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Evaluation of the levels of physical activity amongst Primary school children in Malta

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BACKGROUND

Malta is currently facing a childhood obesity epidemic. Almost 40% of primary and 42% of secondary school children are overweight or obese secondary to energy imbalances and increase in sedentary behaviour. Physical inactivity is another risk factor for childhood obesity and hence adult obesity, leading to various physical, psychological, social and economic implications. The aim of the study was to assess general levels of physical activity in Maltese primary school children.

METHOD

One hundred and twenty 9-year-old children from three state primary schools completed the Physical Activity Questionnaire for Older Children (PAQ-C). The PAQ-C measures the general levels of physical activity in children in terms of frequency and duration. It consists of ten items, covering different time-of-day segments for physical activity and scored using a five-point scale.

RESULTS

On average, children underwent physical activity twice in their spare time during week days. Children were mostly active during Physical Education lessons and school breaks rather than in their spare time. During the weekends, children were involved in active games an average of 2-3 times. In general, children described themselves as partaking in physical activity, 3-4 times during the whole week, which is less than once daily. Physical activity frequency is low in Maltese children potentially because of the extreme academic pressure as well as preferential involvement in sedentary activities.

CONCLUSION

School-based physical activity interventions should be implemented during physical education lessons and school breaks to maximize physical activity levels achieved by children as a public health strategy against childhood obesity.

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INTRODUCTION

Childhood obesity is a multi-factorial condition and is increasing worldwide, causing public health crises in several countries. Malta is no exception with 39.7% of primary school children and 42.6% of secondary school children being overweight or obese.[1] This is reflected in the latest Health Behaviour in School-aged Children (HBSC) study carried out in 2013/2014, in which Malta achieved the highest proportion of 11, 13 and 15-year-old children who were overweight or obese.[2]

As the risk of diseases related to sedentary behaviour in adulthood rises over time, it is highly important to prevent obesity during childhood. Lack of physical activity is a major factor in childhood obesity and obese children typically grow into obese adults.[3] Increased physical activity has been reported to lead to higher academic achievement,[4-5] in addition to known health benefits. However, the Maltese population's culture is deeply set in academia and does not recognise physical activity as important in its' own merit. This is highlighted in the HBSC study, in which Malta scored the highest proportion of 11, 13 and 15-year-old children pressured by schoolwork and who spend more hours on studying.[2] The study also showed that few Maltese children achieve the recommended 60 minutes of Moderate and Vigorous-intensity Physical Activity (MVPA) a day, with girls being less active than boys and MVPA decreasing with increasing age.[2] MVPA is the intensity level required for physical activity to have health benefits.

Physical activity (PA) is defined as bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level, and can involve anything from daily household chores to structured exercise and sport. PA can be categorized in various ways, including type, intensity, and purpose.[6] WHO recommends that children aged between five and seventeen years should accumulate at least 60 minutes of age-appropriate MVPA daily.[7]

Multiple studies emphasise the importance of PA patterns initiated during childhood as this lays the foundation for activity habits in adulthood.[8–10] Indeed, physical inactivity is identified by WHO as the fourth risk factor of global mortality, causing 6% of cases of cardiovascular disease, 7% of diabetes type 2, 10% of breast cancer, 10% of colon cancer, and hence causing an estimated 3.2 million deaths worldwide.[11]

On recognising Malta's obesity crisis, objective data on frequency of PA levels carried out by children were required. Numerous measurement techniques have been devised to specifically evaluate the levels of PA in children, each having their advantages and limitations.[12–14] Unfortunately, a reasonable 'gold-standard' measurement tool does not exist, and consequently, criterion validity cannot be assessed. The aim of this study was to assess general levels of PA and data was collected by means of a questionnaire. This study seeks to propose a strategy that maximises PA and elevates its' intensity in order to be beneficial for health

MATERIALS AND METHODS

One hundred and fifty 9-year old students in their fifth year of Primary school were invited to participate in this study. Three state schools within St Benedict's College in Malta were randomly chosen. St Benedict's College was chosen for this study as the

schools are provided with two regular Physical Education (PE) lessons taught by PE teachers, whereas in other schools, one is taught by the PE teacher and the other is to be carried out by the class teacher. In total, 120 students in eight classes accepted to participate.

