

Childhood Obesity as a Global Problem: a Cross-sectional Survey on Global Awareness and National Program Implementation

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What is already known on this topic?

The rising trend of childhood obesity worldwide, with its effect on both childhood and adult health, highlights its importance as an international priority. As a multifactorial health challenge, its prevention and management rely on many factors, including establishing a healthy food environment with the involvement and engagement of multiple stakeholders.

What this study adds?

Most countries of the respondents have data and programs targeted at tackling childhood obesity. Levels of support from governments, schools and private organizations as well as awareness regarding World Health Organization and UNICEF guidance vary with progress. Furthermore, implementation was still hindered in most countries.



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Abstract

Objective: The rising global epidemic of childhood obesity is a major public health challenge. Despite the urgency, there is a lack of data on the awareness and implementation of preventative measures. The aim of this study was to identify areas for improvement in the prevention and management of childhood obesity worldwide.

Methods: A cross-sectional electronic survey was distributed to 132 members of national pediatric societies of the International Pediatric Association.

Results: Twenty-eight (21.2%) participants, each from a different country across six World Health Organization (WHO) regions completed the survey. Most participants reported that national prevalence data of childhood obesity is available (78.6%), and the number increased during the Coronavirus disease-2019 pandemic (60.7%). In most countries (78.6%), the amount of sugar and salt in children's products is provided but only 42.9% enacted regulations on children-targeted advertising. Childhood obesity prevention programs from the government (64.3%) and schools (53.6%) are available with existing support from private or non-profit organizations (71.4%). Participants were aware of WHO's guidance concerning childhood obesity (78.6%), while fewer were aware of The United Nations International Children's Emergency Fund's (UNICEF) guidance (50%). Participants reported that WHO/UNICEF guidance acted as a reference to develop policies, regulations and national programs. However, progress was hindered by poor compliance. Lastly, participants provided suggestions on tackling obesity, with responses ranging from developing and reinforcing policies, involvement of schools, and prevention across all life stages.

Conclusion: There are different practices in implementing prevention measures to counter childhood obesity globally, particularly in statutory regulation on food advertising and national programs. While support and awareness was relatively high, implementation was hindered. This reflects the need for prompt, country-specific evaluation and interventions.

Keywords: Childhood obesity, obesity, children, awareness, program

Introduction

The rising epidemic of childhood obesity worldwide is a major public health challenge in the 21st century. Obesity is both a non-communicable disease (NCD) and a modifiable risk factor for many other NCDs, such as cardiovascular diseases, certain types of cancers and type 2 diabetes (1). With less than a decade to the 2030 Sustainable Development Goals (SDGs), the success of achieving these targets is at risk if childhood obesity is not made a global priority. The World Health Organization (WHO) reports that the prevalence of childhood obesity has nearly tripled since 1975, with an estimated 39 million children below the age of 5 years classified as overweight or obese in 2020 and over 340 million children and adolescents between the ages of 5-19 years were overweight or obese in 2016 (2).

With a significant shift in global priorities and disruption to daily routines brought by the Coronavirus disease-2019 (COVID-19) pandemic, studies found that weight gain amongst children and adolescents was on the rise (3). Reduced opportunities for physical activity and proper nutrition due to school closures, increased stress and disrupted routines promoted unhealthy eating habits. Today, children's diets are far from optimal with overconsumption of sugar, sodium and fat, and an insufficient consumption of fruit and vegetables (4). Although the success of the prevention and management of childhood obesity is reliant on many factors, the role of the food environment, defined as the physical, socio-cultural, economic, and political context by which consumers interact with food systems to

consume foods (5), also play a significant role.

Products aimed at children constitute a great proportion of the food industry's market segment. Globally, it is estimated that the child-oriented food and beverages market will reach 146.7 billion US dollars by 2025, growing at an annual rate of 5% (6). Food advertising, packaging and regulations controlling the amount of sugar and salt in food products are all important factors influencing children's diets. However, very little is known about the regulations on advertising, packaging, and nutritional components of food products aimed at children globally.

As childhood obesity is a condition of multifactorial origin, successful preventative and management strategies depend on collaboration between multiple stakeholders. The WHO has established several programs, systems, and recommendations for member states on tackling childhood obesity, promoting population-wide policies and initiatives and community-based interventions. With federal and local government jurisdiction over many components of the food environment, the WHO has also recommended key policy actions to restrict promotional marketing, add taxes or levies on sugar-sweetened beverages, and provide regulations for nutrition labeling. The United Nations International Children's Emergency Fund (UNICEF) has also published a step-by-step framework to guide country-level interventions on childhood obesity.

To aid in moving towards the goal of identifying areas for improvement in the prevention and management of childhood obesity, this study reports the global picture of childhood obesity with a focus on the awareness and

implementation of preventative measures for obesity in children, based on an international cross-sectional survey conducted by the International Pediatric Association (IPA).

