhood overweight and obesity in the Maltese Islands, with attention given to variations by socioeconomic background and other characteristics. It also explores what barriers parents face in trying to maintain a healthy weight in children, and their views on who is responsible for addressing the obesity epidemic. The researchers felt that parents in particular were the ideal population to target because they have a large impact on children's lifestyles, and their support for policy measures is therefore likely to make policy implementation more successful and effective. Such information is invaluable for the development of context-specific recommendations for policies and strategies to address childhood obesity.

Methods

RESEARCH DESIGN AND SAMPLING METHOD

A cross-sectional study was conducted between 2018 and 2019. Paper questionnaires were distributed to a stratified random sample of parents/guardians of 1,880 primary school-aged children aged between 5 to 11 years (school Year 1-6). Maltese and English language versions of the questionnaire were distributed in 4 State schools (public; non-fee paying), 2 Church schools (run by religious organisations; subsidised) and 1 Independent school (private; fee-paying) in Malta and Gozo, which ratio is representative of the number of children attending each type of school. Questionnaires were distributed to approximately 50 students per year (*i.e.* Year 1-6; six years in total) in each participating school. Siblings were given only one copy of the questionnaire per family. Parents unable to communicate in Maltese or English were excluded from this study. To enhance geographic regional representation, one primary school was randomly selected from each of the six 'Nomenclature of Territorial Units for Statistics (NUTS)' 'Local Administrative Units (LAU)' (Districts) [18], with an additional school selected from the Western district, being the largest NUTS unit with a variety of the three different school types.

THE RESEARCH TOOL AND DATA COLLECTION

The questionnaire used to collect data was based on the 'Public attitudes to reducing levels of overweight and obesity in Scotland' questionnaire developed by NHS Health Scotland in conjunction with ScotCen [17]. Permission to use the questionnaire was sought and received. Contextual translation of the English questionnaire to Maltese was done. Questions were culturally adapted to the Maltese context in consultation with local experts (consultant paediatricians, Public Health Medicine consultants with interest in policy, nutritionists, and experts from the Ministry for Education). Following this, both questionnaires were reviewed by another bilingual professional who ensured that the questions in Maltese retained the meaning of the questions in English. Psychometric evaluation of the research tool was done. Face validity of the questionnaire was performed, followed by test-retest reliability testing. A pilot study was carried out in two schools, following which minor adaptations were made, producing the final research tool. The questionnaire collected personal demographic and socio-economic data; information about respondent's experiences of barriers to maintaining a healthy weight; explored attitudes about responsibility for addressing obesity, recognition of the consequences of obesity and assessed support for 22 policy options. These 'upstream' policy options were selected as these had not yet been introduced in Malta, and most of them had been listed as potentially actionable measures in the Health Weight for Life Strategy [16]. Thus, policies related to children's education on healthy eating and regulating unhealthy F&B within schools were not assessed, because these have already been addressed locally. A 5-point Likert scale was used for most questions except for the section on responsibility for obesity, for which a multiple tick-box option was used. In addition, self-reported weight and height measurements of participating parents and their children were collected to enable calculation of Body Mass Index (BMI).

5-point Likert scales were grouped into 3 categories, so that scores "1" (strongly disagree) and "2" (disagree) were grouped together as "Disagree", and scores "4" (agree) and "5" (strongly agree) were grouped together as "Agree", while "3" (neither agree or disagree) was left as neutral. Weight status was categorised using BMI cut-off points established by the WHO [19]. The 'type of job' variable was coded according to the International Standard Classification of Occupations (ISCO-08) codes, which were then grouped into 4 categories.

ETHICAL CONSIDERATIONS

Ethical approvals to conduct this study were obtained from the Research Ethics Committee of the University of Malta, the Research and Innovation Unit of the Ministry for Education and Employment, the Secretariat for Catholic Education, college principals and the head of each participating school. The questionnaire was anonymous and no personal identifiers were collected.

DATA ANALYSIS

R Statistical Software (v3.5; R Core Team 2018) was used to assess representativeness of the children of the respondent sample compared to the actual population of primary schoolchildren for sex and type of school. Data analysis was carried out using SPSS® version 25. Univariate analysis was performed to assess the association between the dependent (22 policy options) and independent (children's and parents' characteristics) variables using Chi-squared test and Fisher's Exact Test. P-values that could be rounded down to 0.05 or lower were considered to be statistically significant. The 22 policy options were then grouped into four policy factor domains (each having Eigenvalue higher than 1) using Principal Component Analysis (PCA) with Varimax rotation which were then used in the regression analysis:

- Factor Domain 1: Restriction policies;
- Factor Domain 2: Taxation policies;
- Factor Domain 3: Enabling/ Incentive policies;
- Factor Domain 4: Food Regulation policies.

Policy options with factor loadings that rounded to 0.5 and above were included in the domains. The mean support of all the policies that loaded on the respective factor domain was calculated, ranging between 1 and 5 (where a higher mean represents higher support, with '3' signifying neutral level of support). Support for the four factor domains was treated as a continuous variable. As the Shapiro-Wilk test indicated that the four factor domains had a non-normal distribution, the Mann-Whitney U test, Kruskal-Wallis test and Spearman's rank correlation coefficient test were used to assess the influence of the independent variables (children's and parents' characteristics, and barriers) on support for each policy factor domain. The independent variables that were significantly associated with support for any of the four factor domains were used to create models using multivariate linear regression with a forward stepwise approach (results in Tab. III).