Ethical approval for this study was sought and granted by the University Research Ethics Committee. Informed consent from the parents and an assent from the students were obtained, together with required permissions from the respective schools and the Education Department.

On the day of data collection, the researcher measured the participants' height, weight and waist circumference according to WHO guidelines[14-15] and provided a brief general presentation on PA to each class of students. Then the Physical Activity Questionnaire for older Children (PAQ-C) was distributed in Maltese[17] or English[18] according to the students' preferences. The PAQ-C was developed and validated for use in large-scale research with children.[18-19] It is a self-administered, 7-day recall questionnaire designed to measure general PA levels among children aged 8 to 14 years during the scholastic year. Test-retest (1-week) reliability for PAQ-C is 0.75 for males and 0.82 for females. It was previously validated against a seven-day activity recall questionnaire (r=0.46), Leisure Time Exercise Questionnaire (r=0.41) and Caltrac accelerometer (r=0.39).

PAQ-C consists of ten items, covering different time-of-day segments for PA and scored using a five-point scale.[21] The first question is a checklist of 22 common sports and leisure activities, plus room for additional activities. The aim of this question is to serve as a memory cue. The next three questions assess activity during school hours; mainly during PE lessons and both breaks. Three further questions evaluate children's activity right after school, later in the evening and during the weekend. In the eighth item the child is asked to choose the best statement to describe the amount of activity during the last seven days. The last activity question asks how often the child carried out PA for each day of the previous week. The tenth question assesses whether an illness prevented the child from doing his/her usual activity during the previous 7 days.[19] If illness was present, the child was excluded from activity assessment. It is not the purpose of the PAQ-C to evaluate caloric expenditure. Some advantages of the questionnaire include good compliance as it is filled with the researcher in class, takes less than 20 minutes to complete and uses memory cues to aid recall. Disadvantages comprise difficulty to completely capture short-burst nature of children's activity and recall bias. Permission for use of the questionnaire in this study was sought and granted from the authors. They were also asked for permission to replace the snow sports activities "ice skating", "ice hockey" and "cross-country skiing" with alternative locally common sports such as "gymnastics", "tennis" and "martial arts". The questions were read by the principal researcher, using an overhead projector, allowing enough time for students to fill in their answer, as well as providing support if difficulties were encountered regarding the questions. This modus operandi has been shown to enhance the quality of answers provided.[22] It was ensured that all students filled each question before proceeding to the next, so that questions did not remain unanswered.

Questionnaire data were inserted in Microsoft Excel 2016 software and subsequently analysed. Scoring the PAQ-C five-item Likert-scale responses was guided by the manual.[23]

The participants' body mass was measured using a portable GIMA PEGASO 27288 digital scale/stadiometer to the nearest 0.1kg. Standing height was measured to the nearest 0.5cm with the same stadiometer. Measurements were taken in thin socks, with feet together and knees and back straight according to WHO standardized techniques.[16]

In view of the limitations of BMI (Body Mass Index) as an indicator of excess fat mass and cardiometabolic risk especially in children,[24] waist circumference (WC) was also used in this study to improve the sensitivity of the findings. WC has been used as a proxy measure of central body fat which is better than overall body fat to predict adverse cardiovascular risk factors in both adults and children. [25] It is also known that children with a WC over the 90th percentile were more likely to suffer from cardiovascular risks than children with a WC lower than 90th percentile.[26] All anthropometric measurements were taken with the subjects standing behind a screen for privacy.

The height, weight and WC data were also inputted in Microsoft Excel® and AnthroPlus software developed by World Health Organization,[27] was used to convert height and weight measurements into BMI z-scores according to the 2007 WHO growth reference charts.[28] A BMI z-score of -1 and under implies underweight status, between -1 and 1 represents normal weight status, between 1 and 2, overweight status and above 2, obese status.