Methods

Study Setting and Design

An electronic survey was emailed to 132 national pediatric societies across regions under the umbrella of IPA between the 7th and 23rd of January 2022. Google Forms, a web-based survey software automatically collected and stored responses in an electronic spreadsheet. Subjects included in this study were national pediatric societies' presidents or other members representing their respective societies. From each country, only one response was analyzed. To summarize the demographics of the participants and their responses, descriptive statistics were used. Responses to open-ended questions were summarized by approximating the similarity in semantic content. Ethical clearance was not required for this study.

The Survey

Two pediatric endocrinologists, the co-chairs of the IPA Strategic Advisory Group on NCDs, a group of pediatricians specializing in NCDs from different countries across regions, developed the survey questions. The questionnaire was divided into three main sections. The objectives of the survey were explained in the first section. If participants gave consent to participate, they proceed to the next section. The second section included four questions on the demographic details of participants, such as the name of the country, region, name of the pediatric society, and the designation of participants within their respective societies. The third section included 15 questions on the availability of national data on obesity in children and food labels mentioning the amount of sugar and salt, the country's regulation on the advertisement of children's food, programs from the government and schools to prevent obesity, support from private and civil society organizations, awareness of WHO and UNICEF's guidance on childhood obesity, and suggestions to overcome obesity in children. There were multiple-choice and open-ended questions. The survey took approximately 5-10 minutes to complete.

Statistical Analysis

Data obtained in this study was analyzed using two programs, Google Sheets and Statistical Package for the Social Sciences for Windows, version 25.0 (IBM Corp, Armonk, NY' USA). Descriptive statistics were used to describe demographic data and responses to multiple-choice questions. Responses

to open-ended questions were analyzed by approximating into similar semantic content. Several questions had results less than the total number of respondents, as they were follow-up questions for certain responses. The final question had more responses than the total number of respondents as respondents were allowed to give multiple answers.

Results

Demographics of Participants

We received 33 responses, with double responses from different participants, each from four different countries (United States, Turkey, Mexico, and Jordan). Based on the data completeness, only one response was included for these four countries, while the other was excluded. Another incomplete response was also excluded. A total of 28 responses from 28 countries across all six WHO regions were included as an illustrative sample to be analyzed.

Participants in this study were predominantly from the European region (35.7%) and the region of the Americas (21.4%). The majority of the participants were from upper-middle-income countries (46.4%) and high-income countries (35.7%). There was no representative from the low-income category, and one participant's country of origin was not listed on the World Bank Classification. Participants were presidents of the pediatric societies and representatives appointed on behalf of the presidents, each contributed 28.6%. The remainder were pediatricians or pediatric endocrinologists who were members of advisory councils in their respective countries (Table 1).

National Program and Regulations Related to Obesity in Children

The national prevalence data about obesity in children was reported to be available by the majority of participants (78.6%). During the COVID-19 pandemic, most participants (60.7%) confirmed an increase in the number of children with obesity, while the rest (39.3%) reported not being aware of the rise in the number.

Information about the amount of sugar and salt in food products for children was provided on the nutrition information label in about four-fifths of participants' countries. However, there was no information available on the maximum amount of sugar and salt reported by most participants (60.7%), as only seven answered "yes" and the remaining four responded "don't know". In addition, advertising rules for children's food packaging are only available in 12 participant countries, while 13 other participants reported such rules were not available.

We asked whether there were any prevention programs or interventions from the government and schools. More than half of the participants confirmed that programs or interventions from the government (64.3%) and school (53.6%) were available (Table 2).

Non-governmental Programs Related to Obesity in Children

Support from private organizations or non-profit organizations (civil society organizations) for childhood obesity prevention programs was reported to be available by most participants (71.4%). Most of these programs were locally and nationally operated (75%) (Table 3).

About two-thirds of participants were aware of regional programs established to prevent childhood obesity (57.1%). However, more than three-quarters of participants were aware of WHO's guidance concerning childhood obesity (78.6%). For those who answered that they were aware of this guidance, they reported that the guidance was used as a reference to develop national policies and regulations (35%) and applied through national programs (15%). Other responses included emphasizing childhood obesity as a priority (5%), increasing awareness of it (5%), participating in the WHO Europe Childhood Obesity Surveillance Initiative (5%) and developing a center for the prevention

and treatment of obesity in children and adolescents (5%). However, several participants also reported that programs and regulations existed but progress was hindered by poor compliance (15%), while others were unaware of how the guidance influenced their country's national programs (15%).

