2022

# A study on
# **Childhood Obesity in Malta**

With a special focus on **4-5 year old children**

Superintendence of Public Health, Ministry for Health
Directorate for Research, Lifelong Learning and Employability,
Ministry for Education, Sport, Youth, Research and Innovation

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# Executive Summary

## Introduction:

Obesity is a worldwide and chronic disease, with significant morbidity and mortality from cardiovascular, neurological, and oncological sequelae. Obesity often begins in childhood with two out of five Maltese children being overweight (OW) or obese.

Surveillance systems are vital to monitor the outcomes of the various health policies aimed at promoting healthy weight. To date, there are no widespread surveillance systems in place looking at the prevalence rates for OW/obesity for children under 5 years within the WHO European Region.

## Purpose of study:

This study aims to measure the body mass index (BMI) of 4-5-year-old children attending kindergarten 2 (KG2) in Malta, and describe their lifestyle behaviours, and to measure the body mass index of 5—16-year-old children attending primary, middle and secondary schools in Malta and Gozo.

## Methods:

The study employed a cross-sectional study, comprising a survey for parents/guardians of children in KG2 and a body composition study among children in KG2-Y11, which study considered anthropometrics (height and weight); demographics (sex, birth month and year, school and locality); and lifestyle data (breakfast intake on measurement day and extracurricular participation in physical activity). A stratified random sampling approach was taken across Maltese schools, ensuring proportional representation across the ten State Colleges, Church and Independent Schools. Data collection for the body composition study was carried out in the first six months of 2022 by trained data collectors and directly inputted on a Class Record Form in Excel Spreadsheets. Children in KG2 also received a paper-based Family Record Form for the child's parents or legal guardians to complete and return to the school, which were passed on to the research team.

Ethical approval to conduct the study was obtained from the Health Ethics Committee. Data protection approval was obtained from the Malta Commissioner for Information and Data Protection.

BMI was calculated by dividing the weight in kilograms by the height squared in meters. The value was cross-referenced with the WHO Child Growth Standards for children aged 0-60 months and the WHO Growth Reference for children aged 61 months-19 years to determine body composition status.

## Findings:

Using the WHO Child Growth Standards, 12.1% of 4–5-year-old children in KG2 (60 months or less) were either overweight or obese, and 3.7% were obese. Using the WHO Growth Reference, 33.0% of children in KG2 aged 61 months and over were either overweight or obese, and 11.8% were obese, while 39.4% of children and adolescents between Y1-11 were either overweight or obese, 17.3% being obese. Overall, males were more likely than females to be OW/obese. Body composition changes across the school phases, with increasing OW/obesity rates from KG2 to middle school, and a slight decrease in secondary school. Healthy diets and engaging in physical activity are important in maintaining a healthy weight.

Overall, a healthy diet revolves around exclusively breastfeeding for the first 6 months of the child's life and continuously breastfeeding until two years and beyond, and children aged 3 to 12 years consume 3-4 servings of cereal per day, 3-5 servings of vegetables, 2-3 servings of fruit per day, 2-3 servings of milk and milk products per day, 1-2 servings of protein per day, 1-2 servings of fats per day, and drink mostly water.

Breastfeeding is the gold standard of infant nutrition, providing immediate and long-term benefits including protection against OW/obesity and diabetes mellitus. Whilst breastfeeding rates in Malta appear to be improving, parent-reporting indicated that 22.2% of children were never breastfed, 40.0% of children were breastfed for less than six months, and 37.8% of children were breastfed for more than 6 months.

Regular, nutritious breakfast in children and adolescents improves cognitive function, academic outcomes, quality of life, health, and well-being. Daily breakfast consumption among children attending KG2 stood at 43.2% and breakfast consumption on measurement day among children and adolescents in KG2-Y11 was just under 60%. Overall, breakfast intake seems more common among boys, with overall declining rates in both boys and girls across the school phases.

Diets rich in fruit and vegetables are conducive to healthy outcomes. The proportion of KG2 children who consume fresh fruit and vegetables every day was 48.5% and 14.5%, respectively. Snacking may contribute towards total energy intake and OW/obesity. Savoury and sweet snacks are popular food choices. The proportion of KG2 children who consume savoury snacks and sweet snacks every day was 4.6% and 14.8%, respectively. Consumption of sugar-sweetened beverages, particularly carbonated soft drinks, is associated with weight gain. The proportion of KG2 children who consume sugar-containing soft drinks, and fruit juices, smoothies or squashes every day was 4.4% and 9.8%, respectively.

Regular physical activity decreases the risk of noncommunicable diseases such as heart disease, stroke, diabetes, and certain cancers; improves blood pressure; helps maintain a normal weight; and improves mental health and overall wellbeing. Most parents of KG2 children reported that their child spent at least 2 hours per week on extra-curricular sport or physical activity (65.9%) and spent at least 1 hour per day playing actively/vigorously (90.4%). Just over half (52.3%) the children (KG2-Y11) partaking in this study claimed to participate in organised extra-curricular sport or physical activity at least once a week. Overall, sports participation seems more common among boys, with increasing rates in both boys and girls throughout primary school, declining and stabilising in middle and secondary school.

Screen time is a distinct form of sedentary behaviour which has several negative consequences including worse body composition indicators. 76.8% of children exceeded the WHO recommendation of not more than 1 hour of sedentary screen time per day. The proportion of KG2 children who spent at least 2 hours per day watching TV or using an electronic device was 27.3%.

## Conclusion:

About one in eight KG2 children (12.1%) aged up to 60 months and one third (33.0%) of KG2 children aged 61 months and over were either overweight or obese. The rate increased to just under 40% of children in Y1-11, with OW/obesity being more prevalent in the middle school years. Obesity was more prevalent among males. Breastfeeding rates remain well below global targets. Eating habits among children attending KG2 were poor in fruits and vegetables, rich in savoury and sweet snacks, and low in sugar-containing soft drinks. Parent-reported physical activity rates and screen time rates appeared to be high among KG2 children. Just under 60% of KG2-Y11 children claimed to have eaten breakfast on measurement day, with breakfast intake being more prevalent among younger students. 52.3% of students claimed to practice extra-curricular sport at least once weekly. Breakfast intake and sports participation were both slightly associated with BMI (not OW/obese and OW/obese) in Y1-Y11s.

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- Ministry for Health Ethics Committee
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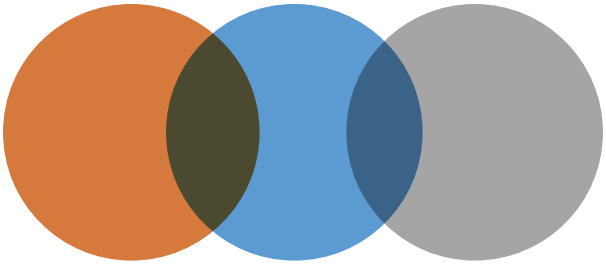


# Abbreviations

| | |
|---|---|
| **BM** | budgetary measure |
| **BMI** | body mass index |
| **CDC** | Centre for Disease Control |
| **CI** | confidence interval |
| **COSI** | Childhood Obesity Surveillance Initiative |
| **HBSC** | Health Behaviour in School Children |
| **IYCF** | Infant and Young Child Feeding |
| **KG2** | kindergarten 2 |
| **NSO** | National Statistics Office |
| **OW** | overweight |
| **PE** | physical education |
| **SD** | standard deviation |
| **SDG** | Sustainable Development Goal |
| **SSB** | sugar-sweetened beverage |
| **WBTi** | World Breastfeeding Trends Initiative |
| **WHO** | World Health Organization |
| **Y** | school year |

# Introduction

Overweight (OW) or obesity is defined as “abnormal or excessive fat accumulation that presents a risk to health” (1). Obesity is a worldwide and chronic disease, with significant morbidity and mortality from cardiovascular, neurological, and oncological sequelae (2). Obesity often begins in childhood (2,3). In fact, 2 out of 5 Maltese children are overweight or obese (4).

Obesity contributes to increased healthcare costs, both directly due to treating associated diseases, and indirectly through lost productivity due to absenteeism and premature death. Even though the total national health expenditure and total health expenditure as a percentage of the gross domestic product have increased steadily over the years (5), in 2018 only 1.3% of the Maltese healthcare expenditure was on preventive care (6). As a result, obesity in Malta is now an economic burden with an expenditure of approximately €36.3 million, or 5.6% of the total health expenditure (7).

Obesity is an important noncommunicable disease and a driver of other noncommunicable diseases, and its prevention and management is necessary to achieve Sustainable Development Goal (SDG) 3.4: “By 2030, reduce by one-third premature mortality from NCDs through prevention and treatment and promote mental health and well-being” (8). Indeed, various international and national policies are aimed at promoting healthy weight.

**NATIONAL POLICIES INCLUDE:**

**Healthy Eating Lifestyle Plan (2007)**

**A Strategy for the Prevention and Control of Noncommunicable Disease in Malta (2010)**

**A Healthy Weight for Life: A National Strategy for Malta 2012-2020 (2012)**

**A National Curriculum Framework for All (2012)**

**Food and Nutrition Policy and Action Plan for Malta 2015-2020 (2014)**

**National Breastfeeding Policy and Action Plan 2015-2020 (2015)**

**A Whole School Approach to a Healthy Lifestyle:**
**Healthy Eating and Physical Activity Policy (2015)**

**A National Policy for Sport in Malta 2017-2027 (2016)**

**Dietary Guidelines for Maltese Children: The Mediterranean Way! (2018)**

Surveillance systems are vital for morbidity monitoring and evaluating population-level interventions and policies, which strengthen advocacy efforts for government action (9,10). The World Health Organisation (WHO) European Region conducts two initiatives that regularly collect data on the prevalence of OW/obesity in children: the Childhood Obesity Surveillance Initiative (COSI) which looks at Primary school-aged children (6-9 years) using anthropometric data and the Health Behaviour in School-aged Children (HBSC) survey which looks at self-reported data in children and adolescents aged 11, 13 and 15.

There are no standardised surveillance programmes which look at the prevalence rates for OW/obesity for children under 5 years within the WHO European Region, and only 35 of the 53 WHO European Region Member States hold data on BMI of under 5s, with wide methodological inconsistencies among them (9). This despite SDG 2.2.2, which requires the "Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) amongst children under 5 years of age, by type (wasting and overweight)" (11). In Malta, no national studies on the weight of children under 5 years have been conducted. Within this context, there is an opportunity (in Europe and in Malta) to strengthen existing surveillance for children under the age of 5 years to provide timely, regular and quality data that can inform policy action (9).

This study aims to measure the body mass index of 4–5-year-old children attending kindergarten in Malta, and describe their lifestyle behaviours, and to measure the body mass index of 5–16-year-old children attending Primary, Middle and Secondary schools in Malta and Gozo.

It was commissioned in the 2020 Budget, namely through two budgetary measures (BM):

BM 370/2020: "Isir studju li jeżamina b'mod partikolari r-rata ta' obesità f'Malta fejn jidħlu tfal ta' 4-5 snin. Ir-riżultati ta' dan l-istudju għandhom jelenkaw ix-xejriet u b'hekk jinħarġu rakkomandazzjonijet dwar kif nistgħu nsostnu s-saħħa aktar sana għat-tfal".

BM 191/2020: "Jerġa jitfassal studju nazzjonali fost l-istudenti biex jitkejjel il-piż ta' kull student ..."

# Methodology

This section outlines the research methodology that was used for this study. The survey method was a cross-sectional study. The study population consisted of two cohorts:

A 4–5-year-old children [kindergarten 2 (KG2)] for the BMI study, and their parents or guardians for a survey on lifestyle data;

B 5–16-year-old [Year (Y) 1-11] children for the BMI study.

The study assumed a 95% confidence level, a maximum confidence interval (CI) of +/- 5% and 80% power. For children in year KG2, oversampling was necessary to mitigate anticipated non-response. Assuming a response rate of approximately 20%, it was estimated that around 1,900 parents would need to be contacted, corresponding to just under half the KG2 student population. For Y1-Y11, just over 10% of the population in each school year was recruited. A stratified random sampling approach was taken across Maltese schools, ensuring proportional representation across the ten State Colleges, Church and Independent Schools.

Data collection was carried out between 31st January and 28th June 2022. Middle and Secondary school children were measured between 31st January and 13th May 2022. Primary and KG2 children were measured between 14th March and 28th June 2022. Data collection for both cohorts involved three data types: anthropometrics (height and weight); demographics (sex, birth month and year, school, and locality); and lifestyle data (breakfast intake on measurement day and extracurricular participation in physical activity). Anthropometric measures were taken in schools using standardized scale-stadiometers (GIMA 27288 PEGASO DIGITAL SCALE) to help reduce interobserver bias. Data was collected by trained data collectors and directly inputted on a Class Record Form in Excel. Children in KG2 received a paper-based Family Record Form (in Maltese and English) for the child's parents or legal guardians to complete and return to the school, which were then passed on to the research team.

Ethical approval to conduct the study was obtained from the Health Ethics Committee. Data protection approval was obtained from the Malta Commissioner for Information and Data Protection. Parents and children were informed about the study ahead of measurement day and could opt out of participating. Some schools applied an opt in, rather than an opt out, consent process.

BMI was calculated by dividing the weight in kilograms by the height squared in meters (1). The value was cross-referenced with the WHO Child Growth Standards for children between 0-60 months (12) and the WHO Growth Reference for children between 61 months-19 years (13) to determine body composition status. The WHO recommends the following cut-off points when determining body mass index in children:

| CLASSIFICATION | AGE: BIRTH TO 60 MONTHS | AGE: 61 MONTHS TO 19 YEARS |
|---|---|---|
| SEVERELY THIN | | < -3 SD |
| THINNESS | | < -2 SD |
| POSSIBLE RISK OF OVERWEIGHT | > 1 SD | |
| OVERWEIGHT | > 2 SD | > 1 SD |
| OBESE | > 3 SD | > 2 SD |

**Table 1: BMI cut-off points according to WHO**

The differing cut-off points between the two cohorts, that is: birth to 60 months; and 61 months to 19 years, reflects a cautious approach at interpreting body composition in growing children due to insufficient evidence on health outcomes, and therefore needs to be taken into consideration when interpreting the results (14).

Data collected was validated using the WHO AnthroPlus software, with cases falling beyond the lower or upper standard deviations (SD), as indicated by the WHO Standards and WHO Reference, excluded from the BMI analysis (see Table 2) (13).

| | WHO Standards (0-60 months) | | WHO Reference (61 months-19 years) | |
|---|---|---|---|---|
| **Indicator** | **Lower SD** | **Upper SD** | **Lower SD** | **Upper SD** |
| WAZ | -6 | +5 | -6 | +5 |
| HAZ | -6 | +6 | -6 | +6 |
| BAZ | -5 | +5 | -5 | +5 |

**Table 2: WHO AnthroPlus default flag limits by indicator**

Following the data validation exercise among KG2 students, 12 children aged 60 months and less and 5 children aged 61 months and over were excluded from the dataset, as were 55 children in Y1-11.

Overall, 7,568 children participated in the study. These were distributed as follows: 2,006 students in KG2, 2,949 students in Primary school, 1,071 students in Middle school and 1,542 Secondary school students. When it comes to KG2, 1,966 children had complete anthropometric (height and weight) and demographic (age, sex, NSO district) data, of which 1,949 individuals were included in the study following validation. Figures stood at 2,922 and 2,889 respectively for Primary school children. Middle school children for which anthropometric and demographic data were available stood at 1,046, 1,044 of whom were included in the study following validation, while for Secondary school level these figures were 1,480 and 1,477 respectively. 1,129 parents or legal guardians of children in KG2 participated in the Family Record Form: a participation rate of 57.4%[1].