RESULTS

Subject demographics – including number of participants, gender, mean age (SD), mean BMI (SD), percentages of obese, overweight, normal weight, underweight students in the cohort are portrayed in Table 1 and Figure 1.

Of note, is the high proportion (54.6%) of the study population which is either overweight or obese.

Spare time PA took place on average, twice a week. The most common activities performed outside of school during the children's spare time were catch/tag (7.96%), jogging/running (7.68%) and football (6.23%). The least common activities were rowing (2.75%), badminton (3.03%) and triathlon (3.27%) (Figure 2).

One-way ANOVA verified there was a statistical significance of $p<0.01$ in physical activity levels between the days of the week, with Saturdays (15.68%) and Wednesdays (15.88%) being the most active days (Figure 3).

Table 2 and Figure 4 display the different time segments children undergo PA. Maltese children are most active during PE lessons and during school breaks (PAQ-C score is above 4). Whereas they are least active (PAQ-C score below 2) during their free time outside of school.

Figure 5 below illustrates the lack of correlation between BMI z-score and total PAQ-C score ($p=0.651$).

A strong positive and expected correlation can be observed between BMI z-score and waist circumference (Figure 6). However, there also was no significant correlation between WC and total PAQ-C score ($p=0.668$) (Figure 7).

Table 1   Descriptive statistics of the study cohort; *N*=120

	Mean	SD
Gender	-	-
Males	68	-
Females	52	-
Age (years)	9.389	0.268
Males	9.410	0.276
Females	9.363	0.263
Body height (cm)	133.579	5.924
Males	133.564	5.340
Females	133.794	5.611
Body mass (kg)	33.753	8.570
Males	34.165	8.337
Females	33.353	8.840
BMI z-score	0.844	1.371
Males	1.007	1.441
Females	0.655	1.275
Waist circumference (cm)	65.245	9.752
Males	66.529	10.026
Females	64.808	9.533

Figure 1   Weight status of the questionnaire cohort

Weight status

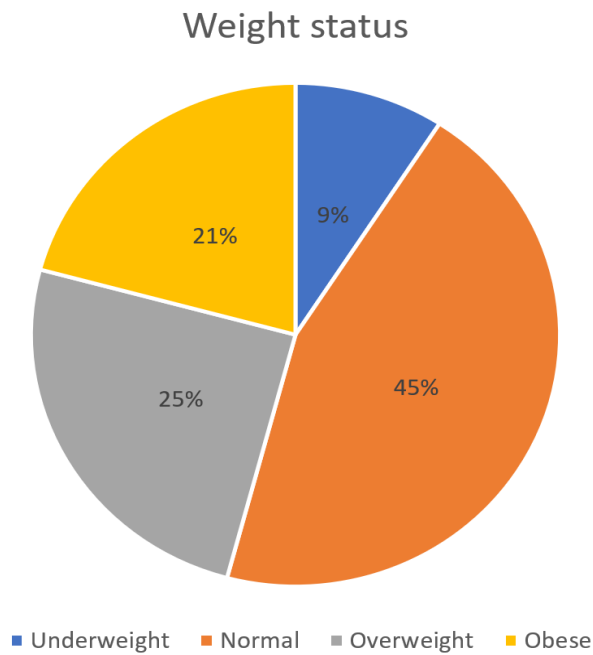■ Underweight ■ Normal ■ Overweight ■ Obese