In contrast, fewer participants were aware of UNICEF's guidance concerning childhood obesity, with the results being split evenly between those aware and those who were not (50%). Participants responded that UNICEF's guidance had acted as a reference to develop national policies and regulations (28.6%) and applied through national programs (21.4%). Other responses included campaign and advocacy work (14.3%) and increasing the awareness of childhood obesity (14.3%). One participant shared that it had

Table 1. Characteristics of respondent

Characteristics	Number of responses (%)
Region (based on WHO regions)	
South-East Asia Region India, Thailand	2 (7.1)
Western Pacific Region Australia, China, Malaysia, Singapore	4 (14.3)
Eastern Mediterranean Region Jordan, Pakistan, Palestine	3 (10.7)
European Region Bosnia and Herzegovina, Croatia, Ireland, Latvia, Luxembourg, Russian Federation, Serbia, Spain, Turkey, United Kingdom	10 (35.7)
African Region Botswana, Senegal, South Africa	3 (10.7)
Region of the Americas Argentina, Canada, Dominican Republic, Honduras, Mexico, United States	6 (21.4)
Respondent's Country of Origin, based on Income Level (World Bank Classification 2023)	
Low Income	0 (0)
Lower-Middle Income	4 (14.3)
Upper-Middle Income	13 (46.4)
High Income	10 (35.7)
Not classified/No data	1 (3.6)
Designation within the Pediatric Society	
President	8 (28.6)
On behalf of the President	8 (28.6)
Others (advisory group member, member)	12 (42.8)
WHO: World Health Organization	

Table 2. National program and regulation related to obesity in children

Characteristics (number)	Number of responses (%)
Availability of national prevalence data of obesity in children (28)	
Yes	22 (78.6)
No	5 (17.9)
Don't know	1 (3.6)
The number of children with obesity increased during the COVID-19 pandemic in your country (28)	
Yes	17 (60.7)
No	0 (0)
Don't know	11 (39.3)
Availability of label on the amount of sugar and salt in food products for children in your country (28)	
Yes	22 (78.6)
No	5 (17.9)
Don't know	1 (3.6)
Availability of a maximum amount of sugar and salt in food products for children in your country's regulation (28)	
Yes	7 (25.0)
No	17 (60.7)
Don't know	4 (14.3)
Availability of any advertising rules for children's food packaging in your country (28)	
Yes	12 (42.9)
No	13 (46.4)
Don't know	3 (10.7)
Availability of any programs or interventions from the government to prevent obesity in children in your country (28)	
Yes	18 (64.3)
No	9 (32.1)
Don't know	1 (3.6)
Availability of any programs or interventions from schools to prevent obesity in children in your country (28)	
Yes	15 (53.6)
No	10 (35.7)
Don't know	3 (10.7)
COVID-19: Coronavirus disease-2019	

Table 3. Non-governmental programs related to obesity in children

Characteristics (number)	Number of responses (%)
Presence of support of private organizations or non-profit organizations (civil society organizations) for childhood obesity prevention programs in your country (28)	
Yes	20 (71.4)
No	4 (14.3)
Don't know	4 (14.3)
If yes, are these programs nationally or locally operated? (20)	
Nationally operated	2 (10)
Locally operated	3 (15)
Both	15 (75)
Awareness of regional programs established to prevent childhood obesity (28)	
Yes	16 (57.1)
No	12 (42.9)
Awareness of WHO's guidance concerning childhood obesity (28)	
Yes	22 (78.6)
No	6 (21.4)
If "Yes", how has this guidance influenced your country's national programs? (20)	
Emphasizing childhood obesity as a priority	1 (5)
Adopting as references to develop national policies and regulations aimed to reduce obesity	7 (35)
Apply practical recommendations to national programs	3 (15)
Increase the awareness of childhood obesity	1 (5)
Participate in the WHO Europe Childhood Obesity Surveillance Initiative	1 (5)
Develop a Center for the Prevention and Treatment of Obesity in Children and Adolescents	1 (5)
Programs and regulations exist but hindered by poor compliance	3 (15)
Don't know	3 (15)
Awareness of UNICEF's guidance concerning childhood obesity (28)	
Yes	14 (50)
No	14 (50)
If "Yes", how has this influenced your country's national programs? (14)	
Emphasizing childhood obesity as a priority	1 (7.1)
Campaign and advocacy work	2 (14.3)
Adopting as references to develop national policies and regulations	4 (28.6)
Cooperation with the Chamber of Commerce and their support for obesity prevention	1 (7.1)
Increase the awareness of childhood obesity	2 (14.3)
Apply practical recommendations to national programs	3 (21.4)
Don't know	1 (7.1)

WHO: World Health Organization, UNICEF: The United Nations International Children's Emergency Fund

Table 4. Suggestions to overcome obesity in children

Characteristics (number)	Number of responses
Prevention is key at all ages	4
Recognize obesity as a disease, which prompts early diagnosis and regular check-ups to be mandatory	3
Holistic and comprehensive approach involving all stakeholders	5
Educate and empower families at the community level	9
Develop, support and reinforce regulations and policies that support a healthy food environment, including regulating processed foods to limit added sugar	11
Build national programs including providing weight management services	7
Facilitate exercise and promote physical activity across all ages	10
Encourage healthy habits from infancy by promoting breastfeeding	5
Involving schools as a key stakeholder	8
Raise public awareness of obesity by ensuring better access to information	3
Prevention begins with pre-pregnancy and pregnancy women	2
Encourage healthy eating habits	8
Tensions between for-profit and public health agendas must be acknowledged and addressed	1
Limit screen time	1
Encourage sleep at night	1
Support families to reduce divorce	1

influenced the cooperation with the Chamber of Commerce and their support for obesity prevention.