Results

A total of 1,169 completed questionnaires were returned, giving a response rate of 62.2%. There were no statistically significant differences for sex ($p = 0.860$) and school type ($p = 0.994$) between the children of the respondent sample and the actual population of primary schoolchildren (based on the latest data from Malta's National Statistics Office) [20].

SOCIO-DEMOGRAPHIC CHARACTERISTICS

Table I summarises the socio-demographic characteristics of participants and their children. The participants' median age was 37.9 years (age range 22-66 years).

BARRIERS TO MAINTAINING A HEALTHY WEIGHT

The food environment was more commonly identified as being a barrier to maintaining a healthy weight than the PA environment (Fig. 1). Cheap fast food being too easily available was the most common barrier identified

(92.6%; 95% Confidence Interval (CI): 90.9-94.1%), whereas PA being too expensive was the least common barrier identified (24.6%; 95% CI: 22.1-27.1%).

RESPONSIBILITY FOR ADDRESSING THE OBESITY PROBLEM

As shown in Figure 2 and 3, parents were overwhelmingly identified as having a key role to play in addressing the obesity epidemic (94.4%; 95% CI: 93.1-95.8%), but children themselves were also thought to be responsible for their overweight status by a third of respondents. The majority of respondents (85.7%; 95% CI: 83.7-87.8%) chose one or more of the options denoting individual responsibility (*i.e.* parents, relatives, healthcare professionals, children) as well as one or more of the options denoting collective responsibility (*i.e.* schools, media, government, food and drink manufacturers, local sports centres or supermarkets).

Most respondents (78.6%; 95% CI: 76.2-81.0%) were in favour of immediate governmental action to address the childhood obesity problem. Only 5.6% (95% CI: 4.2-7.0%) were in opposition.

RECOGNITION OF THE CONSEQUENCES OF OVERWEIGHT AND OBESITY

The majority of participants (92.0%; 95% CI: 90.4-93.6%) believed that childhood overweight and obesity increases the risk of health problems. 72.9% (95% CI: 70.3-75.5%) of respondents were aware that excess weight in childhood does not go away by itself.

SUPPORT FOR POLICY TO ADDRESS OBESITY

The support level for each of the 22 policy options is shown in Figure 4. Policies that facilitate healthy behaviour, referred to as 'enabling or incentive policies', received the most support. In order of decreasing popularity, these included increasing safe spaces for PA (94.0% in favour; 95% CI: 92.6-95.4%), followed by providing free weight management services for overweight children (90.8%; 95% CI: 89.1-92.5%) and increasing PA to at least one hour daily during school hours (89.9%; 95% CI: 88.2-91.6%) as can be seen in Figure 4. Taxation policies were the least supported overall, with fewer than half of the participants in favour and almost a third who were neutral. However, the level of support increased if taxation were to be ring-fenced. The level of parental support for the different policy options varied significantly ($p < 0.05$) by various child and parental socio-demographic characteristics as seen in Table II. In this Table, the 22 policy options are grouped into 8 categories based on the literature review that was conducted. Compared to parents with a low level of education, parents with a higher educational level were the most significantly supportive of most of the proposed policies, but were significantly less supportive of offering free healthy meals at schools ($p = 0.019$), and measuring children's weight in schools and sending health report card with the child's weight status to parents ($p < 0.001$). The parents' income, employment status and type of job also influenced the level of support for many policy

Tab. I. Socio-demographic characteristics of participants and their children.

Characteristics	Variable	Category	Frequency (n)	Percentage (%)
Children's characteristics	Sex (n = 1 169)	Boy	596	51.0
		Girl	573	49.0
	Type of school (n = 1 169)	State	655	56.0
		Church	352	30.1
		Independent	162	13.9
	Self-reported BMI (n=836)	Underweight	32	3.8
		Normal	457	54.7
Overweight		153	18.3	
Parents/Guardians' characteristics	Age group (n = 1 169)	Obese	194	23.2
		20-29	87	7.4
		30-39	645	55.2
		40-49	409	35.0
	Gender (n = 1 169)	≥ 50	28	2.4
		Male	197	16.9
	Region of residence (LAU) (n = 1 169)	Female	972	83.1
		Southern Harbour	210	18.0
		Northern Harbour	193	16.5
		South Eastern	173	14.8
		Western	213	18.2
		Northern	212	18.1
	Country of birth (n = 1 169)	Gozo	168	14.4
		Not Malta	115	9.8
	Relationship status (n = 1 169)	Malta	1 054	90.2
		Lives with partner	1 053	90.1
	Highest level of education achieved (ISCED level) (n = 1 166)	Does not live with partner	116	9.9
		Primary (0-1)	5	0.4
		Secondary (2-3)	392	33.6
		Post-secondary/vocational (4-5)	342	29.3
		Tertiary (6)	295	25.3
	Employment status (n = 1 155)	Postgraduate (7-8)	132	11.3
		Not gainfully employed	283	24.5
	Type of job (ISCO code) (n = 926)	Gainfully employed	872	75.5
		Professionals and managers (1-2)	414	44.7
		Associate professionals (3)	148	16.0
		Clerks, services & sales, armed forces workers (4,5,0)	312	33.7
Monthly household income (€) (n=881)	Manual and craft workers (6-9)	52	5.6	
	< 1 000	82	9.3	
	1 000-1 599	205	23.3	
	1 600-2 299	180	20.4	
	2 300-3 299	219	24.9	
Self-reported BMI (n=999)	≥ 3 300	195	22.1	
	Underweight	28	2.8	
	Normal	427	42.7	
	Overweight	341	34.1	
		Obese	203	20.3

options. Parents suffering from obesity and parents of children suffering from obesity were significantly less supportive of providing more safe spaces for PA than parents with a normal weight and those having normal weight children.