Figure 2 Physical activity performed during the Maltese children's spare time
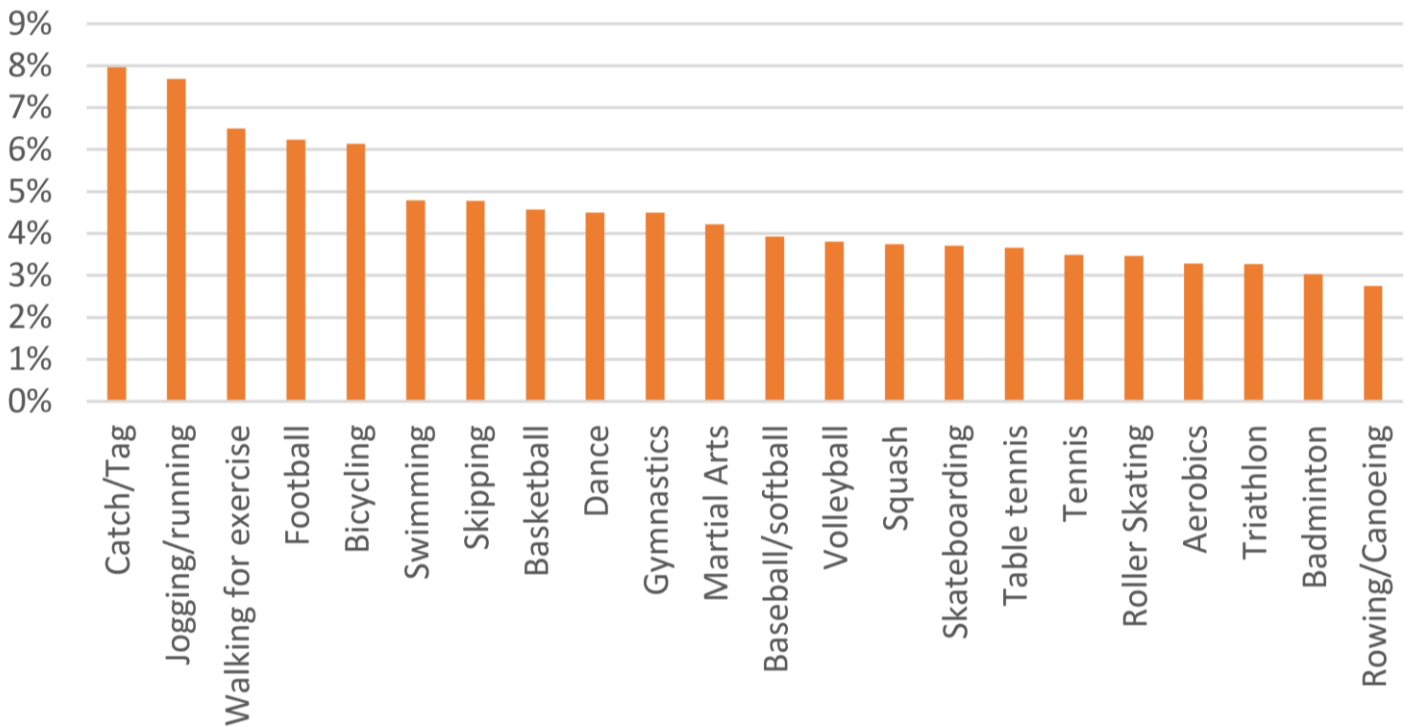

Figure 3 Weekly physical activity (PAQ-C score of 1=no PA, 2=rarely, 3=occasionally, 4 = often, 5 = very often).
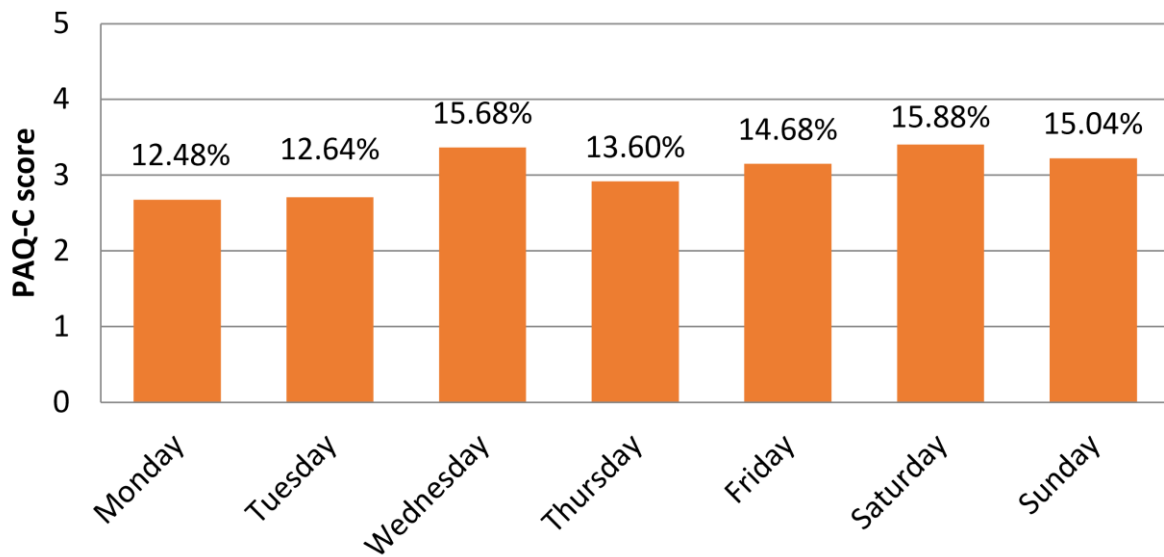
Table 2   Total PAQ-C scores and individual question scores
(SD = standard deviation)