Lastly, the questionnaire asked for suggestions from participants to overcome obesity in children, summarized in Table 4. Whilst each participant gave several answers, the suggestions can be summarized as follows. The majority of responses centered on developing, supporting and reinforcing regulations and policies that support a healthy food environment (n = 11), facilitating exercise and promoting physical activity across all ages (n = 10), and educating and empowering families at the community level (n = 9). Other common answers included encouraging healthy eating habits (n = 8), the involvement of schools as crucial stakeholders (n = 8) and building national programs (n = 7). Participants also emphasized that prevention needed to be done at all ages (n = 4), beginning in infancy by promoting breastfeeding (n = 5) and in pre-pregnancy and pregnant women (n = 2). Several participants also highlighted that obesity needed to be properly recognized as a disease (n = 3) and that a holistic and comprehensive approach must involve all stakeholders (n = 5). Other answers included raising public awareness by improving access to information (n = 3), addressing tensions between for-profit and public health agendas (n = 1), limiting screen time (n = 1), encouraging sleep at night (n = 1) and supporting families to reduce divorce (n = 1).

Discussion

This study was conducted to identify the availability of national programs focusing on the prevention of obesity in the pediatric population, including regulations on children's food environment. Data collected from 28 countries across global regions, provided preliminary insights into different practices in implementing prevention measures against childhood obesity and, more importantly, multinational suggestions for improvement from pediatric societies' perspectives.

Given the emergency posed by the implications of the rising number of children with excessive weight globally, the aim of "No increase in childhood overweight" was endorsed by member states of WHO at the 65th World Health Assembly as one of six Global Nutrition Targets 2025 in the "Comprehensive Implementation Plan for Maternal, Infant, and Young Child Nutrition" (7). National prevalence data of obesity in children, one of the key indicators for monitoring, were reported available by more than three-quarters of participants from 22 different countries, although, four participants reported none, and one did not know. Compared to the latest "UNICEF-WHO-The World

Bank: Joint Child Malnutrition Estimates", only one country among these five has "no data", defined as no input data (e.g., household survey data) for use in the country-level models (8). This discrepancy might be caused by low awareness and probably suggests that childhood obesity might not be highlighted or recognized as a top health issue.

The survey was undertaken when the epidemic of childhood obesity overlapped with the COVID-19 pandemic. Compared with the rate before the COVID-19 pandemic, increased weight gain in children and adolescents was documented in studies from China, Europe, and the USA (9). Most participants (60.7%) also noticed an increasing number of children with obesity in their countries. School closures, changes in children's dietary intake, physical inactivity, and unhealthy commodity industries' marketing strategies are among many consequences of pandemic mitigation policies causing this trend (10).

Obesity and overweight are complex problems. Given their multifaceted determinants and health consequences, multisectoral and comprehensive strategies are required to effectively and sustainably prevent and manage this problem. The food environment is one of the key drivers of the rise in obesity. It features increasing availability, affordability, and accessibility, including the marketing of foods high in saturated fats, trans-fats, sugars, and/or salt and these are usually highly processed (10-12).

Despite no details being provided on which food label system was implemented due to the use of close-ended survey questions, our initial finding shows that in most of the participants' countries, general information on the amount of sugar and salt was available in food products for children. The Chilean system is still considered a gold standard among multiple food labelling systems available globally. Octagonal black labels are used in their front-of-package labelling system for foods high in sugar, sodium, and saturated fats. Additionally, products with these labels are also banned from schools. A positive impact on knowledge and awareness and reductions in the consumption of unhealthy foods (13) resulting from providing simplified nutritional information should be considered as a policy to prevent obesity and encourage children to make healthier food choices.

Exposure to the child-targeted marketing of unhealthy foods plays a significant role in the development of childhood obesity (14,15). A set of recommendations was released by WHO in 2010, calling for international and national action to reduce the impact by restricting the marketing of foods and beverages high in saturated fats, trans-fatty acids, free sugar, or salt to children (14). Advertising rules for children's food

packaging were only reported available by 12 participants (42.9%) in their countries, while 13 reported none, and the rest did not know. Recent evidence has indicated that unhealthy food marketing increased children's dietary intake and preference (16) and influenced children's thoughts and behavior, particularly enhancing preference for, attitudes to and consumption of unhealthy marketed foods (15), further emphasizing the urgent need for food advertising restriction for foods marketed at children.