Results subsequently presented in this study were weighted according to National Statistics Office (NSO)[2] district, age, and sex distributions in the 2021 census. All data in this report refers to weighted data unless specified.

[1] Data in this paragraph is unweighted.

[2] NSO, personal communication, 15 September 2022.

# Literature & Results

## OVERWEIGHT AND OBESITY

At a global level, an estimated 38.2 million children under the age of 5 (2019) and 340 million children and adolescents between 5-19 (2016) were either overweight or obese (15). OW/obesity among children and adolescents aged 5-9 years has increased drastically along the years from 4% in 1975 to 18% in 2016 (15).

### OW/obesity in children aged under 5 years

According to a literature review, the prevalence of OW/obesity in children under 5 years ranges from 1 to 28.6% across WHO European Region member states (9). Methodological limitations of the review may explain this variance, notably the fact that it was a mixed methods review, included studies spanning 18 years (1998-2016), and that studies used different definitions for OW/obesity (9). In another study, the pooled prevalence of OW/obesity and obesity in preschool children in Europe was 17.9% (95% CI: 15.8-20.0), and 5.3% (95% CI: 4.5-6.1), respectively (16). In a study across six countries, the prevalence of OW/obesity varied widely between countries, 8-30% overweight and 1-13% obese, with higher rates in Southern European countries (17). Similar findings were also seen in another study comparing the BMI of preschool children in Sweden and Spain (which was 10% higher) (18). In the WHO European Regional Obesity Report 2022, the prevalence of OW/obesity in children under 5 years in 2020 ranged between 3.5% in Tajikistan and 17.0% in Ukraine (19).

Three small Maltese studies using Centre for Disease Control (CDC) standards indicate that the prevalence of OW/obesity in children under 5 years of age is around 40%, with obesity ranging from 12.5-23.3% (20–22). However, the study being presented in this report is the first large-scale National study that measured the prevalence of overweight or obesity in preschool children.

#### *Results from this 2022 National Study*

**Kindergarten 2 (KG2): 4-5-year-old children**

Data from KG2 are presented as two cohorts (60 months and under; 61 months and over) because different growth charts are used for children aged 60 months or less and those aged 61 months and older. Therefore, the following results need to be interpreted with caution.

Using the WHO Child Growth Standards for 4–5-year-old children (N=1,394; 729 boys, 665 girls)[3], Table 3 shows the weighted BMI distribution of 4-5-year-old children in KG2. Using the WHO AnthroPlus (13), twelve children were excluded from the analysis due to extreme values.

The proportion of students who were either overweight or obese was 12.1%, with 3.7% being obese. When using the WHO Child Growth Standards, overweight prevalence rates between 10% and <15% are considered “high” (23).

[3] Unweighted data.

| ≤ 60 months | ≤ 1 SD* | Possible risk of OW | OW | Obese | OW/Obese |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| Male | 65.0 | 20.1 | 10.8 | 4.2 | 14.9 |
| Female | 74.6 | 16.2 | 6.0 | 3.2 | 9.2 |
| **Total** | **69.8** | **18.2** | **8.4** | **3.7** | **12.1** |

**Table 3: BMI distribution of 4-5-year-old children in KG2**
* The WHO Growth Standard does not differentiate underweight and 'normal' BMI when using BMI-for-age.

Using the WHO Growth Reference for children aged 61 months to 19 years (N = 572; 291 boys, 281 girls)[4], Table 4 shows the weighted BMI distribution of children in KG2 aged 61 months or more. Using the WHO Growth Reference guidelines (13), five children were excluded from the analysis due to extreme values.

65.2% of participants in the study fell within the normal parameters of BMI. The proportion of students who were underweight was 1.8%, while 33.0% were overweight or obese.

| 61 months+ | Underweight | Normal | OW | Obese | OW/Obese |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| Male | 2.2 | 63.8 | 20.5 | 13.4 | 34.0 |
| Female | 1.4 | 66.4 | 21.8 | 10.4 | 32.2 |
| **Total** | **1.8** | **65.2** | **21.2** | **11.8** | **33.0** |

**Table 4: BMI distribution of KG2 children aged 61 months or older**

Sex and BMI were weakly, but significantly, associated among children in kindergarten aged up to 60 months, but not among older kindergarten children. This could be explained by the smaller sample size of the latter cohort (aged 61 months or older).

## OW/obesity in children in Y1-11 (5-16-year-old children)

The prevalence for OW/obesity (2018-2020) for children between 7-9 years across the 33 countries of the WHO European Region participating in the COSI was 31% (14% obese) for boys, 28% (10% obese) for girls, and 29% (12% obese) overall (24). In Malta, the prevalence of OW/obesity stood at 33.0% (14.9% obese); 34.9% (17.5% obese) and 31.1% (12.2% obese) for boys and girls, respectively (24). Between 2007 and 2017, the prevalence of OW/obesity for this age group improved in countries with high prevalence (25).

The prevalence of OW/obesity among Maltese children aged 10-11 years was 44.0% and 20.9%, respectively in 2012 (26). According to 2018 HBSC data, 21% of adolescents were either overweight or obese (27). Maltese figures were much higher and worsened between 2014 and 2018 (see Figures 1 & 2) (27). These self-reported figures represent an underestimation of the situation: self-reported height tends to be overestimated; self-reported weight tends to be underestimated (28).

[4] Unweighted data.

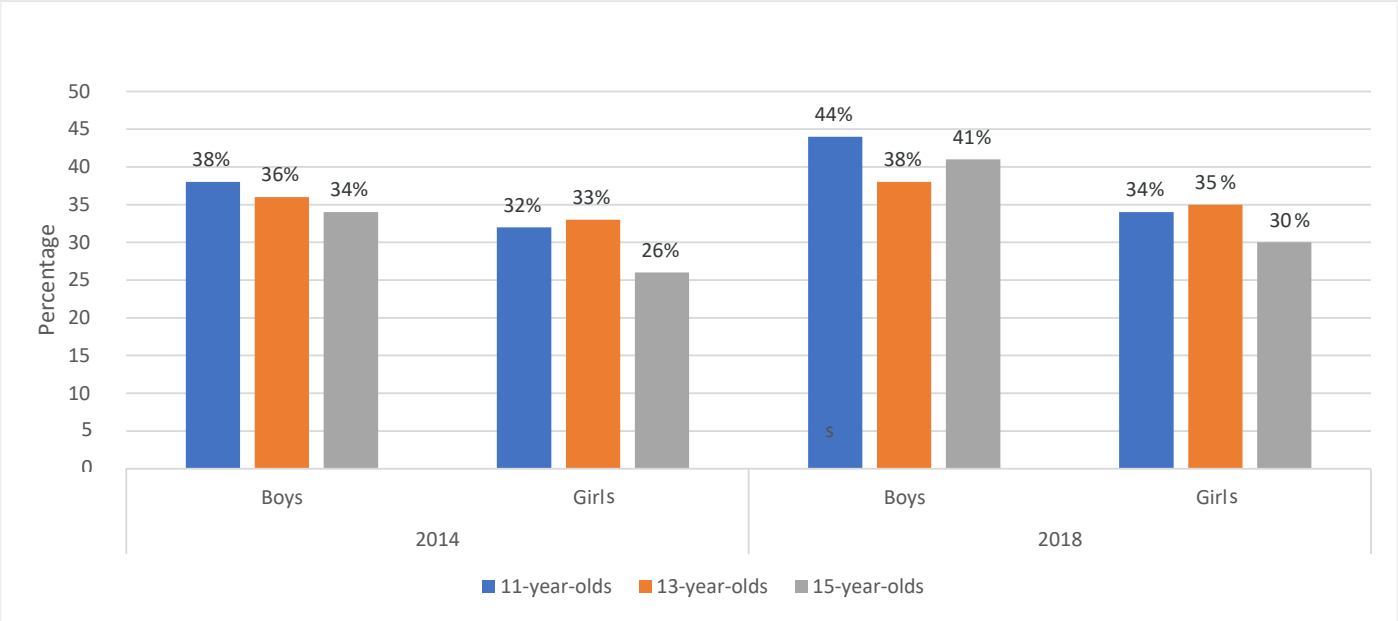



**Figure 1: Prevalence of OW/obese adolescents in Malta in 2014 and 2018 (Source: HBSC)**

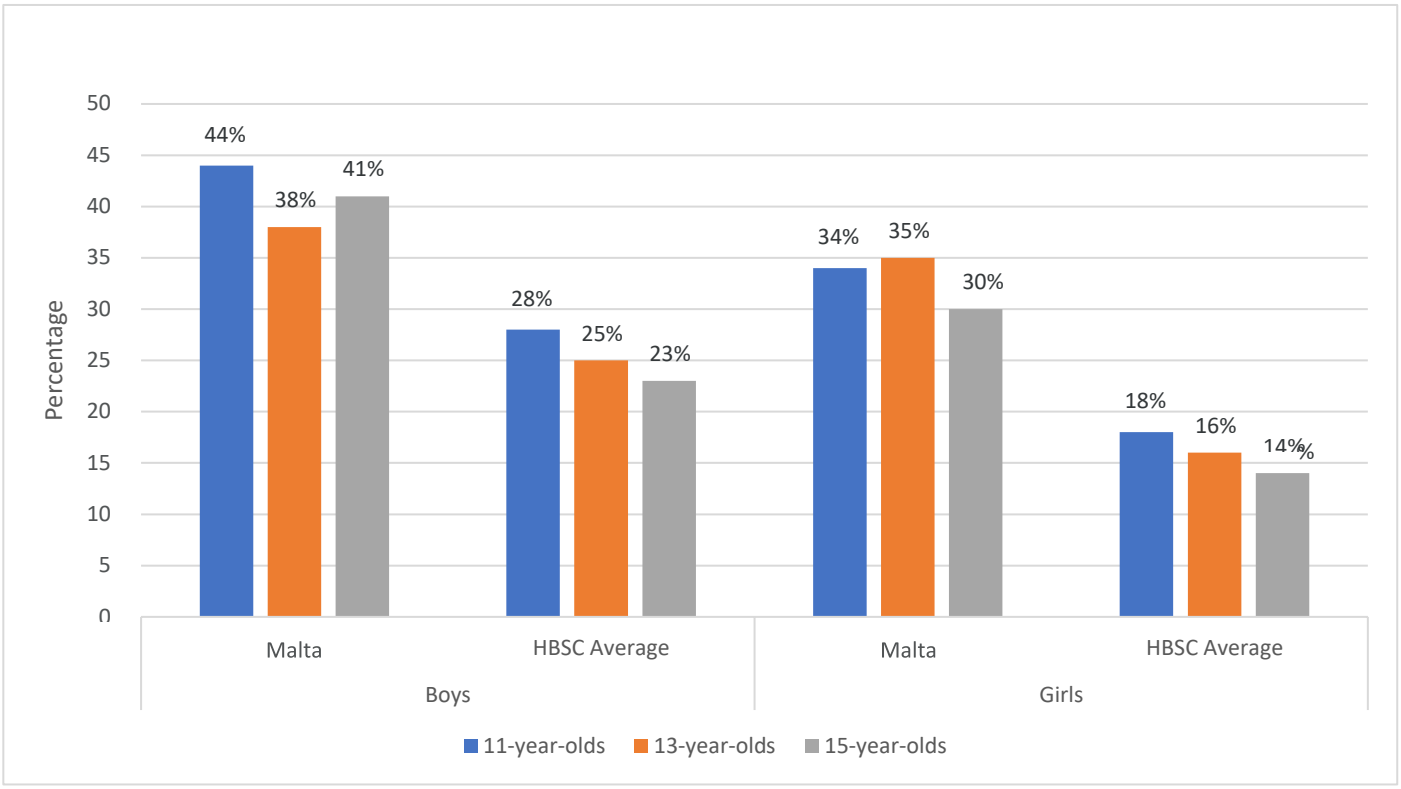



**Figure 2: Prevalence of OW/obese adolescents in Malta and HBSC Average for 2018 (Source: HBSC)**

A population study in Malta, carried out in 2015, measured 41,747 (90.7%) primary and secondary school children (ages 4.7–17 years). The study found that 41.0% of children were either overweight or obese, most being obese (26.0%) (4). Excess weight was more prevalent among males (43.1%; females 38.7%) with a slight overall increase from primary (39.7%) to secondary (42.6%) school (4).

## *Results from this 2022 National Study*

**Year 1 to Year 11 (5-16-year-old children)**

Around 59.5% of participants in the study fell within the normal parameters of BMI. The proportion of students who were underweight was 1.2%, while 39.4% were overweight or obese.

### *Sex*

Table 5 displays the BMI distribution of children and adolescents in Year 1 to Year 11. Females participating in this study were slightly more likely than males to be within the normal (females: 61.9%; males: 57.3%) or overweight parameter (females: 22.6%; males: 21.6%), while males were more likely than females to be classed as obese (males: 20.0%; females: 14.3%). Overall, males were 5 percentage points more likely to be classed as overweight or obese.

| | Underweight | Normal | OW | Obese | OW/Obese |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| Male | 1.2 | 57.3 | 21.6 | 20.0 | 41.6 |
| Female | 1.1 | 61.9 | 22.6 | 14.3 | 36.9 |
| **Total** | **1.2** | **59.5** | **22.1** | **17.3** | **39.4** |

**Table 5: BMI distribution of children and adolescents in Year 1 to Year 11**

### *School phase*

Table 6 shows the BMI distribution of children by school phase. Children in Middle school were least likely to have normal weight, and most likely to be overweight or obese. This is in keeping with HBSC data (see Figure 1).

| School phase | Underweight | Normal | OW | Obese | OW/Obese |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| Primary | 0.9 | 61.2 | 20.8 | 17.1 | 37.9 |
| Middle | 1.2 | 55.5 | 23.4 | 19.9 | 43.3 |
| Secondary | 1.6 | 58.8 | 23.6 | 16.0 | 39.6 |
| **Total** | **1.2** | **59.5** | **22.1** | **17.3** | **39.4** |

**Table 6: BMI distribution of children by school phase**

### *School phase by sex*

Figure 3 shows the OW/obesity rates, by school phase and sex, in children and adolescents in Years 1 to 11. There was a significant, but weak, difference in the BMI of males across school phases. In Middle school, males were 8 percentage points less likely to have a normal weight than in primary or secondary school, with only 51.0% of Middle school boys falling within the normal parameter. Conversely, Middle school boys were more likely to be overweight (23.6%) or obese (24.7%) than those in other school phases.

Conversely, there was no statistically significant difference in females across school phases. Females were more likely to have a normal BMI in primary school than in other school phases. The proportion of females who are overweight increased by 5 percentage points between primary (20.6%) and secondary (26.0%). The percentage of girls who are underweight or obese remained largely stable across the three school phases.

Looking at school phases individually, sex and BMI were weakly, but significantly, associated in Primary and Middle school level, but not at Secondary level. In both Primary and Middle school, males were more likely to be overweight or obese than females. In Primary school, 40.0% of males were overweight or obese, while this figure stood at 35% in females. In Middle school, 48.3% of males were overweight or obese, compared with 37.2% of females.