When the 22 policy options were grouped into four policy factor domains using PCA Varimax rotation, Enabling/Incentive policies received the most support

(mean 4.37 out of 5; 95% CI 4.34-4.40), while taxation policies received the least support (mean 3.28; 95% CI 3.21-3.34) (Tab. III). Socio-economic variables had a statistically significant effect on the level of support for most policy domains (level of education, income, employment status and type of job), though some lost their significance following multivariate linear regression as shown in Table III. Parents working as professionals

Fig. 1. Barriers to maintaining a healthy weight in children.

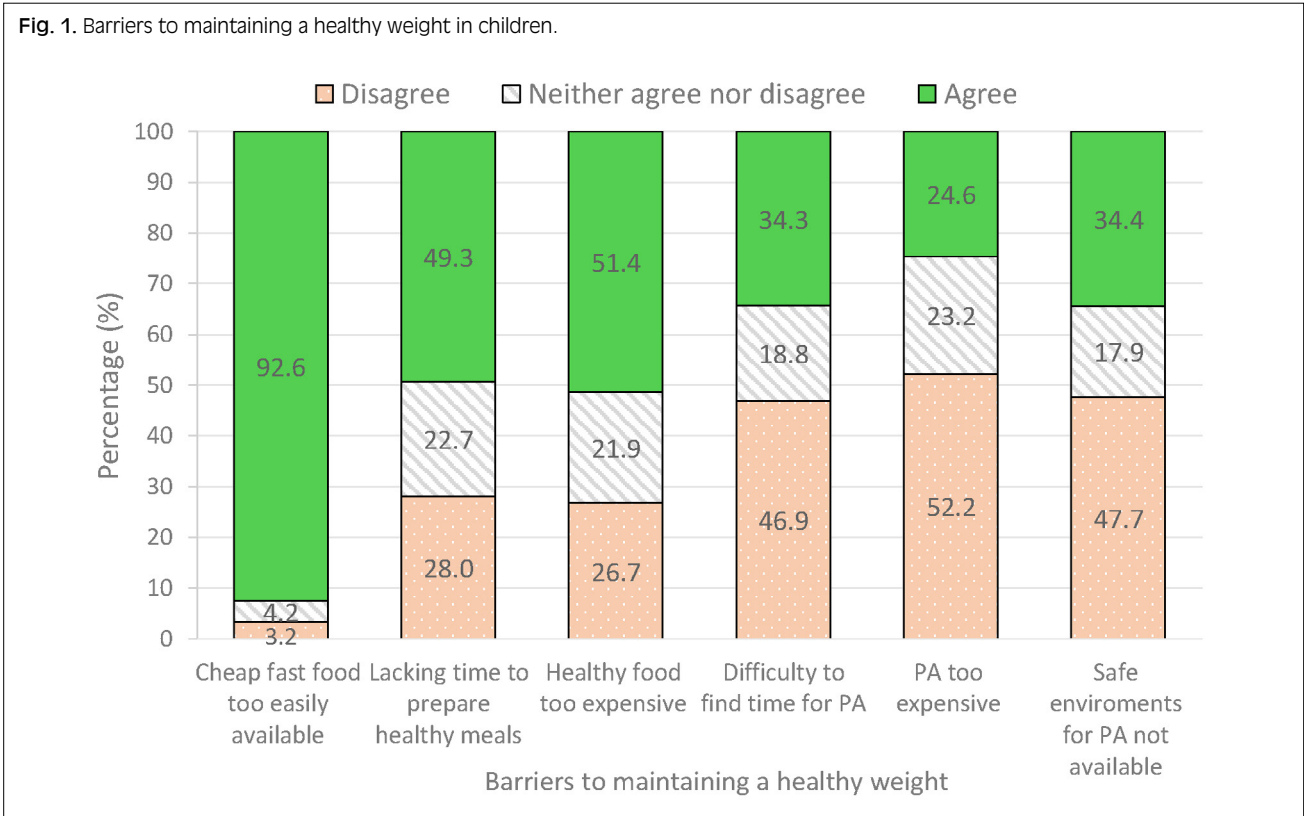
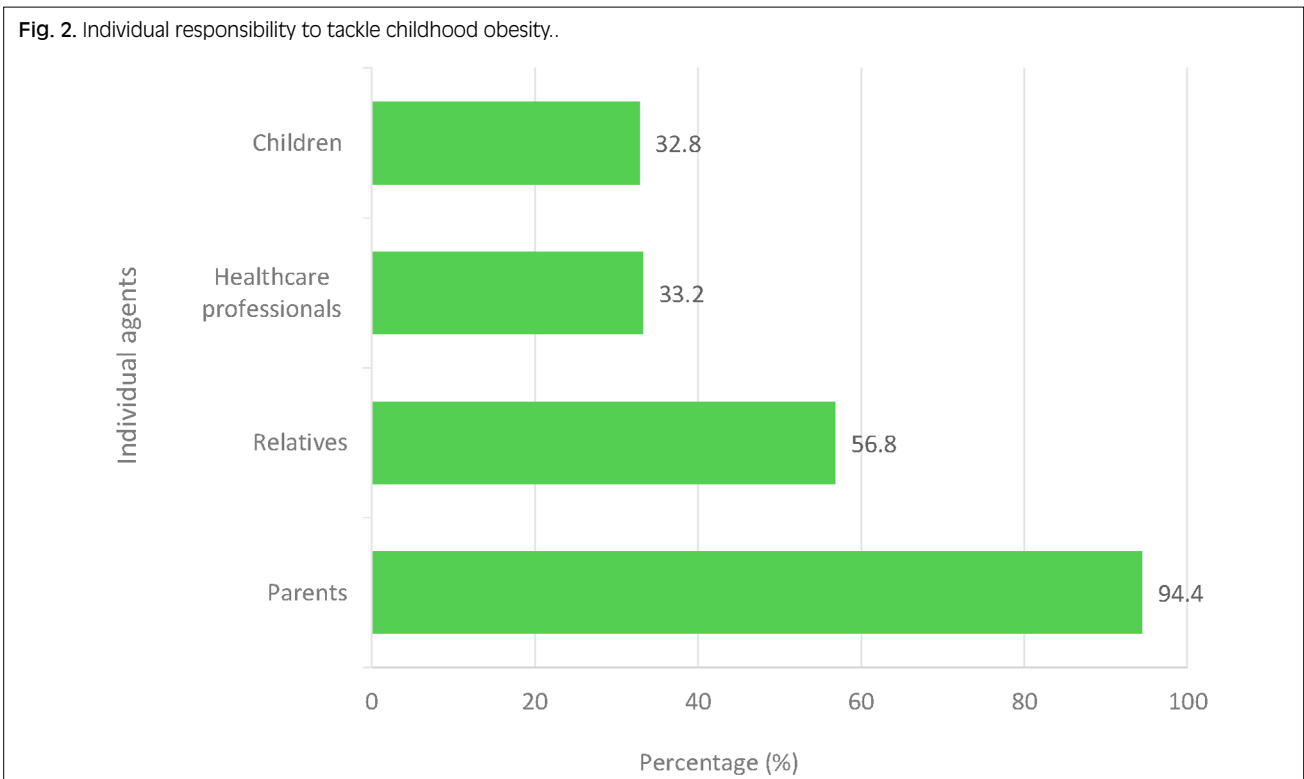
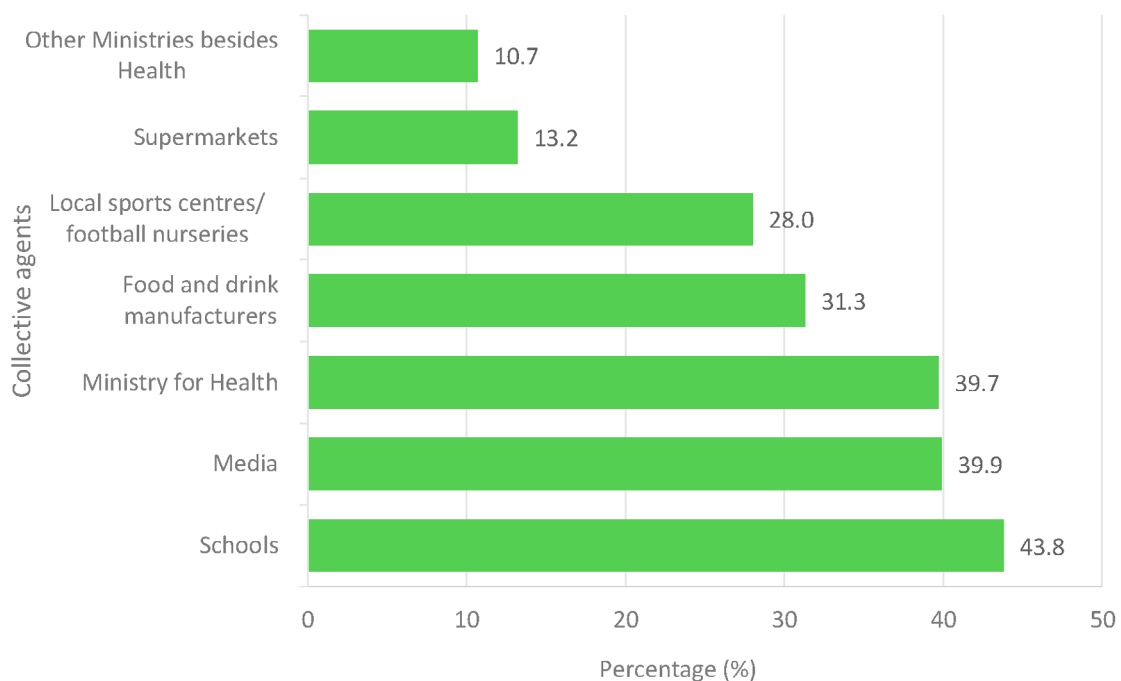


Fig. 2. Individual responsibility to tackle childhood obesity.



(ISCO codes 1-3) were significantly more supportive of food regulation policies, and manual and craft workers (ISCO codes 6-9) were significantly less supportive of Taxation policies; parents whose children attended Independent fee-paying schools were significantly more

supportive of taxation policies; parents with a higher level of education (ISCED levels 6-8) were significantly more supportive of Restriction policies as shown in Table III. Other variables whose effect remained statistically significant following multivariate analysis

Fig. 3. Collective responsibility to tackle childhood obesity.

include parental age, children's self-reported BMI and country of birth. Parents who perceived that cheap fast food was too easily available was a barrier to maintain a healthy weight were significantly more supportive of all four policy factor domains (Tab. III).