A systematic review of 153 randomized controlled trials in various settings, including schools, has documented provided evidence that combinations of diet and physical activity interventions can reduce the risk of obesity in young children (0 to 5 years), while interventions focusing only on physical activity will only reduce the risk of obesity in the age group 6-12 years and 13-18 years with some evidence that combination of interventions may be effective in these age groups (17). Our findings suggest that programs or interventions from the government and schools to prevent obesity in children are generally available, as reported by more than half of the participants, although not specified.

It is well established that a multi-sectoral and multidisciplinary approach is needed to tackle the childhood obesity epidemic. Current prevention models actively engage and involve representatives from multiple sectors, including private organizations, public health agencies and non-governmental organizations, including WHO and UNICEF. Most participants (71.4%) reported the availability of support from private organizations for childhood obesity prevention programs. Most of these programs were noted to be locally and nationally operated (75%).

WHO has placed substantial focus on preventing and managing childhood obesity. Beginning in 2012 with the adoption of the Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition by the World Health Assembly, WHO continued putting childhood obesity as a global priority by incorporating the prevalence of overweight in children under five as one of the indicators of the SDGs for nutrition (indicator 2.2.2) (7). With the establishment of the Commission on Ending Childhood Obesity in 2014, six recommendations were released by WHO in 2016 (18). These recommendations included the implementation of programs that promote the intake of healthy foods, reduce the intake of unhealthy foods, promote physical activity, reduce sedentary behaviors, and promote healthy school environments, integrate guidance for NCD prevention from preconception and antenatal care and provide family-based, multi-component, lifestyle weight management services (18). Most participants reported that they were aware of WHO's guidance concerning childhood

obesity (78.6%). Participants further elaborated that guidance published by WHO had influenced their respective country's programs, with several participants reporting that comprehensive national programs based on WHO's recommendations have been implemented (15%), while others reported that the recommendations were used as a reference in developing national policies and regulations (35%). Our study found that implementing programs and regulations in several countries was hindered by poor compliance, as reported by 15% of our participants. However, further studies are needed to investigate specific regulations and programs implemented in each country, as well as factors affecting the success of such programs.

Similar to the WHO, UNICEF regional and country offices and headquarters have also begun taking action on preventing overweight in children and adolescents. Established in 2015, SDG No. 3.4 puts reduction of one third premature mortality from NCDs as a global priority (19). In 2016, a global meeting with internal and external stakeholders was conducted to advise UNICEF on the key focus of UNICEF programs concerning overweight children and adolescents (20). The year after, the prevention of overweight children and adolescents was incorporated into the UNICEF Strategic Plan 2018-2021 for the first time as part of Goal Area 1: Every child survives and thrives (21). The UNICEF Nutrition Strategy Framework 2020-2030 brought about the vision of "nutrition for every child" (22). With the goal of protecting and promoting diets, services and practices that support optimal nutrition, growth and development of all children, adolescents and women, the Strategy calls for a systems approach to maternal and child nutrition that builds on UNICEF's strengths as a multisectoral agency with partnerships across the world (22). Compared to our participants' awareness of WHO guidance on childhood obesity, fewer participants were aware of UNICEF's guidance concerning childhood obesity (50%). Those who were aware shared similar responses with the previous question on WHO's guidance regarding how UNICEF's guidance has influenced their country's programs.

The final section of the questionnaire explored suggestions from participants regarding how to tackle the childhood obesity epidemic. Each participant provided multiple suggestions, and thus there were more suggestions than the number of participants involved in this study. Amongst the suggestions received, most participants emphasized the importance of developing, supporting and reinforcing regulations that build a healthy food environment for children and families. Existing initiatives in the field of global health have shown that the success of programs are highly dependent on the ability to engage stakeholders

from multiple sectors including public health agencies (23). As reported in the WHO Global Nutrition Policy Review 2016-2017, only 78% of the 167 countries involved included nutrition-relevant policies, strategies and plans in their responses to address overweight children (24). A smaller percentage of countries had regulations on the marketing of complementary foods and marketing of food and non-alcoholic beverages to children, at 16% and 40% respectively (20).

Regulations and policies that address childhood overweight and obesity take many forms, ranging from policy interventions that support the creation of an enabling environment that promotes physical activity to formation of a cross-governmental task force that oversaw commercial investments, school education, nutrition labelling or taxation of sugary drinks (25). A systematic review found that for every 10% increase in sugary drinks price with a tax, sugary drink consumption is estimated to be reduced by 7% (26). Studies like this provide evidence that the involvement of public agencies through policies and regulations implemented on a national level have provided promising contributions to reducing childhood overweight and obesity.