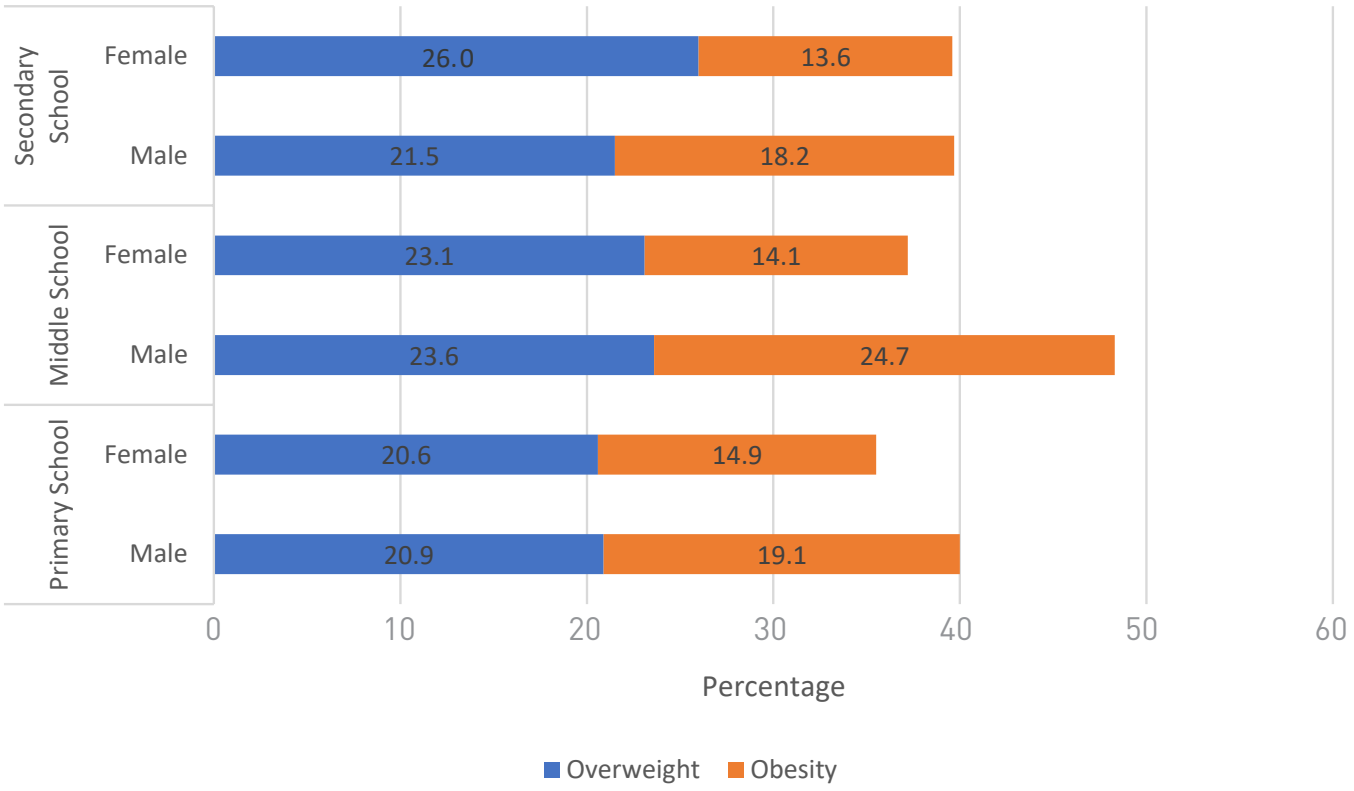



**Figure 3: OW/obesity rates by school phase and sex for children and adolescents in Y1-11**

Figure 4 shows the OW/obesity rates, and obesity rates by sex and school year for children and adolescents from Y1-11. Among males, the OW/obesity rate increased between Year 3 (32.6%) and Year 4 (47.7%). Overweight and obesity in boys peaked in Year 8, affecting just over half the children (50.2%), where the overweight rate was higher than in other school years. However, the obesity rate among males was highest in Year 5 (27.8%).

Among females, the rate of OW/obesity increased between Year 1 (27.6%) and Year 5, where it peaked at 46.2% because of an increased obesity rate (24.2%). It fluctuated between 35.2% and 43.3% in subsequent school years.

The obesity rates for both males and females increased between Year 3 and Year 4.
This warrants further exploration.

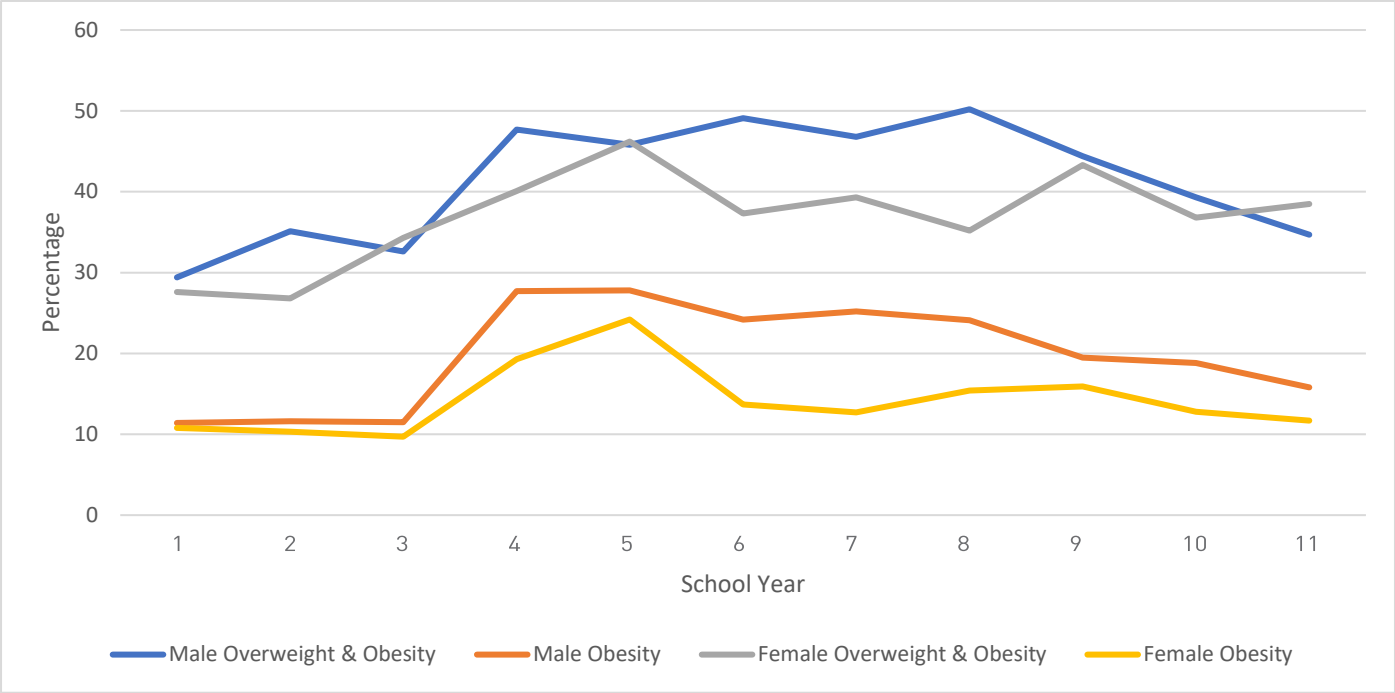



**Figure 4: OW/obesity rates, and obesity rates by sex and school year for children and adolescents from Y1-11**

## Determinants of and intervention levels for OW/obesity

The cause of OW/obesity is an energy imbalance between calories consumed and calories expended (15). However, obesity is a more complex problem comprising many interlinked variables, as shown by the Research Framework for Childhood Obesity in Figure 5 (29).

This model uses a socio-ecological approach putting the individual at the centre. The first and most proximal layer includes non-modifiable genetic or biological factors, and modifiable personal, behavioural, and family and peer factors. The second, middle layer includes food and physical environments, community policy and practices, media advertising and promotions, and cultural factors. The third and most distal layer includes governmental, school and organisation policies, food production and economic influences (29).

Considering the complex interplay of the various determinants of obesity, no single intervention can truly impact the obesity epidemic (19). WHO provides Member States with a compendium of interventions across the life course and interventions that are specific to the different stages of the life course (19).

However, there are several barriers that need to be addressed for successful obesity policy implementation. These barriers include the continuing insistence that obesity is an individual, rather than societal, responsibility, not giving enough importance to the upstream determinants of obesity (e.g., sociocultural, economic, built, and natural environments, food environments, etc.), prioritising economic factors over health, and difficulty in securing cross-sectoral engagement (19). These need to be taken into consideration when planning national health strategies.

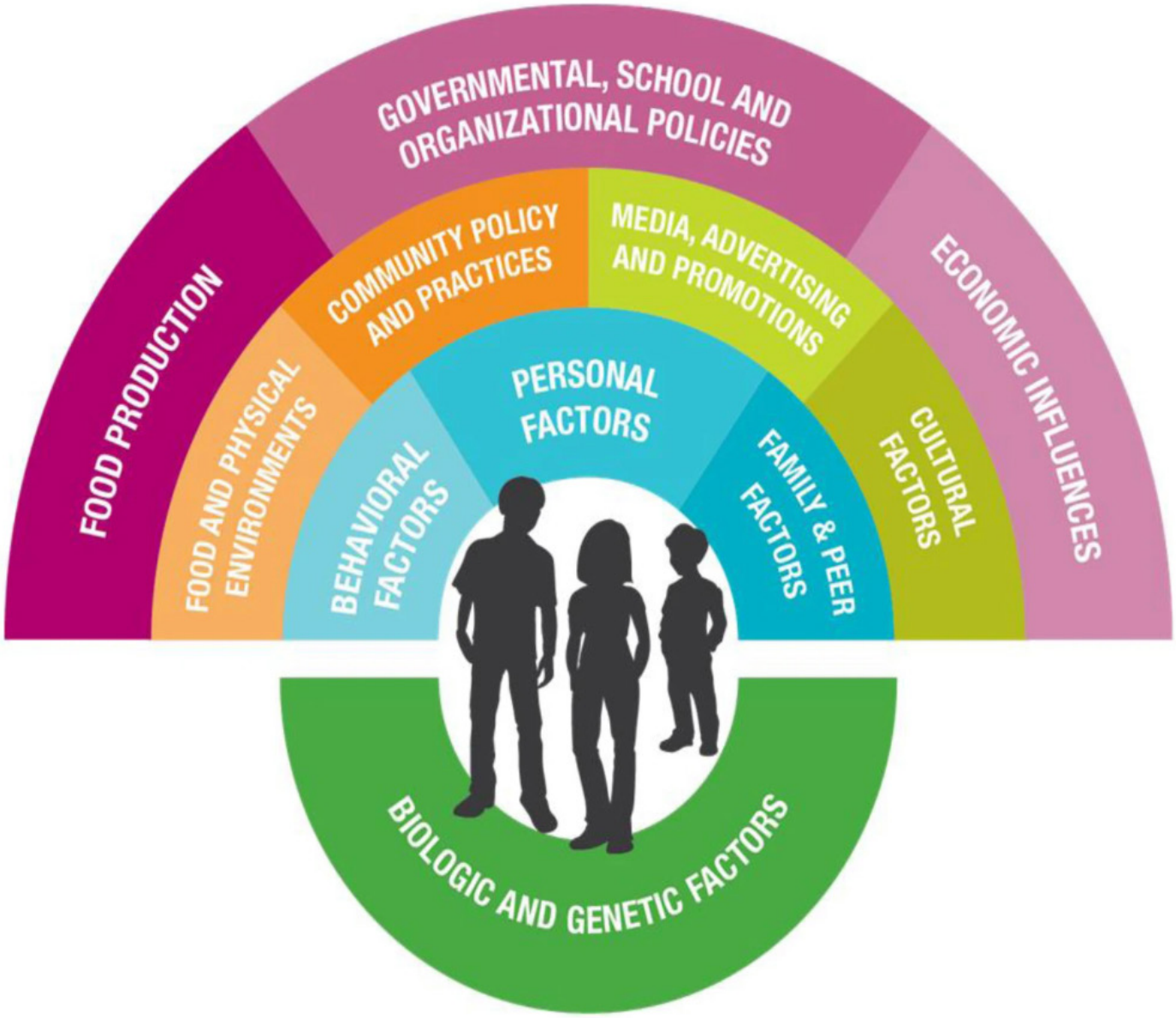
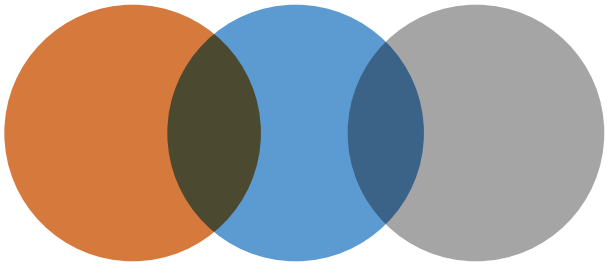



**Figure 5: Research Framework for Childhood Obesity. Source: Michael & Susan Dell Center for Healthy Living**



# Eating habits

A healthy diet is important to prevent all forms of malnutrition and noncommunicable diseases (30). However, it has become increasingly difficult to adhere to a healthy diet due to increased availability of processed foods, rapid urbanization, and changing lifestyles which have led to consumption of foods high in fat, free sugar and salt/sodium, and low in dietary fibre (30).

**Overall, a healthy diet revolves around the following (30):**

- Exclusive breastfeeding for the first 6 months of the child's life and continuously breastfeeding until two years and beyond;
- Balance energy intake and expenditure;
- Minimum daily intake of 400g fruit and vegetables (excluding starchy roots);
- Limit fat intake (fats: 30%; saturated fats: 10%; trans-fats: 1% of total energy intake);
- Shift saturated and trans-fat intake towards unsaturated fats;
- Limit the intake of free sugars to less than 10% (or even less than 5% for additional health benefits) of total energy intake;
- Limit salt intake to less than 5g/day.

The Dietary Guidelines for Maltese Children recommend that children aged 3 to 12 years consume 1 serving of complex carbohydrates, 2 servings of vegetables, and 1 serving of protein per meal (31). In a single day, children should also have 3-4 servings of cereal, 3-5 servings of vegetables, 2-3 servings of fruit, 2-3 servings of milk and milk products, 1-2 servings of protein, 1-2 servings of fats, and drink mostly water (31).

The forthcoming part of the report focuses on breastfeeding, the frequency of breakfast consumption, the frequency of consumption of healthy foods, specifically fruit and vegetables, the frequency of unhealthy snacks, specifically savoury and sweet snacks consumption, and the frequency of sugar-sweetened beverage consumption.

# Breastfeeding

### *Background/importance*

Breastfeeding is the gold standard of infant nutrition, providing immediate and long-term benefits to both the child and the mother (32–34). For the infant, short-term benefits include protection against gastrointestinal and respiratory infection (32), while long-term benefits include protection against OW/obesity and diabetes mellitus (33,34). Compared to children who were breastfed for at least 6 months, obesity likelihood increases in children who were breastfed for a shorter duration[5] and more so in children who were never breastfed[6] (35). Malta-specific analysis showed that, when compared to children who were breastfed for at least 6 months, children who were never breastfed[7] or breastfed for a shorter period[8] were more likely to be obese (35).