Discussion

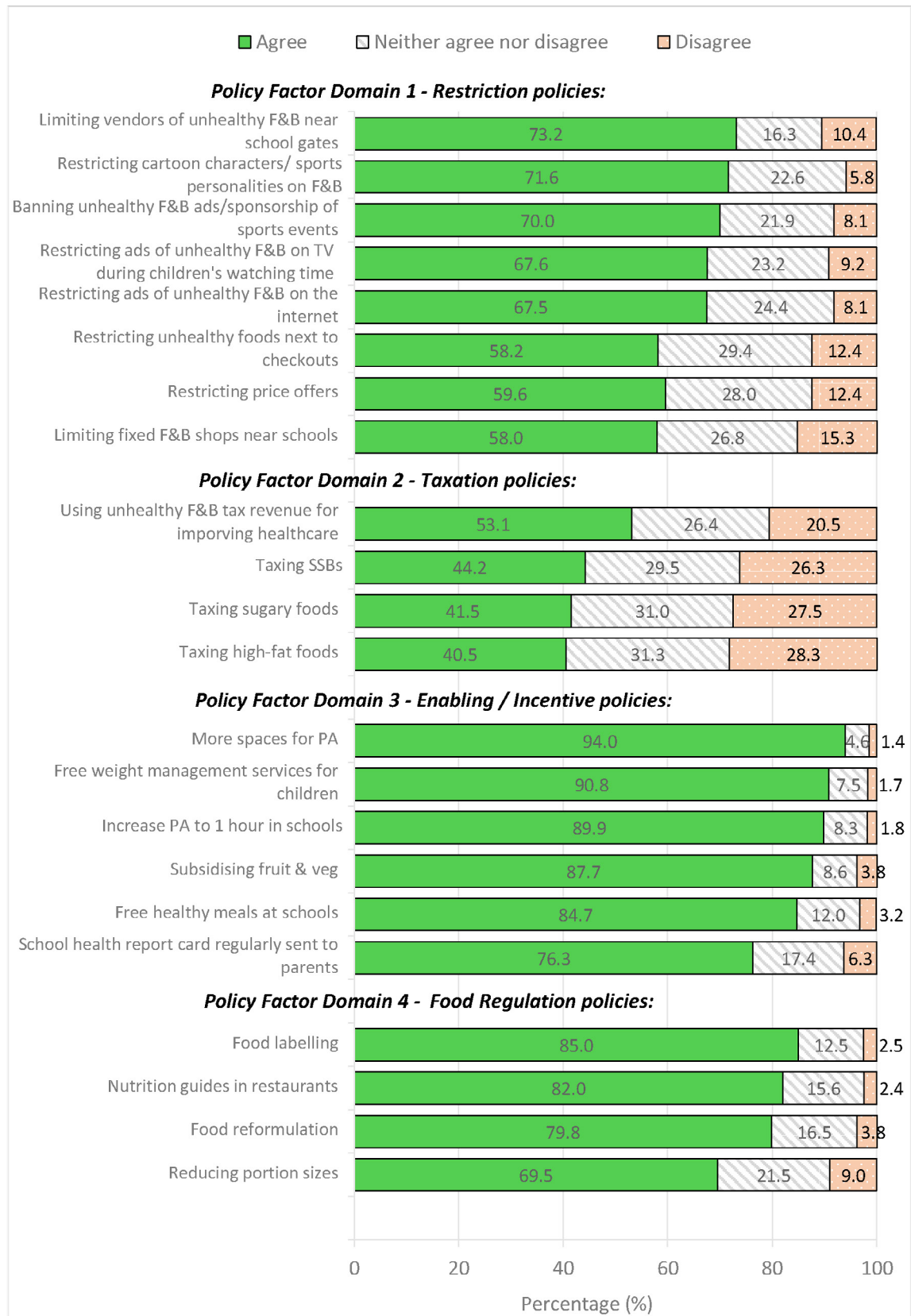
Children are vulnerable because their behaviour is impacted by others, especially parents, since they are unable to make autonomous decisions [21]. Similar to an American study, over 90% of participants attributed responsibility to address childhood obesity to parents (94.4% in our study; 90.7% in the American study) [22] and the public is now highly aware of obesity-related health threats facing adults and children. RTI International sponsored a representative survey of U.S. households ($n = 1,047$). At the same time, most respondents also felt that responsibility should be shared by the individual and society, rather than solely focusing on individual responsibility as in previous literature [23] obesity has for decades been defined as an individual issue with strong moral dimensions. Studies tend to show that obese people are viewed as selfish, impotent, lazy and unattractive; they are stigmatized in every aspect of their life, from their work to their education or health. The medicalization process that occurred in a very thorough way since the 1950s has not changed that fact that obesity continues to carry a lot of symbolic and cultural dimensions that have a lot to do with the cultural promotion of beauty in our modern societies. From a

qualitative analysis led in two countries (England and France).