Other common suggestions from participants included facilitating physical activity and encouraging healthy eating habits across all ages, especially through the involvement of schools as a key stakeholder. It has been well established that childhood obesity occurs due to an imbalance between energy intake and expenditure. Davison and Birch (27) described an ecological model that suggests that risk factors for childhood obesity include dietary intake, physical activity, and sedentary behavior, with environmental factors such as school policies, demographics and parenting style, acting as further influences on children's eating and activity habits. Studies reported that adolescents associate junk food with pleasure, independence and convenience, whilst viewing liking healthy food as "odd" (28). This supports the need for changing societal perceptions of eating behavior. In contrast, a high degree of physical exercise is linked to favorable impacts on bone mineral density, muscular growth, and metabolic profile (29,30). The WHO recommends that children should engage in physical activity for a minimum of 60 minutes per day. Unfortunately, it is estimated that only 20% of youth achieve this level of physical activity (31).

As children spend the majority of their time in schools, institutions of education play an essential role in promoting healthy eating behaviors as well as increasing physical activity. It is estimated that children consume a large proportion (19-50%) of their total daily calories at school (32). Evidence has also found that a school environment

that facilitates physical activity is linked with a lower risk of overweight and obesity. When schools have at least three physical activity-friendly environmental factors, such as larger school size, more physical activity programs, and better physical activity teaching experience, students have a lower prevalence of obesity than those without (33,34). As children engage with various individuals throughout their lives, including healthcare professionals, caregivers and teachers, there is a need for continued training and education across sectors to ensure that all stakeholders are conscious of their interactions with children to minimize bias and stigma (35). In particular, teachers need to actively ensure that all children, regardless of their weight, can be included and are welcomed in all school activities (35). Linking with the importance of physical activity in school, teachers should be wary of inadvertently creating stigmatizing situations, for example by specifically targeting and excluding children with overweight or obesity from performing drills or tasks, that might expose them to additional teasing or bullying from their peers (35). Furthermore, schools should include specific policies concerning weight-based teasing in their anti-bullying policies (35).

Childhood and adolescent obesity prevention should occur at all ages, emphasizing the importance of not only the first 1000 days of life, but also the first 1000 weeks of life, beginning as early as in pre-pregnancy and pregnant women (36). It has been established that interventions in the pre-conception period help mitigate against the critical, life-long adverse effects of obesity which commence *in utero* with epigenetic effects, gene expression and function along with metabolic programming relating to appetite and energy expenditure and ongoing transgenerational effects (37). Furthermore, evidence has emphasized the protective action of breastfeeding against obesity compared with formula feeding, exclusive breastfeeding until 6 months of age and parental weight control before conception and during pregnancy (38,39). Recognizing the substantial influence of parents' practices and lifestyle on their children, it is important that parents and families are actively involved and educated regarding the prevention of childhood obesity. These are all suggestions that were raised by participants in the present study.

Our data demonstrated that although the majority of countries represented by participants involved have data and programs concerning childhood obesity, as well as existing support from private organizations, there is still room for improvement for the awareness and implementation of programs. The success of programs are still hindered by lack of compliance and public awareness. In order to ultimately achieve SDGs targets 2 and 3, united commitment and

action from all countries to conduct country-specific evaluation and interventions are needed to tackle childhood obesity globally.

Study Limitations

The number of participants in the survey disseminated was lower than initially expected. We hypothesize that this was as a result of several factors, including a short survey period and insufficient promotion to member societies to participate in the survey, as well as the survey being directed towards presidents of IPA member societies who might not necessarily have direct access to pediatricians with expertise in NCDs and obesity. With a lower response rate, the distribution of participants may be more restricted. Thus, insights from several regions may not have been represented in the study. Specifically, insights from low-middle income countries, where availability and support may be lower are less represented in this study. Overall, this highlights the need for future data collection to be more representative.

Conclusion

Despite the wide availability of national data on obesity in children and food labels containing information on the amount of sugar and salt, there are different practices in the implementation of prevention measures against childhood obesity globally, particularly in statutory regulation on food advertising and national programs. Whilst support from non-profit organizations and awareness regarding WHO and UNICEF guidance on childhood obesity is relatively high, its implementation is still hindered by a general lack of awareness and poor compliance. With the continuing worsening of the childhood obesity epidemic, it is time for stricter regulations on proven risk factors of obesity in children, enforced by country or regional legislation. Country and region-specific interventions are needed to ensure better awareness, compliance and hence, progress towards tackling the childhood obesity epidemic.

Ethics

Ethics Committee Approval: Ethical clearance was not required for this study.

Informed Consent: Cross-sectional electronic survey.