### *International guidelines*

- The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend the following:
- early initiation of breastfeeding within 1 hour of birth;
- exclusive breastfeeding for the first 6 months of life; and
- introduction of nutritionally-adequate and safe complementary (solid) foods at 6 months together with continued breastfeeding up to 2 years of age or beyond (36).

The first two recommendations and continued breastfeeding at 1 year were set as infant feeding practice indicators for the Maltese National Breastfeeding Policy and Action Plan (37).

In 2012, the World Health Assembly endorsed a Comprehensive implementation plan on maternal, infant and young child nutrition to increase the rate of exclusive breastfeeding in the first 6 months up to at least 50% by 2025 (38).

### *Data*

With 25% of infants in the WHO European Region exclusively breastfed for the first six months of life between 2006-2012, breastfeeding practices in the WHO European Region are well below global targets (39,40). Current trends in high-income countries (1986 to 2019) show high rates of children who are ever breastfed (91%) with significant declines in the first few months after birth, down to 18% and 45% exclusive and general breastfeeding respectively (41). Furthermore, data on breastfeeding after 6 months is too limited, suggesting that breastfeeding after six months is not a priority for high-income countries (41).

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[5] Adjusted odds ratio (adjOR) [95% CI] 1.12 [1.07-1.16]

[6] adjOR [95% CI] 1.22 [1.16–1.28]

[7] adjOR [95% CI] 1.69 [1.23–2.33]

[8] adjOR 1.36 [1.00–1.85]

## 2022

Routine data on breastfeeding in Malta is limited. The National Obstetric Information System captures feeding habits at the time of hospital discharge, which is generally 2-5 days after delivery. Between 2001 and 2020, whilst general (exclusive and mixed) breastfeeding increased from 60.4% to 72.6%, exclusive breastfeeding remained stable at just under 50% (42,43). According to COSI 2015/2017 data, in Malta, 35.2% of children were never breastfed, 40.2% of children were breastfed for less than six months, and 24.6% were breastfed for more than 6 months. Exclusive breastfeeding for the first six months was not reported for Malta (35). In 2017, prevalence data for early initiation of breastfeeding within one hour of birth, exclusive breastfeeding under 6 months and continued breastfeeding at 1 year stood at 64.4%, 9.6%, and 10.4%, respectively (44).

In 2018, a World Breastfeeding Trends Initiative (WBTi) was carried out to assess Malta's Infant and Young Child Feeding (IYCF) policies, programmes, and practices across fifteen indicators. Overall, Malta achieved a IYCF score of 65.5 out of 150, with several indicators noted to be of concern (45). Whilst the report stated that a national breastfeeding and infant and young child policy is in order and being carried out to some degree, finite human and financial resources hinder implementation (45). At the time of assessment, none of the three hospitals were considered Baby Friendly, and there were limited training and educational campaigns (45). Monitoring and evaluation indicators were particularly weak especially for practice indicators on infant and young child feeding, as no national data is available for these indicators (45).

### *Results from the KG2 2022 National Survey*

95.5% of participants[9] responded to the question related to breastfeeding. The weighted breastfeeding rates were as follows: children who were never breastfed stood at 22.2%; those who were breastfed for less than six months stood at 40.0%; and those who were breastfed for more than 6 months was 37.8%.

Comparing the results obtained in this study with the results from COSI 2015/2017, weighted breastfeeding rates appear to be improving (35). Children who were never breastfed decreased from 35.2% to 22.2%, while children who were breastfed for more than 6 months increased from 24.6% to 37.8% (35). The rates of children who were breastfed for less than six months remained approximately the same (35).

### *Determinants of and interventions for breastfeeding*

An understanding of the socioecological model of breastfeeding is necessary to promote breastfeeding. This comprises societal, group, and individual level factors that impact breastfeeding (46). Society-level factors include younger parents, low parental education and single parenthood (46). Group-level factors include inappropriate communication from healthcare staff, negative influences, poor support from family members, return to work or school, and lack of privacy in private and public spaces (46). Individual-level factors include inability to breastfeed, insufficient breast milk, caesarean section delivery and mothers with poor knowledge on breastfeeding (46).

Several interventions are required to increase breastfeeding rates (47). WHO recommends the implementation of the Baby-Friendly Hospital Initiative by ensuring that every hospital providing maternity services and care for newborn infants improves breastfeeding rates through ten steps (47):

[9] Unweighted data.

- Have a written breastfeeding policy that is routinely communicated to all healthcare staff.
- Train all healthcare staff in skills necessary to implement this policy.
- Inform all pregnant women about the benefits and management of breastfeeding.
- Help mothers initiate breastfeeding within a half-hour of birth.
- Show mothers how to breastfeed, and how to maintain lactation even when separated from their infants.
- Give newborn infants no food or drink other than breastmilk unless medically indicated.
- Practise rooming in - allow mothers and infants to remain together - 24 hours a day.
- Encourage breastfeeding on demand.
- Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.
- Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

**Other interventions that could improve breastfeeding rates include:**

- Educating the public about the importance and benefits of breastfeeding (37,48);
- Educating the immediate family and provide lactation support through home visits by community health workers (37,48);
- Integrating breastfeeding management into undergraduate and postgraduate curricula, especially of lactation support personnel (37,49);
- Legislating for increased availability of breastfeeding spaces in public spaces and workplaces (48,49);
- Increasing maternal leave and parental leave, and improving workplace measures that support lactating mothers to continue to breastfeed (37,49);
- Adopting the International Code of Marketing of Breast-milk Substitutes through legislation and policies (37,49);
- Ensuring active National Breastfeeding Committees (49);
- Setting up a sustainable monitoring and data management system to evaluate breastfeeding indicators (37,41,49). Such systems must cover both public and private sectors, collect data in line with the WHO definitions, and ensure that system users are well-trained in data entry (41).

Many of these interventions were included within the policy initiatives of the National Breastfeeding Policy and Action Plan 2015-2020 (37).

# Breakfast consumption

### *Background/importance*

Breakfast is often described as the most important meal of the day (50). Regular, nutritious breakfast in children and adolescents improves cognitive function, academic outcomes, quality of life, health, and well-being (50).

Breakfast skipping is positively associated with OW/obesity, including in children and adolescents (51). In a systematic review on 286,804 children and adolescents across 33 countries from around the world, children and adolescents who skipped breakfast were 94.7% more likely to be overweight or obese (51). In a meta-analysis for cross-sectional studies (14 studies), children and adolescents who skipped breakfast were 43% more likely to be obese when compared to their peers who ate breakfast regularly[10] (52). Finally, skipping breakfast resulted in worse cardiometabolic risk factors including worse lipid profiles, higher blood pressure levels, and higher insulin resistance (53).

### *Data*

Despite this clear association, skipping breakfast is commonplace, with the prevalence of breakfast skipping being 10-30%[11] (53). The pooled estimated daily breakfast consumption of 6–9-year-old children from the WHO European Childhood Obesity Surveillance Initiative (COSI) 2018–2020 was 75%, ranging from 44% to 94% (24). In Malta, this stood at 54.4% (24).

According to 2018 HBSC data, daily breakfast consumption stood at 61% for boys and 55% for girls with decreasing rates from 2014 to 2018. The rates among 11-, 13- and 15-year-old Maltese boys/girls stood at 61%/50%, 55%/41%, and 50%/44%, respectively (27).

### *Results from the KG2 2022 National Survey*

Weighted breakfast consumption rates among children attending KG2 are illustrated in Figure 6. 98.7% of participants[12] responded to the question related to breakfast consumption. Daily breakfast consumption among children attending KG2 stood at 43.2%, which was considerably lower than that of 7-year-old Maltese children from the WHO European COSI 2018-2020 and Maltese adolescents from the HBSC 2018 (24,27).

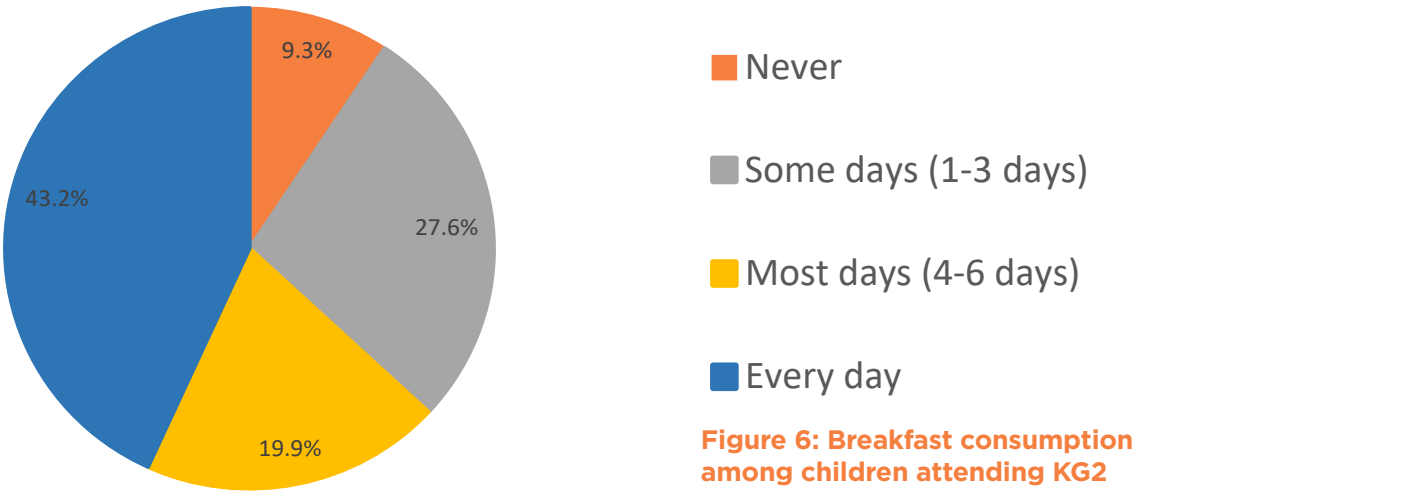


**Figure 6: Breakfast consumption among children attending KG2**

[10] odds ratio (OR): 1.43; 95% CI: 1.32, 1.54

[11] mean +/- SD: 16.0 +/- 16.2%

[12] Unweighted data.

### *Results from KG2-Y11: Breakfast consumption on the day of measurement*

7,092 children in KG2-Y11 responded to the question regarding breakfast consumption, just under 60% of whom claimed to have eaten breakfast on measurement day[13]. In Y1-11, 5,222 students responded to the breakfast question, 5,091 of whom met the inclusion parameters of the study. Breakfast was defined as any food intake (including liquified solid foods) prior to the commencement of lessons. The statistics presented in this report are limited to breakfast intake on measurement day, which cannot be extrapolated to make generalisations about the children's regular breakfast intake. Breakfast intake among younger students seemed to be more prevalent than among older students (see Figure 7). While 74% of children in KG2 reported having had breakfast, this decreased to 62.4% in primary and 58.6% and 56.2% in middle and secondary school, respectively. The lowest breakfast intake was reported by Year 11s, only half of whom (51.6%) reported having had breakfast on measurement day.

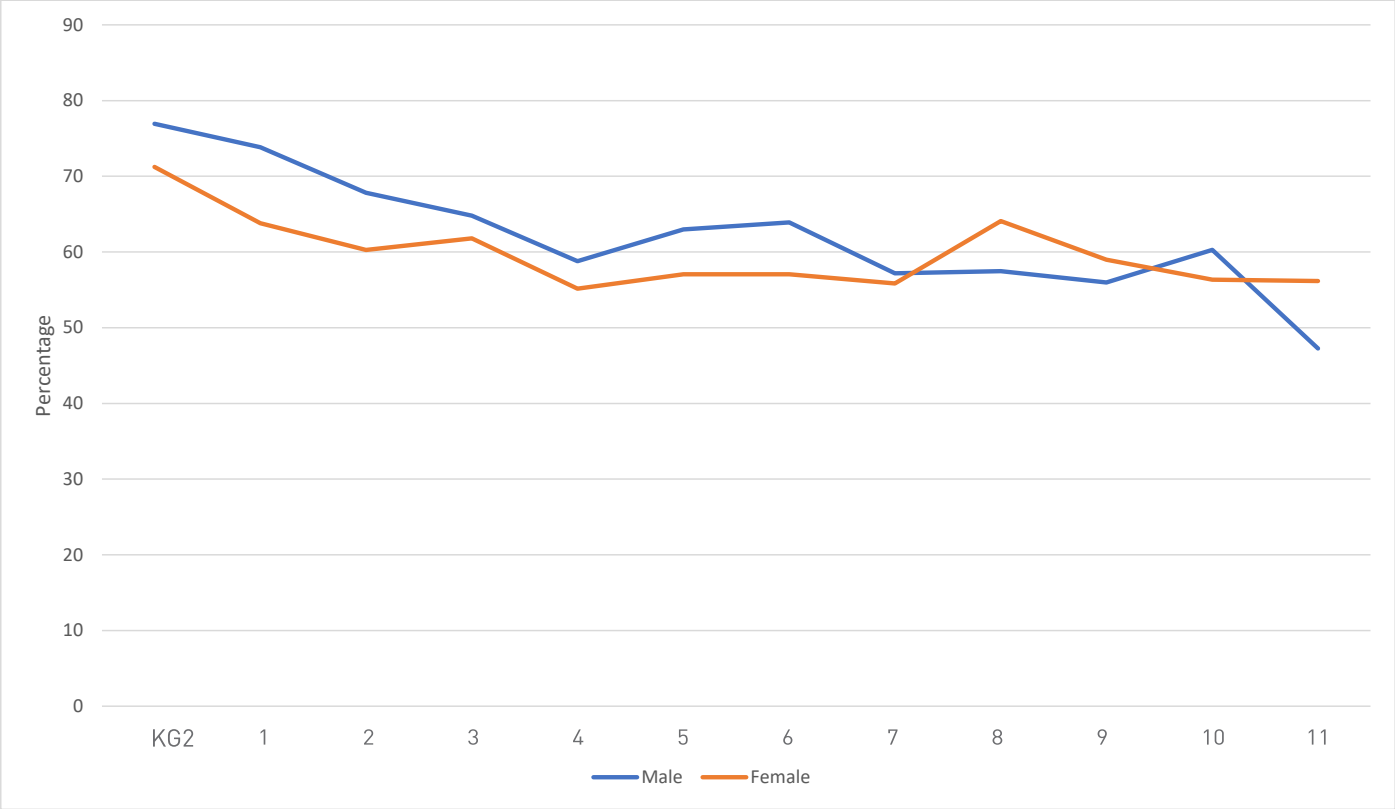


**Figure 7: Breakfast consumption on measurement day in children and adolescents from KG2-Y11, by sex**

### *Associations between breakfast intake and BMI*

Breakfast intake on measurement day was weakly associated with BMI (not OW/obese and OW/obese) among children in Y1-11. Therefore, children who had breakfast on measurement day were slightly less likely to be OW/obese (36.9%) than those who did not (42.5%). Similarly, breakfast intake on measurement day was more popular among those who were not OW/obese (63.1%) than those who were (56.6%). The slight association between breakfast intake and BMI (not OW/obese and OW/obese) was retained when disaggregating by sex (see Figure 8). Therefore, both males and females in Y1-11 who had breakfast were slightly less likely to be overweight or obese than those who had not had breakfast. Notwithstanding the above, boys, both those who had breakfast on measurement day and those who did not, remained more likely to be OW/obese than females.

[13] Unweighted data.