The majority of participants felt that cheap fast food was too easily available (92.6%). This was also identified as the biggest barrier by 91% of Scots in a study by the NHS Health Scotland. This Scottish study (2017) similarly found that the food environment (cost, time, availability) was a bigger barrier to maintaining a healthy weight than lack of time and cost of PA [17]. Our study identified a dissonance between the most common barriers identified, which relate mainly to the food environment, and the policies which received most support, which primarily relate to the PA environment. It is possible that the most popular policies were those that entail the least inconvenience and do not require major changes to the family unit's lifestyle or behaviour, however it is clear that policymakers and politicians will need to take bold, possibly politically controversial decisions – such as introducing ring-fenced taxes – to mitigate the barriers faced by the population in accessing healthy food while addressing the over-abundance of cheap, unhealthy food. Participants generally felt that the cost of healthy food is too high, rather than identifying the cost of PA as a barrier. In the current local context of increasing food prices, due in part to supply chain disruptions caused by the COVID-19 pandemic [24] and the Russia-Ukraine conflict [25], it might be more desirable and politically acceptable to subsidise healthy food from revenue generated by taxing unhealthy F&B instead of subsidising PA.

Similar to the situation described in the international literature, support was lowest for taxation policies [17,

Fig. 4. Support for policy options to tackle childhood overweight/obesity.



26-28] with percentage support being within the previously described ranges of 21.6% in an American study [26] to 62% in a Scottish study [17], although

fewer than a third of respondents expressed outright disagreement with these policies. Furthermore, support increases if the revenue generated were to be ring-fenced

Tab. II. Significant associations between children's and parents' characteristics and support for different policy options.

Independent Variables	Children's characteristics			Parents' characteristics									
	Sex	Type of school	Self-reported BMI	Gender	Age group	Region of residence (LAU)	Relationship status	Country of birth	Education level	Employment status	Type of job	Monthly household income	Self-reported BMI
Nutritional Information*	Food labelling								0.021		0.037	0.030	
	Nutrition guides in restaurants				0.039				0.012				
Marketing, advertising & sponsorship policy*	Restricting cartoon characters/ sports personalities on F&B		0.053		0.027			0.036	0.028	0.003		0.045	
	Banning unhealthy F&B ads/ sponsorship of sports events	0.049							0.013	0.035			
	Restricting unhealthy F&B adverts on TV during children's screen time	0.016			0.016	0.026			0.005	0.038	0.001	0.005	
	Restricting unhealthy F&B adverts on the internet				0.006	0.022					0.008		
Community & Consumer food environment*	Reducing portion sizes					0.003					0.007		
	Restricting price offers								0.054	0.007			
	Restricting unhealthy foods next to checkouts												
Food reformulation*													
Free weight management services for children*													
Built environment policy*	More spaces for PA		0.047		0.046	0.008			0.018		< 0.001	0.002	0.023
	Limiting fixed F&B shops near schools								0.002	0.006			
	Limiting vendors of unhealthy F&B near school gates	0.016						0.048	0.002	0.003		0.028	
School policy*	Free healthy meals at schools				0.048				0.019				
	Increase PA to 1 hour in schools				0.039	0.010			0.013		0.025		
	Schools send health report cards with weight	0.028	0.013		0.017			0.024	< 0.001		0.049		
Fiscal policy*	Taxing high-fat foods		0.005	< 0.001	0.008	0.020			< 0.001	0.003	0.004	0.030	
	Taxing sugary foods		< 0.001	< 0.001					< 0.001	< 0.001	0.001	0.003	
	Taxing SSBs		< 0.001	0.012		0.014			< 0.001	0.002	0.004	< 0.001	
	Tax revenue to improve healthcare services			0.011							0.003		
	Subsidising fruit & veg							0.011					

* Numbers in each cell represent p-values; empty cell = no statistically significant difference ($p > 0.05$); p-values displayed in bold are highly significant (< 0.01).

BMI: Body Mass Index; F&B: Food and Beverages; PA: Physical Activity; SSBs: Sugar-Sweetened Beverages

for healthcare service provision, although the percentage in favour of such policy locally (53.1%) was lower than that in France (72.7%) [29], but higher than that in Australia (41.4%) [28]. While 98% of the countries in the WHO European region have fiscal policies on alcoholic beverages, only 23% have such policies on Sugar-Sweetened Beverages (SSBs) and even lower for foods high in fat, sugar and salt (HFSS) (6%) [30].

Unsurprisingly, enabling policies such as providing more spaces for safe PA, subsidising fruit & vegetables, etc., received the most support, given that these are not associated with a cost burden (e.g. taxation) that directly impacts families' financial outlay. Around 5% of the countries in the WHO European region subsidise healthy foods, but no country has both food taxes and subsidies together in place [30]. Creating more spaces where PA can be safely performed was enthusiastically supported (94.0% in favour), reflecting growing local concern about overdevelopment and increasing advocacy for public open spaces [31] and active transport [32]. Parents with obesity and parents of children with obesity are the least supportive of more spaces for safe PA; this situation should not be overlooked when developing policy, as those who stand to benefit most from such spaces might use them least.

Around schools' perimeter, policies that restrict vendors, in particular mobile vendors, from selling unhealthy foods near school gates and directly targeting children should be prioritised given the considerable support this received, with only one-tenth of parents disagreeing with such a measure, compared to 15.3% disagreeing with limiting fixed F&B shops near schools. This was substantially different from results obtained in an American study, where support for restricting convenience stores within close distance to schools was low (37% in favour), and may be due to the local cultural context [33].

The school setting is an important place where children can be physically active. During the initial phase of the COVID-19 pandemic, the school setting was hugely impacted with many countries going into lockdown and closing schools [34], possibly further widening inequality gaps [35]. Increasing daily PA during school hours across all types of schools would probably be welcomed by parents given the high support this policy received.