Authorship Contributions

Concept: Aman B. Pulungan, Hilary Hoey, Agustini Utari, Feyza Darendeliler, Basim Al-Zoubi, Dipesalema Joel, Arunas Valiulis, Jorge Cabana, Enver Hasanoğlu, Naveen Thacker, Mychelle Farmer, Design: Aman B. Pulungan, Hilary

Hoey, Agustini Utari, Feyza Darendeliler, Basim Al-Zoubi, Dipesalema Joel, Arunas Valiulis, Jorge Cabana, Mychelle Farmer, Data Collection or Processing: Aman B. Pulungan, Helena A. Puteri, Amajida F. Ratnasari, Mychelle Farmer, Analysis or Interpretation: Aman B. Pulungan, Helena A. Puteri, Amajida F. Ratnasari, Hilary Hoey, Agustini Utari, Feyza Darendeliler, Basim Al-Zoubi, Dipesalema Joel, Arunas Valiulis, Jorge Cabana, Enver Hasanoğlu, Naveen Thacker, Mychelle Farmer, Literature Search: Aman B. Pulungan, Helena A. Puteri, Amajida F. Ratnasari, Writing: Aman B. Pulungan, Helena A. Puteri, Amajida F. Ratnasari.

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References

1. World Health Organization. Non-communicable Diseases: Progress Monitor 2017. Geneva (CH), World Health Organization, 2017.
2. Obesity and Overweight. World Health Organization (WHO). Cited: 13.04.2023. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
3. Lange SJ, Kompaniyets L, Freedman DS, Kraus EM, Porter R; DNP3; Blanck HM, Goodman AB. Longitudinal Trends in Body Mass Index Before and During the COVID-19 Pandemic Among Persons Aged 2-19 Years - United States, 2018-2020. *MMWR Morb Mortal Wkly Rep* 2021;70:1278-1283.
4. United Nations Children's Fund. The state of the world's children 2019: Children, food and nutrition, growing well in a changing world. New York (US), UNICEF, 2019.
5. Downs SM, Ahmed S, Fanzo J, Herforth A. Food Environment Typology: Advancing an Expanded Definition, Framework, and Methodological Approach for Improved Characterization of Wild, Cultivated, and Built Food Environments toward Sustainable Diets. *Foods* 2020;9:532.
6. Global Kids Food & Beverages Industry Market Reports. ReportLinker. Cited: 16.04.2023. Available from: <https://www.reportlinker.com/p05864286/Global-Kids-Food-and-Beverages-Industry.html>
7. World Health Organization. Comprehensive implementation plan on maternal, infant and young child nutrition. Geneva (CH), World Health Organization, 2012.
8. World Health Organization (WHO). Global database on child health and malnutrition. UNICEF-WHO-The World Bank: Joint child malnutrition estimates - Levels and trends. Geneva, WHO, 2019. Last Accessed Date: 01.04.2023. Available from: <https://www.who.int/publications/i/item/9789240025257>
9. Jebeile H, Kelly AS, O'Malley G, Baur LA. Obesity in children and adolescents: epidemiology, causes, assessment, and management. *Lancet Diabetes Endocrinol* 2022;10:351-365. Epub 2022 Mar 3
10. Di Cesare M, Soric M, Bovet P, Miranda JJ, Bhutta Z, Stevens GA, Laxmaiah A, Kengne AP, Bentham J. The epidemiological burden of obesity in childhood: a worldwide epidemic requiring urgent action. *BMC Med* 2019;17:212.
11. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, Gortmaker SL. The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011;378:804-814.
12. World Health Organization (WHO). Protecting children from the harmful impact of food marketing: policy brief. Available from: <https://www.who.int/publications/i/item/9789240051348>