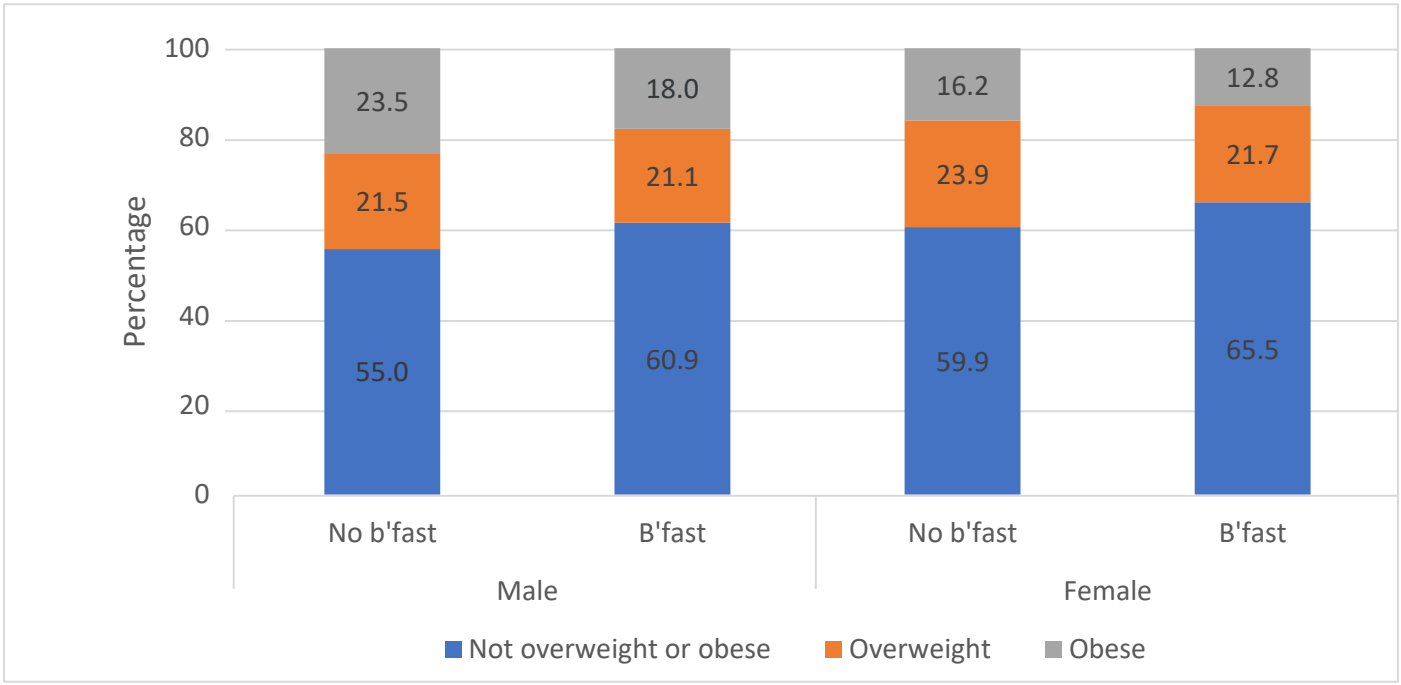


**Figure 8: BMI distribution by breakfast intake on measurement day among children in Y1-11, by sex**

Additionally, when disaggregating for school phase and year, breakfast intake and BMI (not OW/obese and OW/obese) were only weakly associated in middle school and secondary school, and in Years 8, 10 and 11. This means that breakfast consumption on measurement day only impacted BMI in the aforementioned cohorts. Disaggregating by sex, a weak association between breakfast intake on measurement day and BMI was detected among females in middle school and males attending secondary school. The prevalence of OW/obesity among middle school females who did not have breakfast stood at 43.4% (vis-à-vis 33.8% among those who had breakfast on measurement day). The prevalence of OW/obesity among secondary school males who did not have breakfast stood at 47.1% (vis-à-vis 33.7% among those who had breakfast). Looking at school years individually, the two variables were only weakly associated among females in Year 7, as well as males in Years 6, 8, 10 and 11. Since only weak associations between breakfast intake on measurement day and BMI were observed, the data in this report seems to contrast the literature indicating that breakfast positively impacts BMI (51,52). Nonetheless, the differences may only be slight in this study because benefits of breakfast intake are likely to depend on the breakfast composition (54), and regularity of intake, both of which are outside the scope of this report.

### *Determinants of and interventions that improve daily breakfast consumption*

The family environment is a powerful mediator of daily breakfast consumption. Parental breakfast eating (55) and living in two parent families (56) were positively associated with adolescent breakfast consumption. The reverse was true for socioeconomic deprivation (55,56). Daily breakfast consumption is also more common among boys (56). In a systematic review, Ricotti et al. found that multi-level interventions, such as national breakfast promotion campaign and delaying school start time by one hour, led to a decrease in breakfast skipping in children and adolescents (57). Breakfast consumption led to overall improvements in daily nutritional intake, such as decreased consumption of sugar-sweetened beverages and foods which are high in fat and sugar (57). Finally, interventions that promote breakfast consumption may result in lower rates of overweight/obesity in the long-term, but not in the short-term (57). Free breakfast club services are available in state primary schools in Malta (58).

# Fresh fruit and vegetable consumption

### *Background/importance*

Diets rich in fruit and vegetables are conducive to healthy outcomes (59). It is important that children and adolescents adopt healthy dietary behaviours, since such beneficial behaviours are carried on into adulthood (60,61).

### *Data*

Preschool children in Mediterranean countries in the European Union tend to frequently consume fruit and vegetables (62). Among Portuguese preschool children, daily consumption of fresh fruit and vegetables was 86% and 92%, respectively (63). The pooled estimated proportion of 6–9-year-old children from the WHO European Childhood Obesity Surveillance Initiative (COSI) 2018-2020 who consumed fresh fruit every day was 43%, ranging from 23% to 63% (24). In Malta, this stood at 43.9% (24).

According to 2018 HBSC data, daily fruit consumption stood at 40%: 43% for boys and 37% for girls, with increasing rates from 2014 to 2018. The rates among 11-, 13- and 15-year-old Maltese boys/girls stood at 43%/44%, 30%/34%, and 34%/34%, respectively (27).

The pooled estimated proportion of 6–9-year-old children from the WHO European Childhood Obesity Surveillance Initiative (COSI) 2018-2020 who consumed vegetables every day was 34%, ranging from 13% to 57% (24). In Malta, this stood at 14.8% (24).

According to 2018 HBSC data, daily vegetable consumption stood at 38%; 35% for boys and 42% for girls, with increasing rates from 2014 to 2018. The rates among 11-, 13- and 15-year-old Maltese boys/girls stood at 23%/29%, 23%/28%, and 24%/25%, respectively (27).

### *Results from the KG2 2022 National Survey*

Weighted fruit and vegetable consumption rates among children attending KG2 are illustrated in Figure 9. 98.9% and 98.1% of participants[14] responded to the question related to fresh fruit and vegetable consumption, respectively.

Daily consumption of fresh fruit among children attending KG2 in 2022 was 48.5%, that is slightly higher than that of 7-year-old Maltese children from the WHO European COSI 2018-2020 and considerably higher than that of Maltese adolescents from the HBSC 2018 (24,27).

Daily consumption of vegetables among children attending KG2 in 2022 was 14.5%, similar to that of 7-year-old Maltese children from the WHO European COSI 2018-2020 and considerably lower than that of Maltese adolescents from the HBSC 2018 (24,27).

[14] Unweighted data.

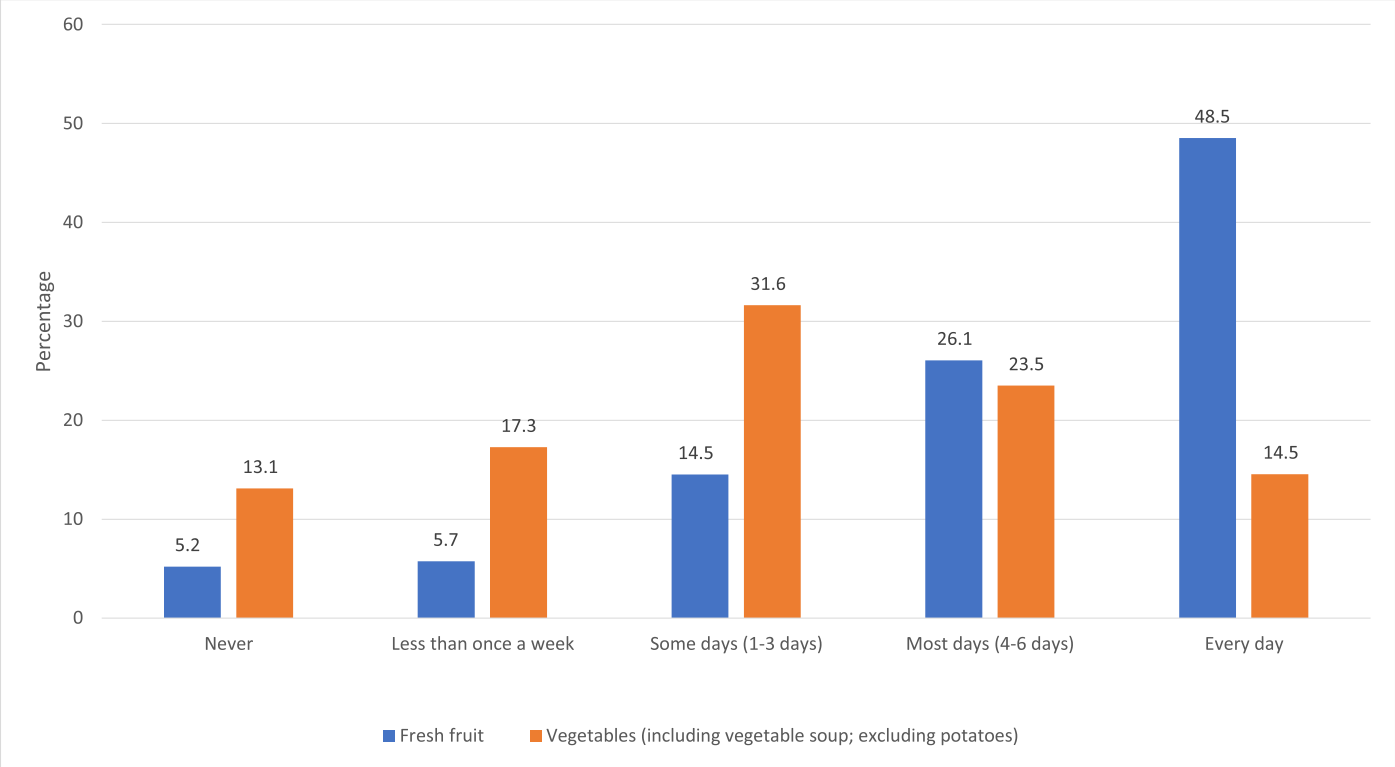


**Figure 9: Fruit and vegetable consumption among children attending KG2**

### *Determinants of and interventions that improve fruit and vegetable consumption*

According to a systematic review, fruit and vegetable consumption in children is positively related to home availability, family rules and parental encouragement (64). Fruit, fruit juice and vegetable consumption are positively associated with parental modelling and parental intake, as are parental education and occupational status (64).

A recent umbrella review looked at the effectiveness of intervention strategies to promote fruit and vegetable consumption among children and adults (65). School-based strategies that targeted policy or the school food environment, such as a food standards policy, providing fruits and vegetables at either a reduced price or free, and increased availability of fruits and vegetables, were deemed effective (65,66). An example includes the EU school fruit, vegetables and milk schemes (67). Increasing access in other settings, such as the workplace and communities, also increased fruit and vegetable consumption (65). School-based nutrition education was not found to improve fruit and vegetable consumption (65).

The findings of a Cochrane review show that multicomponent interventions and child-feeding practice interventions are effective at improving fruit and vegetable consumption rates among children under 5 years of age (68). Multicomponent interventions, such as teacher and parent education, and preschool policy changes, were found to have a small positive effect on fruit and vegetable consumption[15], especially when the interventions were specific to fruit and vegetable consumption rather than general nutrition (68).

[15] standardised mean differences (SMD) 0.32, 95% CI 0.09 to 0.55; 9 trials

Child-feeding practice interventions, such as repeated exposure (for example, different preparation methods, offering a choice of vegetables) and linking fruit and vegetables to rewards, were found to have a small positive effect on child vegetable consumption[16]. Parent nutrition education interventions were not found to be effective at increasing fruit and vegetable consumption among children under 5 years of age[17] (68). Similarly, the evidence for school-based and primary care-based strategies that focused on nutrition awareness and education and skill development were mixed (65). Child nutrition education interventions (2 trials) and child-focused mindfulness interventions (1 trial) appear to have a positive effect on increasing fruit and vegetable consumption (68). Other intervention strategies that improve fruit and vegetable consumption in children and adults include eHealth, mass media, household gardens, and fiscal interventions (65).

Two reviews examined fiscal interventions. Pooled data found that a 10% subsidy in the price of fruits and vegetables increased their consumption by 14% (95% CI: 11 to 17%) (n = 9 primary studies) (69). Another review found that a 10% increase in the price of fruits and vegetables decreased their consumption by 7.2% in low-income countries, 6.5% in medium income countries, and 5.3% in high income countries. Furthermore, price increases on unhealthy foods resulted in increasing consumption of fruits and vegetables (70).

[16] SMD 0.50, 95% CI 0.29 to 0.71; 19 trials

[17] SMD 0.13, 95% CI −0.02 to 0.28; 11 trials

# Snack consumption

### *Background/importance*

There is no universal definition of snacking, with snacking sometimes considered as a food type or eating between main meals (71). In this study, snacks are considered a food type. Consuming snacks is likely to contribute to a higher energy intake (71) and hence to OW/obesity (72). Despite not being conducive to good health (30), savoury and sweet snacks are popular food choices (73).

### *Data*

Preschool children in Mediterranean countries in the European Union tend to frequently consume snacks (62). In a study among Portuguese preschool children, daily consumption of cakes and candies was 65%, and consumption of salty snacks (such as pizza, hamburger, French fries, and packed snacks) 1 to 4 times per week was 73% (63).

The pooled estimated proportion of 6–9-year-old children from the WHO European Childhood Obesity Surveillance Initiative (COSI) 2015–2017 who consumed savoury snacks daily was 5.2%, ranging from 0.0% to 21.5%, while 10.3% consumed sweet snacks daily, ranging from 0.4% to 22.8% (74). In Malta, consumption of savoury and sweet snacks stood at 4.4% and 15.0% respectively (75).

According to 2018 HBSC data, daily sweet consumption stood at 25%; 23% for boys and 27% for girls, with decreasing rates from 2014 to 2018. The rates among 11-, 13- and 15-year-old Maltese boys/girls stood at 34%/39%, 32%/41%, and 42%/43%, respectively (27).

### *Results from the KG2 2022 National Survey*

Weighted savoury and sweet snack consumption rates among children attending KG2 are illustrated in Figure 10. 93.2% and 93.3% of participants[18] responded to the questions for savoury snacks and sweet snacks consumption. The proportion of children in KG2 who consumed savoury snacks and sweet snacks every day was 4.6% and 14.8%, respectively, similar to that of 7-year-old Maltese children from the WHO European COSI 2015-2017 and considerably lower than that of Maltese adolescents from the HBSC 2018 (27,75).

[18] Unweighted data.