Restricting audiovisual media advertising of unhealthy F&B to children is another area of interest. Watching television (TV) increases sedentary behaviour, encourages snacking, and exposes viewers to F&B

adverts [36]. A majority of TV advertisements aimed at children are for unhealthy foods [37]. Children regularly ask their parents to buy food products that they see advertised [38]. Initiatives that regulate adverts of unhealthy food targeting children on TV have been found to be cost-effective [39]. Support for restricting unhealthy food adverts during children's TV programmes/channels was slightly higher in America and Germany, with three-quarters, and four-fifths of respondents in favour respectively [22, 40, 41], compared to two-thirds locally. Around two thirds of countries in the WHO European region have mandatory policies targeting HFSS foods and beverages marketing on children, while 32% have voluntary policies [30]. It would be beneficial if action in this sector is taken at the EU level, since many children nowadays watch international children's channels rather than local TV channels. Regulation of unhealthy F&B advertising on media popular with children should also be considered, given the popularity of engaging with social media, watching online programmes and videos, or playing games online and the significant impact such marketing has on different diet-related outcomes. Since a person's eating behaviours are usually established at a young age and then maintained [42], it is important to optimise the food environment that

influences food preferences as early as possible. Around 80% of Malta's food supply is imported [43], hence international action on mandatory standardised front-of-pack food labels (FOPLs) and food reformulation would undoubtedly benefit Malta and other countries, with respondents being highly supportive of both policies in this study. FOPLs have been recommended by the WHO as a 'best-buy' to prevent non-communicable diseases [44], with participants from 12 countries across different continents being most in favour of multiple traffic lights labels [45]. Optimising nutrition labels of foods/ beverages was highly supported in other countries as well including Germany (86.7%) [41], Australia (85%) [46], five countries in the Asia Pacific region (86.3%) [48], but slightly less in the US (63%-65%) [26, 47]. Food reformulation is also supported by the public in Scotland (82%), and 5 countries in the Asia Pacific region (79.3%) [48]. Adoption of FOPL policies vary across countries – 26% of WHO European region Member States have mandatory policies while 15% have voluntary policies [30]. Additional pressure can be exerted at the international level, such as at EU level, if agreement between Member States around issues such as food reformulation, food packaging regulations on unhealthy foods targeting children, and stricter audio-

visual media advertising is reached. The EU online consultation on the revision of Food Information to Consumers regulation including food labelling is an encouraging step forward [49].

Our observation that parents with a higher level of education were significantly more supportive of several policies than those with a lower educational level was similar to findings of studies conducted in America, Scotland and Turkey [17, 22, 26, 27]. The link between higher levels of education and support for policy might be mediated by parental health literacy. Thus, investing in health literacy, for example through health promotion campaigns on food labels and other initiatives targeted towards those with a lower level of education, might empower parents (and the voting public in general) to be more supportive of demonstrably effective regulatory interventions. Education campaigns should also address misconceptions such as the belief that obesity in children goes away by itself as children grow (a quarter of respondents were not aware). Furthermore, despite over 90% of respondents being aware that childhood obesity can lead to comorbidities, one must also factor in parental optimism, with parents being more likely to believe that their own child is at a lower chance of developing health problems related to obesity than they would for a typical child [50].

This study was limited by a low response by males which could have led to a Type 2 error; significant differences for support by parental gender were only found for one policy (taxing high-fat food). The cross-sectional nature of this study and the use of a paper-based questionnaires could have given rise to the usual limitations of such studies, including recall bias.

Conclusions

Most of the policies assessed in this study were well supported, with policies that received the highest support (increasing spaces for safe PA, followed by free weight management services for children, increasing PA to 1 hour daily in schools, and subsidising fruits & vegetables) being more likely to be effective if implemented. It is vital that the observed socioeconomic differences in the level of support do not foil the implantation of effective policies to address obesity, as inaction further compounds the existing inequality gaps surrounding childhood obesity. Addressing the different aspects of the obesogenic environment has a central role in providing potential solutions.

It is encouraging that most parents are aware that a collective approach is needed to support the individual to address obesity, as this may embolden policymakers and politicians to be less reluctant to introduce regulatory measures that might go against industry demands such as food reformulation, food advertising regulations or licensing restrictions of food stores near schools.

Stronger policy responses to address childhood obesity are needed. To be able to introduce and enforce several of the actions assessed in this study, an inter-sectoral

and whole of government approach is needed, both at national and international levels, as the impact of several policies such as restricting audio-visual advertising and marketing of HFSS foods and SSBs, food reformulation and mandatory standardised FOPL would be felt in many countries. Addressing childhood obesity has become more urgent than ever given that the obesity situation was already worsening prior to the COVID-19 pandemic and is expected to be further negatively impacted by the pandemic [1, 35].

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Ethical approval

This study was approved by the Research Ethics Committee of the University of Malta (Reference: FRECMDS_1718_056), the Research and Innovation Unit of the Ministry for Education and Employment (Reference: RI2018/093), the Secretariat for Catholic Education, college principals and the head of each participating school.

Conflict of interest statement

None of the authors declare any conflict of interest.

Authors' contributions

MB, DC and CG conceptualised the study and designed the methodology. MB collected the data. MB and NC analysed the data. MB, DC and NC interpreted the results. MB drafted the initial version of the manuscript. MB, DC, CG and NC contributed to the final manuscript.

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Supplementary material

Tab. III. Significant influence of parents' and children's characteristics and barriers on support for the four Policy Factor Domains at univariate and multivariate analysis, and change in mean support for the statistically significant categorical variables at multivariate linear regression.