13. Rodríguez Osias L, Cofré C, Pizarro T, Mansilla C, Herrera CA, Burrows J, Castillo C. Using evidence-informed policies to tackle overweight and obesity in Chile. *Rev Panam Salud Publica* 2017;41:e156.
14. World Health Organization. Set of Recommendations on the Marketing of Foods and Non-alcoholic Beverages to Children. WHO: Geneva, 2010
15. Smith R, Kelly B, Yeatman H, Boyland E. Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients* 2019;11:875.
16. Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell NR, Johnston BC. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obes Rev* 2016;17:945-959. Epub 2016 Jul 18
17. Brown T, Moore TH, Hooper L, Gao Y, Zayegh A, Ijaz S, Elwenspoek M, Foxen SC, Magee L, O'Malley C, Waters E, Summerbell CD. Interventions for preventing obesity in children. *Cochrane Database Syst Rev* 2019;7:CD001871.
18. United Nations. Transforming our world: The 2030 agenda for sustainable development. New York (US), United Nations, 2015.
19. World Health Organization. Report of the commission on ending childhood obesity. Geneva (CH), World Health Organization, 2016.
20. United Nations Children's Fund. Designing a UNICEF strategy for child overweight and obesity. Workshop report, 2016.
21. United Nations Children's Fund. UNICEF Strategic Plan 2018-2021. New York (US), United Nations Children's Fund, 2018
22. United Nations Children's Fund. UNICEF Nutrition Strategy 2020-2030. New York (US), United Nations Children's Fund, 2020.
23. Addy NA, Shaban-Nejad A, Buckeridge DL, Dubé L. An innovative approach to addressing childhood obesity: a knowledge-based infrastructure for supporting multi-stakeholder partnership decision-making in Quebec, Canada. *Int J Environ Res Public Health* 2015;12:1314-1333.
24. World Health Organization. Global nutrition policy review 2016-2017: country progress in creating enabling policy environments for promoting healthy diets and nutrition. Geneva (CH): WHO, 2018.
25. Brennan LK, Brownson RC, Orleans CT. Childhood obesity policy research and practice: evidence for policy and environmental strategies. *Am J Prev Med* 2014;46:1-16.
26. Afshin A, Peñalvo JL, Del Gobbo L, Silva J, Michaelson M, O'Flaherty M, Capewell S, Spiegelman D, Danaei G, Mozaffarian D. The prospective impact of food pricing on improving dietary consumption: A systematic review and meta-analysis. *PLoS One* 2017;12:e0172277.
27. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. *Obes Rev* 2001;2:159-171.
28. Chapman G, Maclean H. "Junk food" and "Healthy food": Meanings of food in adolescent women's culture. *J Nutr Educ* 1993;25:108-113.
29. Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act* 2010;7:40.
30. Fritz J, Rosengren BE, Dencker M, Karlsson C, Karlsson MK. A seven-year physical activity intervention for children increased gains in bone mass and muscle strength. *Acta Paediatr* 2016;105:1216-1224. Epub 2016 May 16
31. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U; Lancet Physical Activity Series Working Group. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet* 2012;380:247-257.
32. Story M, Nannery MS, Schwartz MB. Schools and obesity prevention: Creating school environments and policies to promote healthy eating and physical activity. *Milbank Q* 2009;87:71-100.
33. Ip P, Ho FK, Louie LH, Chung TW, Cheung YF, Lee SL, Hui SS, Ho WK, Ho DS, Wong WH, Jiang F. Childhood Obesity and Physical Activity-Friendly School Environments. *J Pediatr* 2017;191:110-116. Epub 2017 Oct 4
34. Sallis JF, McKenzie TL, Beets MW, Beighle A, Erwin H, Lee S. Physical education's role in public health: steps forward and backward over 20 years and HOPE for the future. *Res Q Exerc Sport* 2012;83:125-135.
35. Weghuber D, Khandpur N, Boyland E, Mazur A, Frelut ML, Forslund A, Vlachopapadopoulou E, Erhardt É, Vania A, Molnar D, Ring-Dimitriou S, Caroli M, Mooney V, Forhan M, Ramos-Salas X, Pulungan A, Holms JC, O'Malley G, Baker JL, Jastreboff AM, Baur L, Thivel D. Championing the use of people-first language in childhood overweight and obesity to address weight bias and stigma: A joint statement from the European-Childhood-Obesity-Group (ECOG), the European-Coalition-for-People-Living-with-Obesity (ECPO), the International-Paediatric-Association (IPA), Obesity-Canada, the European-Association-for-the-Study-of-Obesity Childhood-Obesity-Task-Force (EASO-COTF), Obesity Action Coalition (OAC), The Obesity Society (TOS) and the World-Obesity-Federation (WOF). *Pediatr Obes* 2023;18:13024. Epub 2023 Apr 1
36. Larqué E, Labayen I, Flodmark CE, Lissau I, Czernin S, Moreno LA, Pietrobelli A, Widhalm K. From conception to infancy - early risk factors for childhood obesity. *Nat Rev Endocrinol* 2019;15:456-478. Epub 2019 Jul 3
37. Şanlı E, Kabaran S. Maternal Obesity, Maternal Overnutrition and Fetal Programming: Effects of Epigenetic Mechanisms on the Development of Metabolic Disorders. *Curr Genomics* 2019;20:419-427.
38. Victora CG, Bahl R, Barros AJ, França GV, Horton S, Krasevec J, Murch S, Sankar MJ, Walker N, Rollins NC; Lancet Breastfeeding Series Group. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet* 2016;387:475-490.
39. Patro-Gołąb B, Zalewski BM, Kołodziej M, Kouwenhoven S, Poston L, Godfrey KM, Koletzko B, van Goudoever JB, Szajewska H. Nutritional interventions or exposures in infants and children aged up to 3 years and their effects on subsequent risk of overweight, obesity and body fat: A systematic review of Systematic Reviews. *Obes Rev* 2018;19:1620. Epub 2016 Oct 17