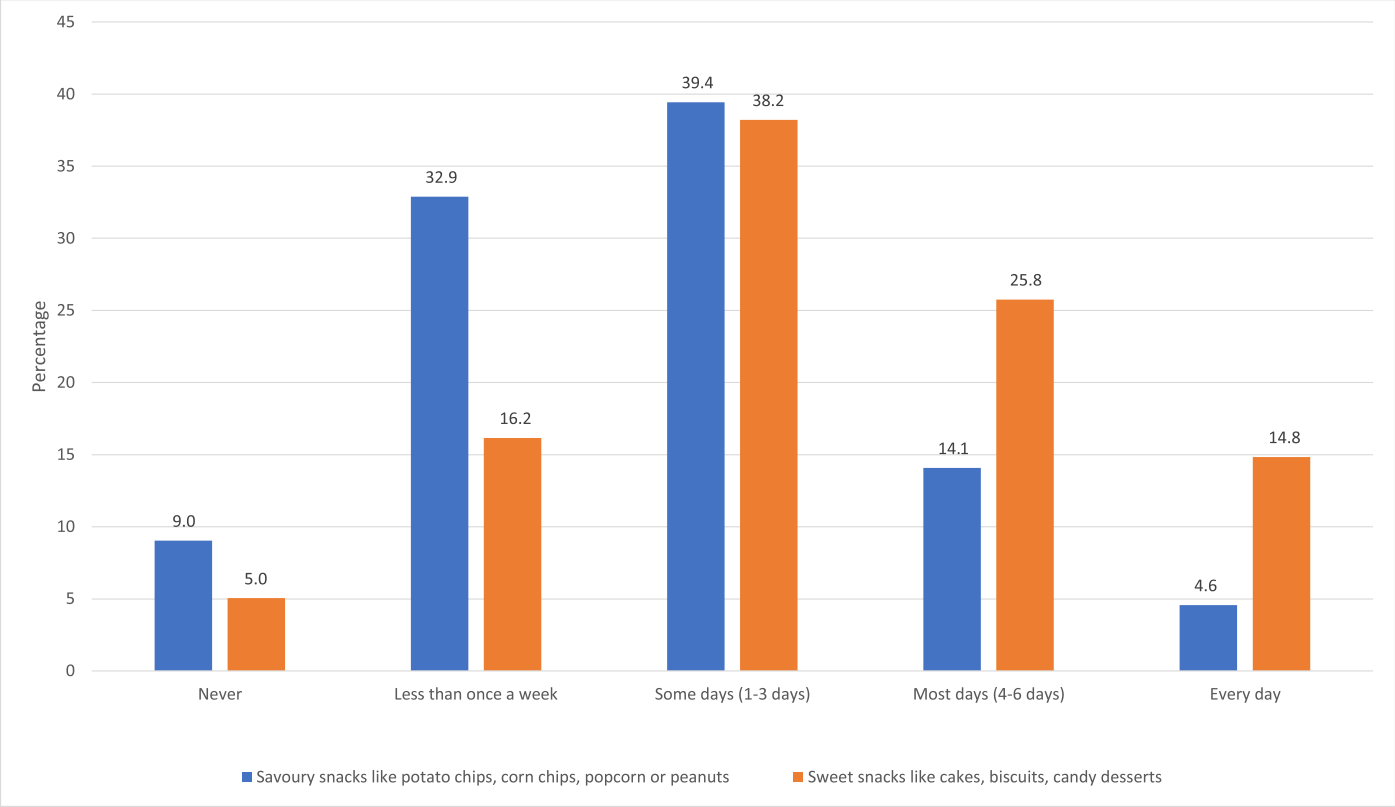


**Figure 10: Savoury snack and sweet snack consumption among children attending KG2**

### *Determinants of and interventions that reduce snack consumption*

Parental restriction of food and home access to unhealthy foods have consistently been associated with snacking among young children (71). This could be explained through the development of disinhibited eating whereby cues for eating are external, rather than internal, and may impair food self-regulation (76). There is also a positive association between stress and unhealthy eating in children, which may begin as early as middle childhood (77).

School food environment policies can promote healthy diets in children (66). School meal standards reduce total fat, saturated fat intake, and sodium intake by 1.5%, 1%, and 170 mg/d, respectively (66). Nutrition standards on food sold to children reduce unhealthy snack intake by 0.17 servings/d (n = 2 (-0.22, -0.13)) (66). Nutrition education interventions can be effective in positively influencing children's dietary choices, including school and home engagement, and age-appropriate interventions that are of adequate duration and intensity (78).

Food marketing exposure (79,80), including advergame (81), are associated with increased snack consumption in children and adolescents, and evidence suggests that food marketing restrictions result in reduced sales and consumption of unhealthy foods (82).

# Sugar-sweetened beverage consumption

### *Background/importance*

Consumption of sugar-sweetened beverages (SSB), particularly carbonated soft drinks, significantly contribute to free sugar intake and is harmful to health (83). It has been associated with weight gain, obesity, type 2 diabetes, cardiovascular disease and certain cancers (83–87). In a recent meta-analysis including 33 studies with 121,282 participants, excessive SSB consumption was shown to increase BMI [weighted mean difference: 0.75 (95% CI: 0.35-1.15)], waist circumference [weighted mean difference: 2.35 (95% CI: 1.34-3.37)], and body fat percentage [weighted mean difference: 2.81 (95% CI: 2.21-3.41)], in children and adolescents (84).

### *Data*

In a meta-analysis focusing on the WHO Regions of Western Pacific, South-East Asia and the Americas, daily sugar-sweetened beverage consumption in children and adolescents was 326.0 mL (95% CI: 288.3, 363.8), with wide variations across countries (88). In southern Europe, preschool children tend to consume sugar-sweetened beverages frequently, with daily consumption reaching half of Portugal's preschool children (62,63). In the WHO European Region (2018-2020), the pooled estimated proportion of 6–9-year-old children who consumed sugar-containing soft drinks on more than three days a week was 22%, ranging from less than 2% to 41% (24). Daily consumption was 16% among 11, 13 and 15 year-olds: 18% for boys and 14% for girls (27). Overall, Malta recorded 15.5% among 7 year olds who consumed sugar-containing soft drinks on more than three days a week, with 7.6% reporting daily consumption (24). Daily consumption was 24%/25%, 24%/22%, and 29%/23% among 11-, 13-, and 15-year-old Maltese boys/girls, respectively (27).

### *Results from the KG2 2022 National Survey*

Weighted consumption rates of soft drinks containing sugar, and fruit juices, smoothies or squashes among children attending KG2 are illustrated in Figure 11. 97.% and 93.1% of participants[19] responded to these questions, respectively. The proportion of children who consumed sugar-containing soft drinks on more than three days a week and every day was 9.9% and 4.4%, respectively. That is lower than that of 7-year-old Maltese children from the WHO European COSI 2018-2020 and considerably lower than that of Maltese adolescents from the HBSC 2018 (24,27).

The proportion of children who consume fruit juices, smoothies, or squashes on more than three days a week and every day was 23.0% and 9.8%, respectively.

[19] Unweighted data.

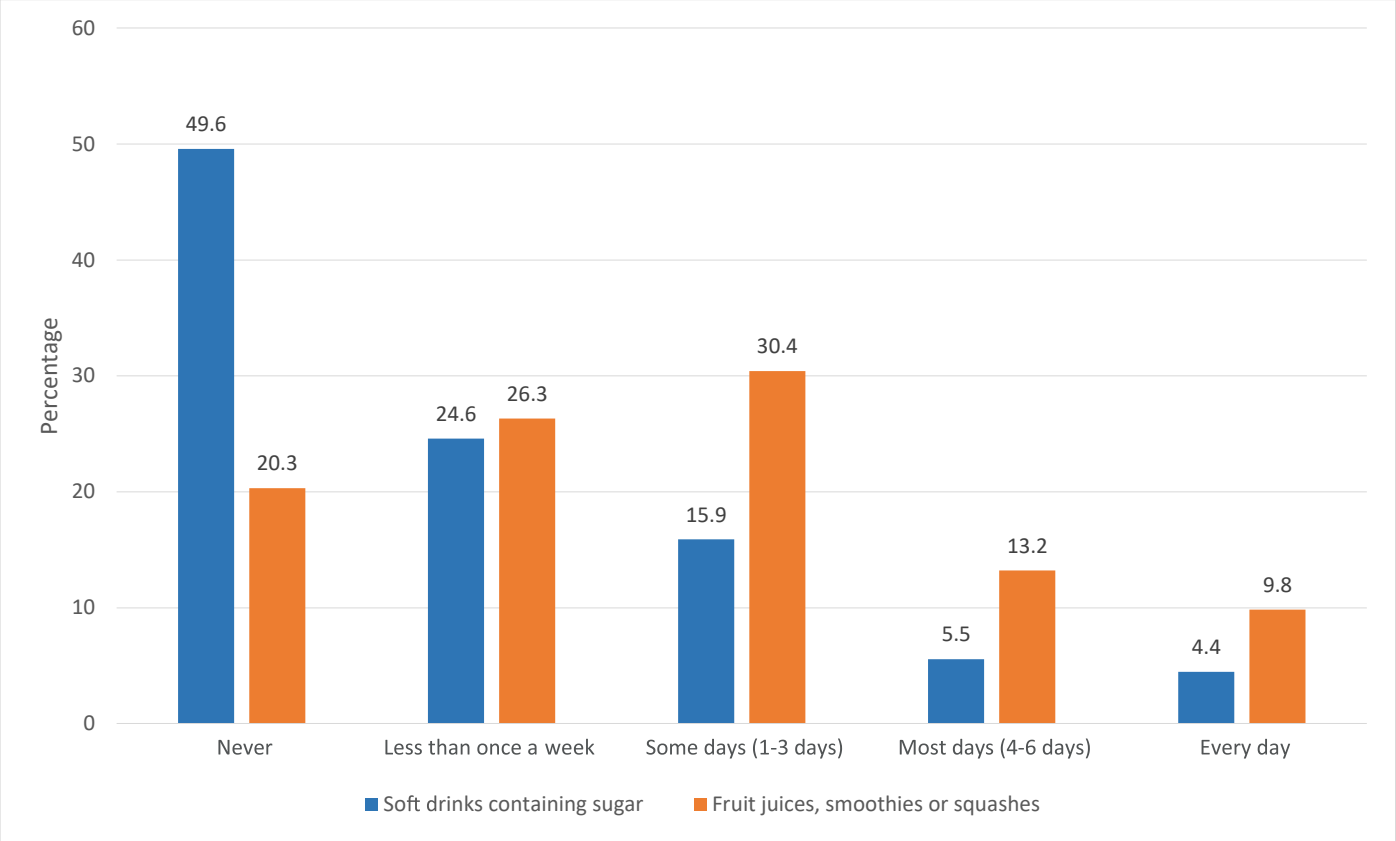


**Figure 11: Consumption of soft drinks containing sugar, and fruit juices, smoothies or squashes among children attending KG2**

### *Determinants of and interventions for reducing SSB consumption*

The socioecological model can be used to categorise the correlates or determinants of SSB consumption in children (89). This comprises individual, interpersonal, and environmental level correlates or determinants (89). At individual-level, SSB preference, screen time, and snack consumption were associated with higher SSB consumption in children (89). At interpersonal-level, children having younger parents, parents with lower levels of education, occupation and income, single parents, or parents who consume SSB themselves, are more likely to consume SSB (89). At environmental-level, school nutrition policies are associated with lower SSB consumption, whilst home availability is associated with higher SSB consumption (89).

Several public policies can help to reduce SSB consumption (83). These include SSB taxation; limiting SSB access in schools, healthcare facilities, government institutions and public spaces, whilst ensuring access to potable water; regulation to prevent marketing of unhealthy food and beverages in the media and during sporting events; public health education campaigns; and front-of-package warning labels (83). SSB taxation decreases sales and consumption: a 10% SSB tax decreases sales and consumption by 10% (95% CI: -5.0% to -14.7%) (90). Furthermore, a tiered tax on SSBs based on sugar content decreases sugar sales without decreasing overall purchasing volume, indicating that manufacturers are successfully reformulating their products (91).

# Physical activity and screen time

## Physical activity

### *Background/importance*

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure above resting level (92). This includes walking, cycling, sport, and active play (92). Regular physical activity decreases the risk of noncommunicable diseases such as heart disease, stroke, diabetes, and certain and cancers (92). It also improves blood pressure, helps maintain a normal weight, improves mental health and overall wellbeing (92).

In a meta-analysis in pre-school children, García-Hermoso et al., showed that exercise interventions are effective in improving body composition indicators, namely body mass index[20], waist circumference[21], and body fat percentage[22] (93). Exercise interventions were also shown to improve cardiorespiratory fitness[23], lower-body muscular strength[24], and speed-agility[25] (93). In a recent systematic review, Pate et al. found that physical activity was positively associated with lower OW/obesity in children under six years of age. Furthermore, higher levels of physical activity were found to be associated with stronger bones and possibly better cognitive outcomes (94).

### *WHO guidelines*

Physical activity is defined as any bodily movement produced by skeletal muscles that results in WHO recommends that children 3-4 years of age should spend at least 3 hours daily in various physical activities at any intensity, of which at least 1 hour should be moderate- to vigorous-intensity physical activity, spread throughout the day, stating that more is better (92). For children 5-17 years of age, the minimum daily recommendation is 60 minutes of moderate-to-vigorous intensity, mostly aerobic physical activity, and muscle- and bone-strengthening activities at least 3 days a week (92).

[20] g = - 0.17; 95% CI - 0.31-0.03

[21] g = - 0.25; 95% CI - 0.47-0.03

[22] g = - 0.31; 95% CI - 0.60-0.23

[23] g = 0.25; 95% CI - 0.08-0.42

[24] g = 0.25; 95% CI - 0.09-0.40

[25] g = - 0.51; 95% CI - 0.78-0.24

### *Data*

There is a dearth in the literature on the prevalence of physical activity in preschool children (95). In a systematic review carried out on 39 studies published across just over two decades, about half of preschool children (n=10,316) did not do enough physical activity (96). In a more recent systematic review among preschool children, the prevalence of light physical activity and moderate-to-vigorous physical activity was between 3.9%-32.6% and 1.7%-41.2%, respectively (97).

One of the main challenges in monitoring the prevalence of physical activity among preschool children is obtaining comparable data across countries, seeing that this cohort does not attend compulsory education (95). Several initiatives are being developed to overcome this information gap, including the International Study of Movement Behaviours in the Early Years (98), the Sleep and Activity Database for the Early Years (99), the Active Healthy Kids Global Alliance (100), and the Childhood Obesity Surveillance Initiative (under 5) (101).

In a pooled prevalence study emanating from the results of the WHO European Childhood Obesity Surveillance Initiative (COSI) 2018-2020 across 27 countries, just over half (53%) 6-9 year old children practiced sport for at least two hours per week, with 40% of children not performing any sport (24). 56.5% of Maltese 7-year-old children spent at least 2 hours a week practicing a sport with just under one-third (31.0%) of children not performing any sport (24). 87% of children between 6-9 years of age spent at least one hour daily in active play, while this stood at 70.7% for Maltese children (24).