Policy Factor Domains	Parents'/children's characteristics**	Univariate Analysis		Multivariate Analysis	
		Mean support (95% CI)	Unadjusted p-value	Mean support (95% CI)	Adjusted p-value*
Factor Domain 1: Restriction policies (Mean support 3.86 out of 5; 95% CI 3.81-3.90) Barriers statistically significant (adjusted p-value): • Cheap fast food too easily available (< 0.001) • Healthy food too expensive (0.023)	Parents' age group (years)		0.049		0.007
	20-29 (Reference)	3.64 (3.47-3.82)		3.69 (3.49-3.88)	
	30-39	3.88 (3.82-3.95)	0.007	4.00 (3.94-4.06)	0.002
	40-49	3.87 (3.79-3.95)	0.012	4.04 (3.96-4.12)	0.001
	≥ 50	3.68 (3.30-4.07)	0.490	3.94 (3.61-4.25)	0.189
	Education level (ISCED)		< 0.001		0.001
	Primary & Secondary (0-3) (Reference)	3.70 (3.62-3.79)		3.78 (3.65-3.90)	
	Post-secondary/vocational (4-5)	3.83 (3.75-3.91)	0.102	3.81 (3.68-3.93)	0.184
	Tertiary (6)	4.00 (3.91-4.09)	< 0.001	4.01 (3.88 - 4.12)	0.001
	Postgraduate (7-8)	4.03 (3.89-4.17)	< 0.001	4.03 (3.88-4.18)	0.001
Region of residence		0.019			
Employment status		0.001			
Type of job		0.001			
Factor Domain 2: Taxation policies (Mean support 3.28 out of 5; 95% CI 3.21-3.34) Barriers statistically significant (adjusted p-value): • Cheap fast food too easily available (0.005)	Child's Type of School		< 0.001		0.004
	Independent (Reference)	3.57 (3.39-3.74)		3.61 (3.34-3.88)	
	State	3.22 (3.13-3.30)	< 0.001	3.15 (3.00-3.31)	0.001
	Church	3.25 (3.14-3.36)	< 0.001	3.21 (3.03-3.39)	0.006
	Child's self-reported BMI		0.014		0.041
	Underweight/Normal (Reference)	3.20 (3.10-3.30)		3.17 (3.02-3.32)	
	Overweight	3.50 (3.33-3.67)	0.004	3.40 (3.17-3.63)	0.045
	Obese	3.35 (3.21-3.49)	0.203	3.40 (3.17-3.63)	0.049
	Type of job (ISCO code)		0.002		0.004
	Professionals and managers (1-2) (Reference)	3.41 (3.31-3.52)		3.48 (3.34-3.62)	
	Associate professionals (3)	3.38 (3.21-3.56)	0.887	3.62 (3.39-3.84)	0.274
	Clerks, services & sales, armed forces workers (4,5,0)	3.26 (3.15-3.38)	0.209	3.40 (3.21-3.59)	0.482
	Manual and craft workers (6-9)	2.83 (2.51-3.15)	0.001	2.80 (2.40-3.21)	0.001
	Region of residence		0.043		
	Education level		0.001		
	Employment status		0.006		
Monthly household income		0.004			

(continues)

Tab. III (follows). Significant influence of parents' and children's characteristics and barriers on support for the four Policy Factor Domains at univariate and multivariate analysis, and change in mean support for the statistically significant categorical variables at multivariate linear regression.

Factor Domain 3: Enabling/Incentive policies (Mean support 4.37 out of 5; 95% CI 4.34- 4.40) Barriers statistically significant (adjusted p-value): • Cheap fast food too easily available (<0.001) • Healthy food too expensive (<0.001) • Parents lack time to prepare healthy meals (0.002) • Safe environments for PA not available (0.029)	Country of birth		0.031		0.034
	<i>Malta (Reference)</i> <i>Not Malta</i>	4.38 (4.03-4.72) 4.27 (3.22-5.00)		0.031	4.39 (4.35-4.42) 4.28 (4.18-4.38)
Factor Domain 4: Food Regulation policies (Mean support 4.06 out of 5; 95% CI 4.02- 4.10) Barriers statistically significant (adjusted p-value): • Cheap fast food too easily available (0.002) • Parents lack time to prepare healthy meals (0.030)	Type of job (ISCO code)		< 0.001		0.001
	<i>Professionals and managers (1-2) (Reference)</i>	4.20 (4.15-4.26)		4.23 (4.17-4.29)	
	<i>Associate professionals (3)</i>	4.15 (4.06-4.23)	0.313	4.18 (4.07-4.28)	0.358
	<i>Clerks, services & sales, armed forces workers (4,5,0)</i>	3.96 (3.89-4.04)	< 0.001	4.04 (3.97-4.12)	< 0.001
	<i>Manual and craft workers (6-9)</i>	3.84 (3.63-4.06)	0.001	3.93 (3.73-4.12)	0.003
	Region of residence		0.019		
	Education level		< 0.001		
Monthly household income		0.005			

* Empty cells under multivariate analysis category adjusted p-value = no statistically significant difference ($p > 0.05$); Category p-values displayed in bold are highly significant (<0.01). ** Only Child's Type of School and Child's self-reported BMI in Factor Domain 2 relate to Children's Characteristics; all other characteristics relate to Parents' Characteristics. BMI: Body Mass Index; CI: Confidence Interval; PA: Physical Activity.