According to 2018 HBSC data, children who reported at least 60 minutes of moderate-to-vigorous physical activity per day stood at 19%: 23% for boys and 16% for girls, with decreasing rates from 2014 to 2018. The rates among 11-, 13- and 15-year-old Maltese boys/girls stood at 29%/19%, 22%/44%, and 15%/5% respectively (27). Children who reported vigorous physical activity four or more times per week stood at 49% for boys and 35% for girls, with rates remaining stable from 2014 to 2018. The rates among 11-, 13- and 15-year-old Maltese boys/girls stood at 51%/42%, 47%/35%, and 39%/20% respectively (27).

### *Results from the KG2 National Survey*

Figure 12 and Figure 13 show the weighted time spent on extra-curricular sport or physical activity per week and playing actively/vigorously per day among children attending KG2, respectively. For ease of reference, 'extra-curricular sport or physical activity' will henceforth be referred to as 'sports participation', while 'playing actively/vigorously' will be referred to as 'active play'. 95.5% and 95.6% of participants[26] responded to the question on sports participation and active play, respectively.

The proportion of children who participated in sport for at least 2 hours weekly was 65.9%, while that of children who spent at least 1 hour per day playing actively/vigorously was 90.4%. Participating in sport for 2 hours or more weekly appears to decrease from early childhood to middle childhood from 65.9% to 56.5% (24). Time spent in active play for at least 1 hour per day appears to decrease from early childhood to middle childhood from 90.4% to 66.9% (24). Whilst the COSI and HBSC variables are not directly comparable, overall, it appears that physical activity decreases with age (24,27).

[26] Unweighted data.

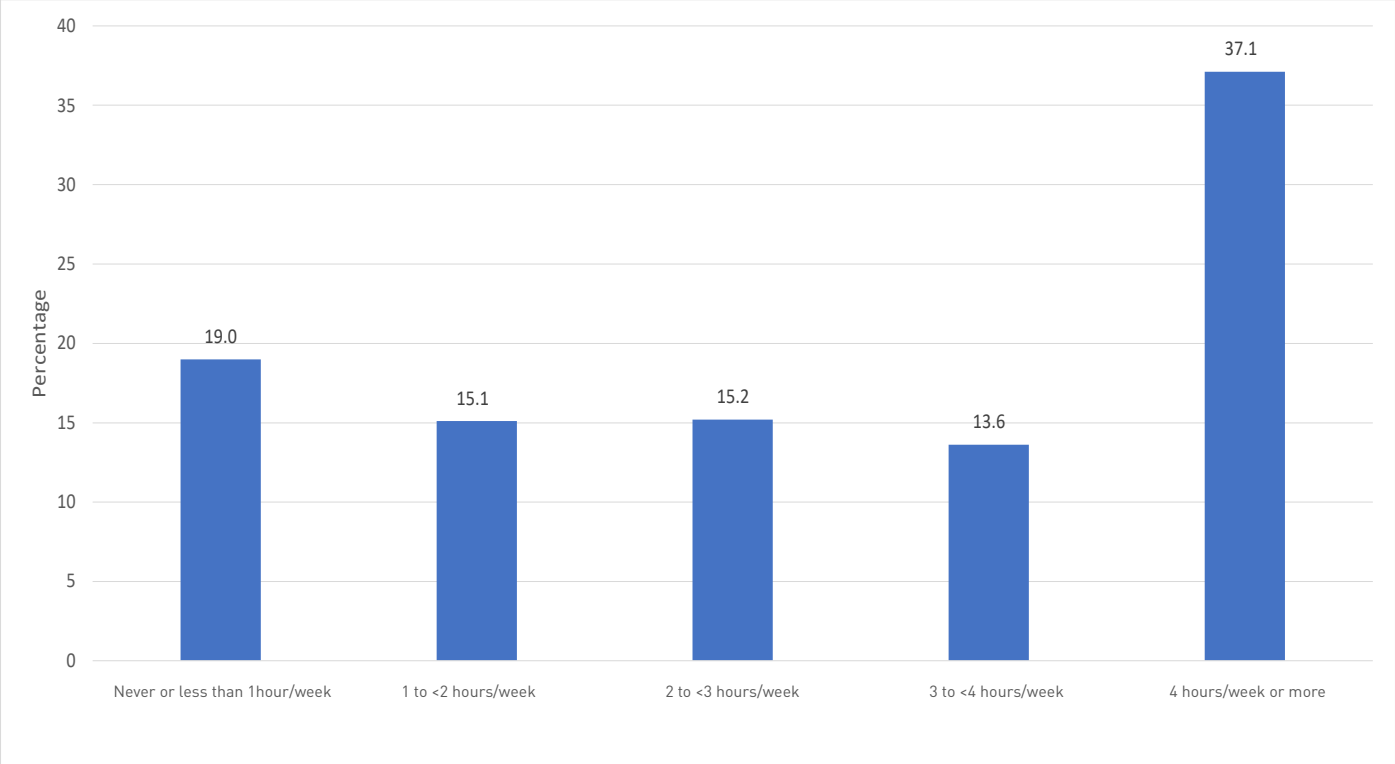


**Figure 12: Time spent on sport participation among children attending KG2**

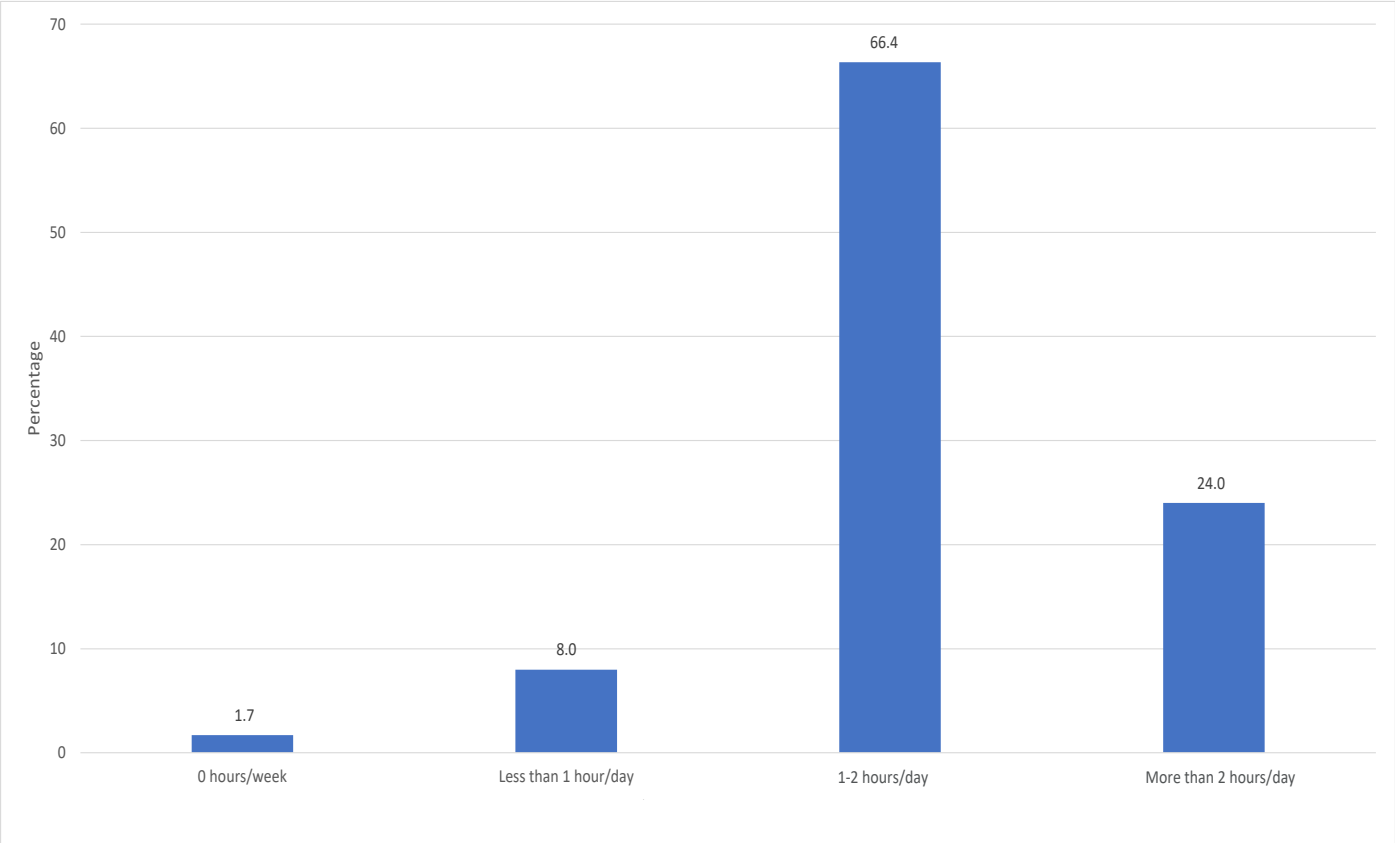


**Figure 13: Time spent playing actively/vigorously among children attending KG2**

### *Results from KG2-Y11: Extra-curricular sport or physical activity participation*

7,078 children in KG2-Y11 responded to the question regarding sports participation, 52.3% of whom claimed to participate in organised extra-curricular sports or physical activities at least once a week[27].

[27] Unweighted data.

Sports participation was most prevalent among Primary schoolchildren (61.1%) and least prevalent among participants in KG2 (48.9%). The latter contrasts with the previously reported data from the KG2 survey, where 81.0% of parents indicated that their children in KG2 participate in at least 1 hour of sport per week. This could represent a different understanding of 'extra-curricular sport or physical activity' between KG2 children and their parents. Middle and Secondary school students' sports participation stood at 57.1% and 54.1% respectively. Only in Years 3-6 did the sports participation rate exceed 60%, peaking at 66.7% in Year 6. Sports participation among females was most prevalent in Year 5 (67.3%), while males' sports participation rate culminated at 72.4% in Year 6 (see Figure 14). Association between sex and sport participation was statistically significant in Years 6-8, whereby males in these cohorts were 10-12 percentage points more likely to participate in sports than females[28].

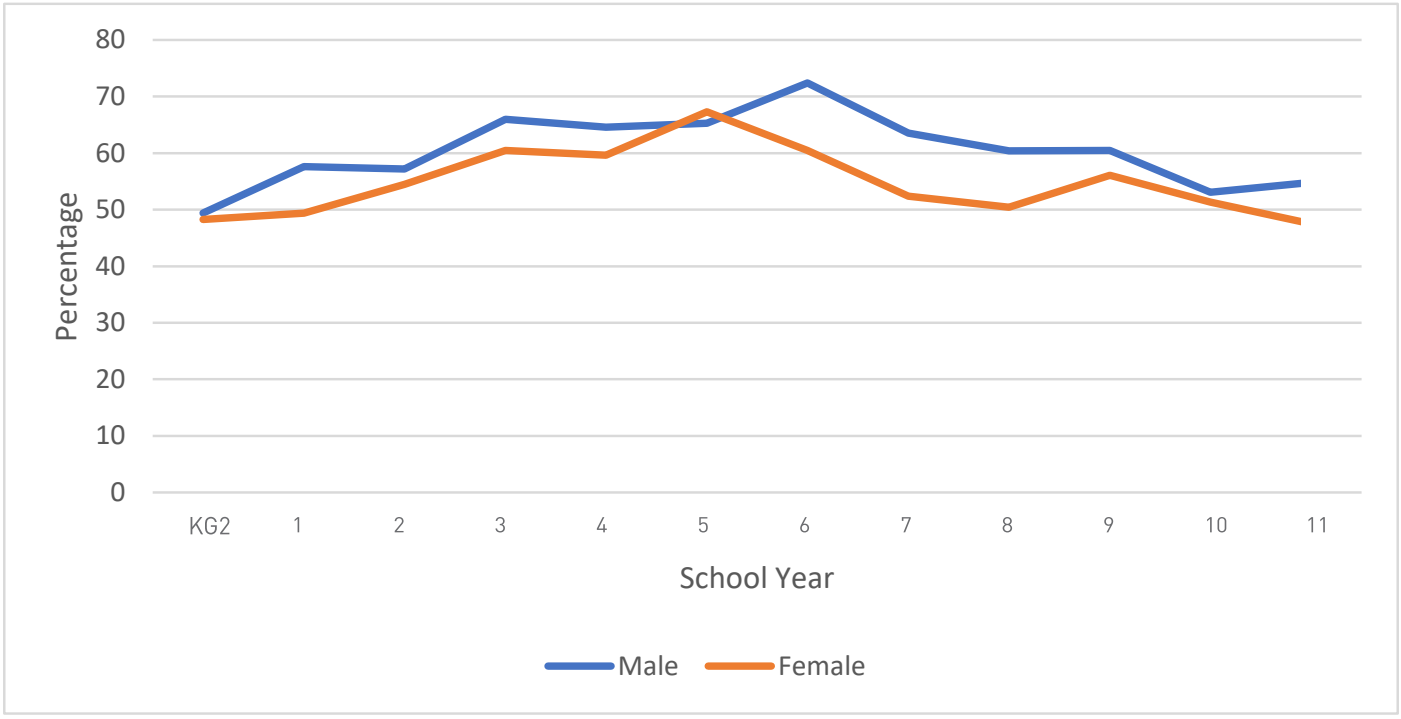


**Figure 14: Participation in extra-curricular sports activities, by sex and school year**

### *Associations between sports participation and BMI in Y1-11*

In Y1-11, 5,235 students responded to the question about sports participation, 5,084 of whom met the inclusion parameters of the study.[29] Associations between sports participation and BMI (not OW/obese and OW/obese) were observed. Associations were also observed when disaggregating by certain variables. These associations, albeit weak, indicate that children in certain cohorts who participated in sports were slightly less likely to be OW/obese than those who did not, and that sports participation was more popular among those who were not OW/obese.

Associations were observed when considering sports participation and BMI (not OW/obese and OW/obese) in Y1-11s, but only for males when disaggregated by sex (see Figure 15). They were also observed in Middle school and Year 8 when disaggregating by school phase and year. The difference in OW/obesity rates among Middle school children who participated in sports (38.3%) and those who did not (49.4%) was over 11 percentage points.

When disaggregated by school year and sex, associations were observed for both males and females in Year 8, females in Year 9 and males in Year 10, where the difference between OW/obesity rates among those who participated in sport and those who did not was at least 15 percentage points.

[28] Sports participation in Year 6: males 72.4%, females 60.5%; Year 7: males 63.5%, females 52.4%; Year 8: males 60.4%, females 50.4%.

[29] Unweighted data

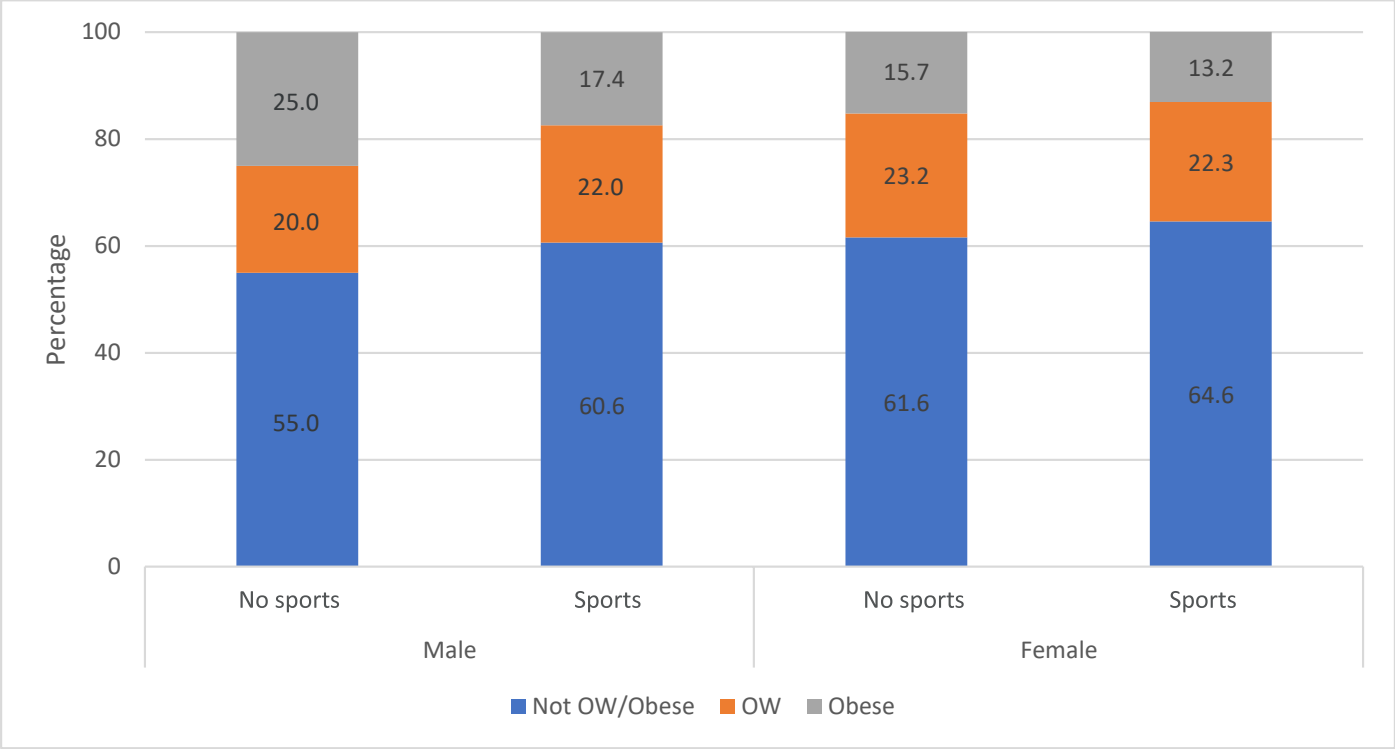


**Figure 15: BMI distribution by sport participation and sex, among children in Y1-11**

### *Determinants of and interventions that improve the level of physical activity*

Children's level of physical activity is influenced at the intrapersonal, interpersonal, environmental, organisational and policy level (102).

At the intrapersonal level, differences in physical activity in preschool children exist by sex (103). Bingham et al. found that boys were more likely to participate in total physical activity, moderate-to-vigorous intensity physical activity and light intensity physical activity when compared to girls (103). In another systematic review, which included a synthesis of qualitative literature, Hesketh et al. found that parents perceived boys to be naturally more active than girls and that they enjoyed physical activity more than girls (104). Parents and children believed that enjoying sports made participation easier (104).

At the interpersonal level, family involvement plays an important role in the level of physical activity among children (102). Parents who are physically active are more likely to have physically active preschool children (102,105). In preschool children, this association is particularly strong in two-parent homes (102) and when the mother is physically active (106). Children whose parents are aware of the importance of physical activity (106) and have positive attitudes towards physical activity, are more likely to be active themselves (102). Preschool children are more likely to partake in physical activity if they are supported by their parents (102,105). Parental support includes encouragement, transport provision, paying coaching and tuition fees, and parents engaging in physical activities together with their children (102).

At environmental level, the more time preschool children spend outdoors, the more overall physical activity they carry out (102,103,107). However, this could be limited by the weather and season, the availability and access to safe and age-appropriate play spaces, and the neighbourhood safety (102). The availability of physical activity equipment is also associated with higher physical activity levels in children (105).

At organisational level, more moderate-to-vigorous and total physical activity can take place in early care and education settings and schools (102,103,105). Theory or model-based interventions

are effective at improving physical activity levels among preschool children (105). In both childcare facilities and schools, multi-component interventions are more effective than single-component interventions (105). Key strategies that can increase physical activity among children at school are increasing the number of physical education (PE) lessons, improving the quality of PE lessons, activity breaks, after-school programs, teacher training and capacity building, changes to the school environment (such as availability of equipment and access and availability to outdoor play spaces), and parental, peer and community involvement (105).

At policy level physical activity guidelines should be incorporated within national childcare regulations (102). However, in Malta, the National Standards for Early Childhood Education and Care Services (0-3 Years) does not include such an indicator (108). Lindsay et al. states that inadequate outdoor spaces and equipment and lack of staff engagement act as barriers to policy implementation (102). In Malta, most child respondents were not satisfied with the current availability of open spaces (109). In a systematic review, Puggina et al. showed that school policies that intend to promote physical activity tend to improve overall physical activity in children but not moderate-to-vigorous physical activity (107).

# Screen time

### *Background/importance*

Screen time is a distinct form of sedentary behaviour which has several negative consequences (110–112). These include worse body composition indicators, decreased fitness, increased risk of metabolic syndrome and cardiovascular disease, poor self-esteem and pro-social behaviour, and decreased academic achievement (110). Screen-based sedentary behaviour is also linked to overweight/obesity in preschool children (111,112).

In a recent systematic review and meta-analysis, Li et al. showed that excessive screen time in infants, toddlers and preschool children was associated with overweight/obesity and sleep problems (112). Children who spent more than one hour per day engaging in screen-based sedentary behaviour were more likely to being overweight or obese than those who spent less time (odds ratio (OR) [95% CI] 1.872 [1.678-2.088]) (112). Similar findings were found in children engaging in screen time for more than two hours daily (OR [95% CI] 1.262 [1.155,1.379]) (112). Children who engaged in excessive screen media use were also more likely to have shorter sleep duration (OR [95% CI] 1.420 [1.392-1.449] and 2.83 [2.132-2.445] for more than one and two hours per day, respectively) (112). This is supported by an earlier systematic review showing that screen-based sedentary behaviour is either negatively associated or not associated with adiposity, motor and cognitive development and psychosocial health (111). Apart from the resultant physical inactivity, this association could also be mediated through increased consumption of unhealthy foods with high fat content, free sugar, and salt, and decreased consumption of healthy foods such as fruit and vegetables (113). This association could also be mediated through disruptions in the 24-hour circadian rhythm due to artificial light exposure resulting in poor sleep which is also associated with overweight/obesity (111).

### *WHO guidelines*

WHO recommends that children between 3 and 4 years of age should not spend more than 1 hour per day engaging in sedentary screen time, such as watching television or playing with electronic devices, stating that less is better (92). This extends to less than 2 hours per day for older children and adolescents (5-17 years) (92).

### *Data*

Despite extensive evidence on the harms of excessive screen-based sedentary behaviour, the WHO targets on sedentary screen time are far from reached (114). Only 35.6% and 56.0% of children aged 2 to 5 years are meeting the 1- and 2-hour guidelines, respectively (114). In a pooled prevalence study emanating from the results of the WHO European Childhood Obesity Surveillance Initiative (COSI) 2018-2020 across 27 countries, 43% of children aged between 6-9 years of age engaged in at least two hours of screen time per day. The proportion of Maltese children engaging at least 2 hours of screen time daily stood at 42.8% (24).

### *Results from the KG2 2022 National Survey*

Figure 16 shows the weighted amount of time spent watching TV or using an electronic device among children attending KG2. 98.4% of participants[30] responded to this question. 76.8% of children exceeded the WHO recommendation of not more than 1 hour of sedentary screen time per day. The proportion of children who spent at least 2 hours per day watching TV or using an electronic device was 27.3%. This appears to worsen in middle childhood (42.8%) (24).

[30] Unweighted data.

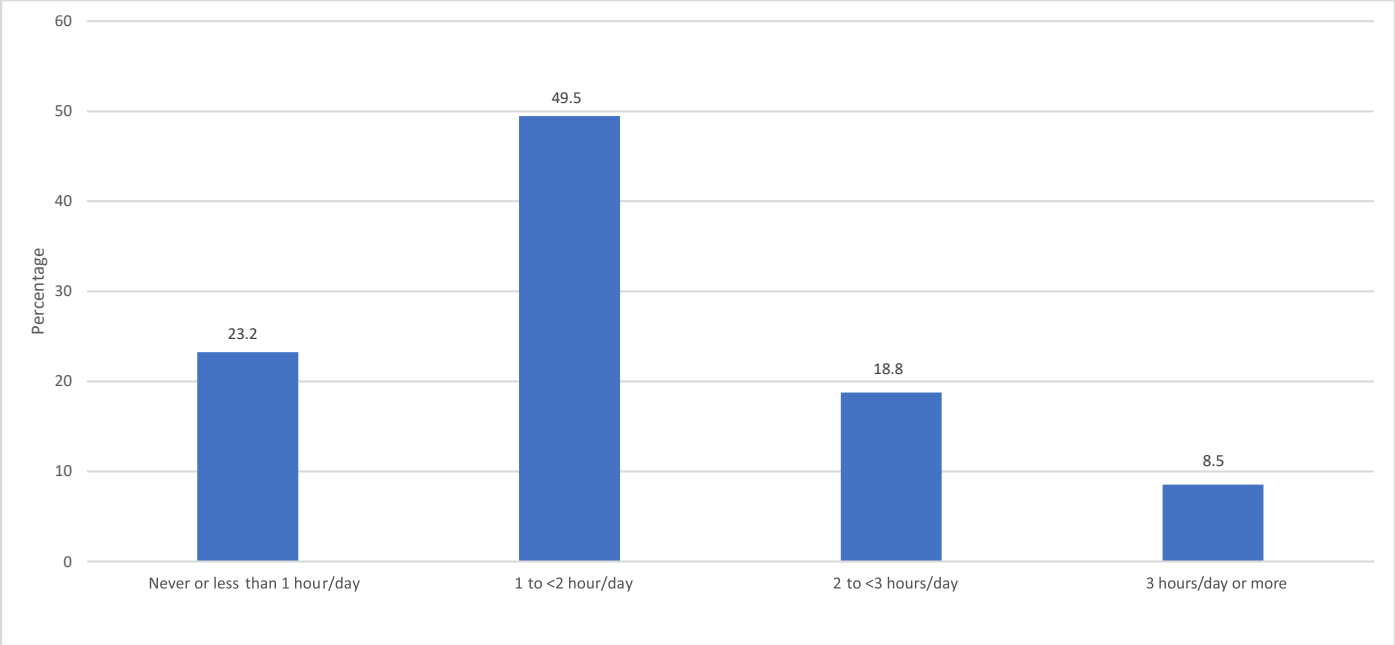


**Figure 16: Time spent watching TV or using an electronic device among children attending KG2**

### *Determinants of and interventions that improve the level of screen time*

Preschool children's level of screen time is influenced at the intrapersonal, interpersonal, environmental, organisational and policy level (102). At intrapersonal level, preschool children coming from low-income families, boys without siblings and girls coming from single-parent families, are more likely to engage in more screen time (102). At interpersonal level, preschool children are less likely to engage in screen time if their parents or other family members do not engage in high amounts of screen time, and if parents purposively restrict screen time (102). At environmental level, availability, and access to safe play areas decreases screen time among preschool children (102). At organisational level, early care and education (ECE) settings can decrease screen time by providing access to outdoor spaces and play equipment and increasing physical activity in ECE settings (102). At policy level, national childcare regulations should include restrictions to screen time (102).

Interventions to reduce screen time are effective[31] (115). They are also effective at reducing BMI by 0.15kg/m[32] (115). A meta-analysis pooling behaviour change techniques showed that behavioural interventions were effective at reducing screen time in children (116). Interventions that targeted younger children (12 years or younger), were of shorter duration, and were carried out by either research staff or other trained individuals were more effective (116).

[31] mean difference -4.63h/w, 95% CI -7.68, -1.59

[32] 95% CI -0.23, -0.08

# Strengths, limitations & biases of this study

## Strengths

- Large sample size for both anthropometric measurements across all years and survey for the KG2 cohort.
- High response rate for both anthropometric measurements across all years and survey for the KG2 cohort across all school types imply high parental engagement.
- This study identified actionable areas for policy makers.
- This study may stimulate further research.

## Limitations and biases

- Children who were absent on the measurement day may have inadvertently led to a degree of exclusion bias.
- Children who were not able to stand on the scales unaided, who had medical conditions, which incurred the use of plaster or prostheses, children with a signed consent refusal by the legal guardian, and children who refused consent, were not included in the study. Children who did not participate in the study may have different BMI when compared to those who participated.
- Having both an opt out and opt in consent process introduced bias. Schools with an opt in consent process had a very low response rate.
- Different data collection teams across State, Church and Independent schools could have introduced an element of information bias.
- Non-compliance to the *BMI Study Instructions for Contact points and Data collector's manual* could not be excluded.
- Recall bias may have influenced the replies of parents to the KG2 survey, and the replies of children and adolescents during anthropometric measurements, especially for younger children.
- Social desirability bias may have influenced the replies of parents to the KG2 survey, and the replies of children and adolescents during anthropometric measurements.

- Possibility of erroneous data entry could not be entirely excluded.
- The wide data collection period could have introduced changes in weight measurements due to changes in fabric weight.
- Considering the size of this study, and its tight timeframes, human resources were very limited.

# Conclusion

The prevalence of OW/obesity in Malta is problematic, including that among children. In KG2, about one in eight children (12.1%) between 51 and 60 months, and one third (33.0%) of children aged between 61 and 68 months were either overweight or obese. The rate increased to just under 40% of children in Y1-11, with OW/obesity being more prevalent in the middle years. Males across Y1-11 were more likely to be classed as obese than females and only half the males attending middle school fell within the normal parameter. Females were more likely to have a normal BMI in primary school than in other school phases.

Among KG2 students, several lifestyle factors were considered: breastfeeding, eating habits, physical activity including sports participation and active play, and screen time. This study also considered breakfast intake, and sport participation across all years.

Breastfeeding rates remain well below global targets. Eating habits among children attending KG2 were poor in fruits and vegetables, rich in savoury and sweet snacks, and low in sugar-containing soft drinks. When compared to previous COSI and HBSC data, daily breakfast consumption, daily vegetable consumption, daily savoury snack consumption, and daily sugar-containing soft drinks consumption appear to increase, whereas daily fruit consumption appears to decrease with age.

60% of KG2-Y11 children claimed to have eaten breakfast on measurement day, with breakfast intake being more prevalent among younger students. Breakfast intake was slightly associated with BMI (not OW/obese and OW/obese), where children who had breakfast on the day of measurement were less likely to be OW/obese, especially in the older school years. However, regular uptake of breakfast is more important than on the day as it may be biased.

52.3% of children in KG2-Y11 claimed to participate in organised extra-curricular sports or physical activities at least once a week, with sports participation being most prevalent among primary schoolchildren. According to parent reports, physical activity rates appear to be high among children attending KG2, however the proportion of children exceeding the WHO screen time recommendations is high. Sports participation was associated with BMI (not OW/obese and OW/obese) among children in Y1-11, where children who participated in sports were less likely to be OW/obese, particularly among males, and among middle school students.

This report adds to the information about childhood OW/obesity in Malta and some of its possible proximal determinants. Information from this report can be used to help policy makers in Malta to develop an overarching prevention framework with specific vertical strategies addressing lifestyle factors. These should include multiple targeted policy interventions to ensure an enabling environment both within the household and schools to improve diet and physical activity, supported by the distal determinants of obesity.

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