	Mean	SD
PAQ-C summary	**3.324**	**0.689**
Leisure and sport Q1	1.897	0.583
PE Q2	4.256	0.988
First break (morning) activity Q3	4.124	1.092
Second break (lunch) activity Q4	4.207	1.147
Afternoon activity Q5	2.975	1.332
Evening activity Q6	3.091	1.400
Weekend activity Q7	3.174	1.237
Free-time weekly activity Q8	3.132	1.533
Overall weekly activity Q9	3.064	0.986

Figure 4   Physical activity distribution within different time segments of the week (PAQ-C score of 1: no PA; 2: 1-2 times; 3: 3-4 times; 4: 5-6 times; 5: 7 or more times). Blue: PA in school; Orange: PA outside of school; Yellow: average and total scores.
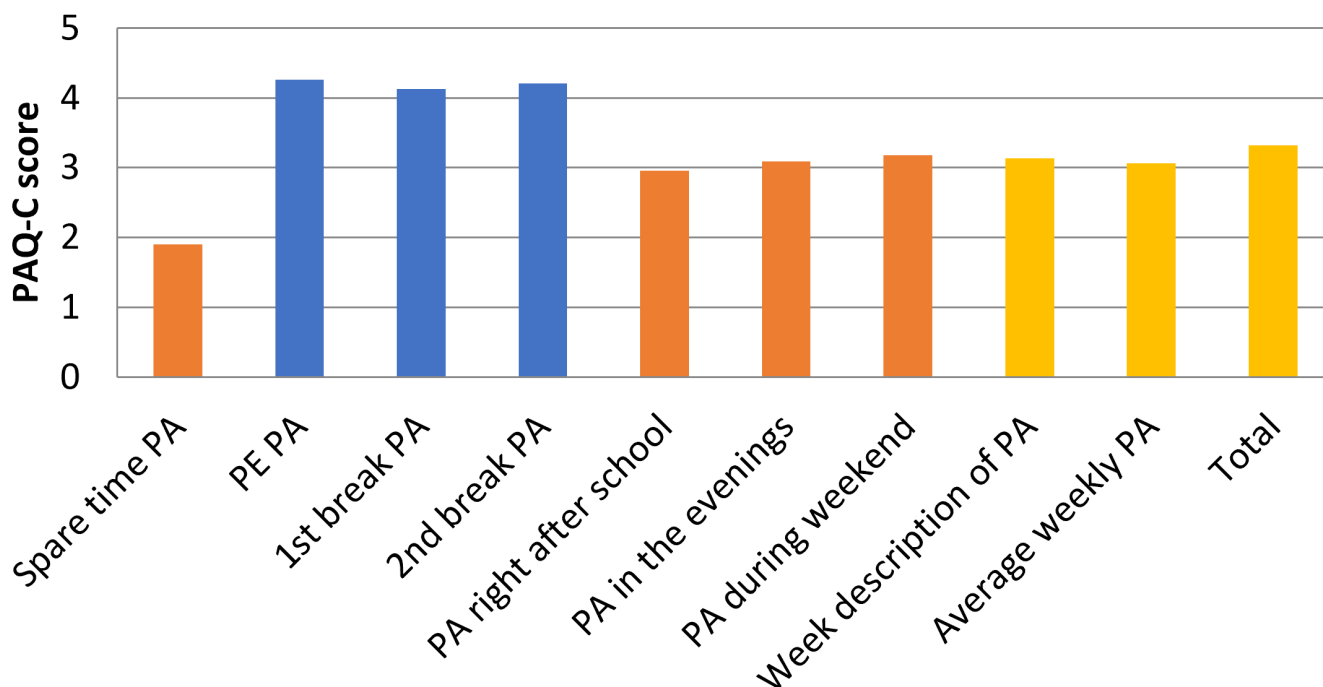
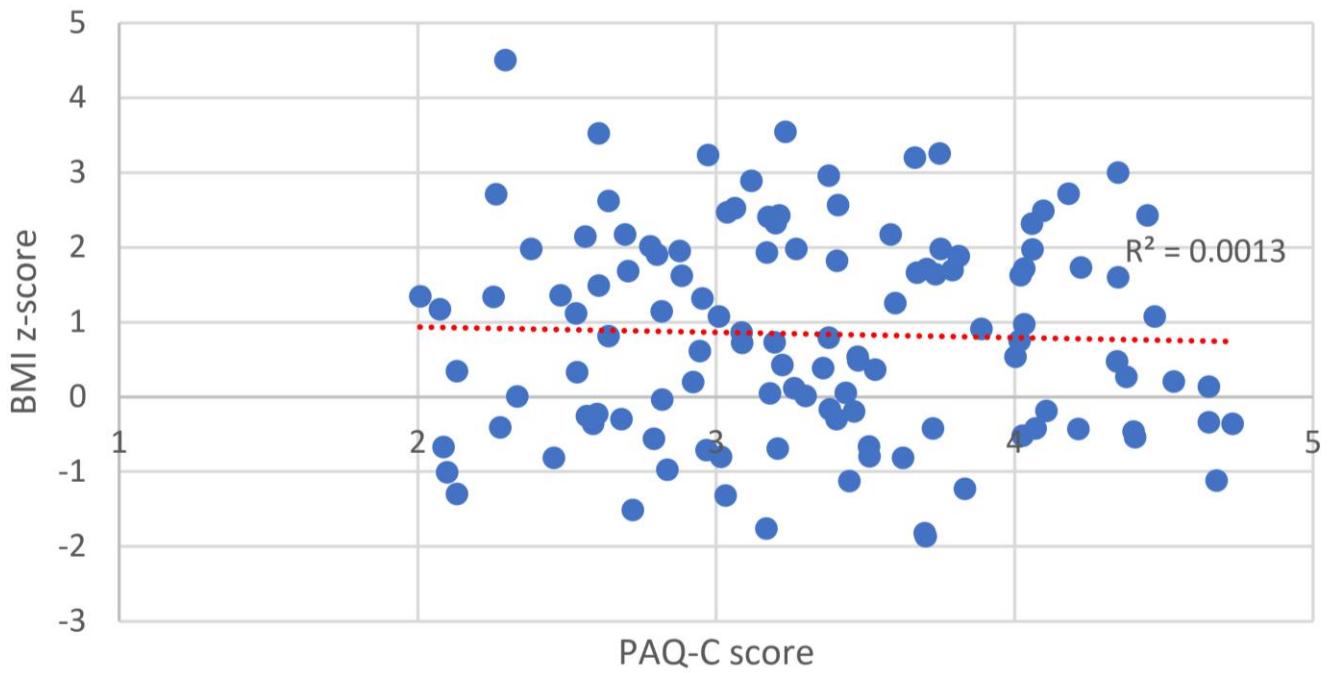**Figure 5**   Absent correlation between BMI z-score and PAQ-C score

Figure 6   Positive correlation between waist circumference and BMI z-score
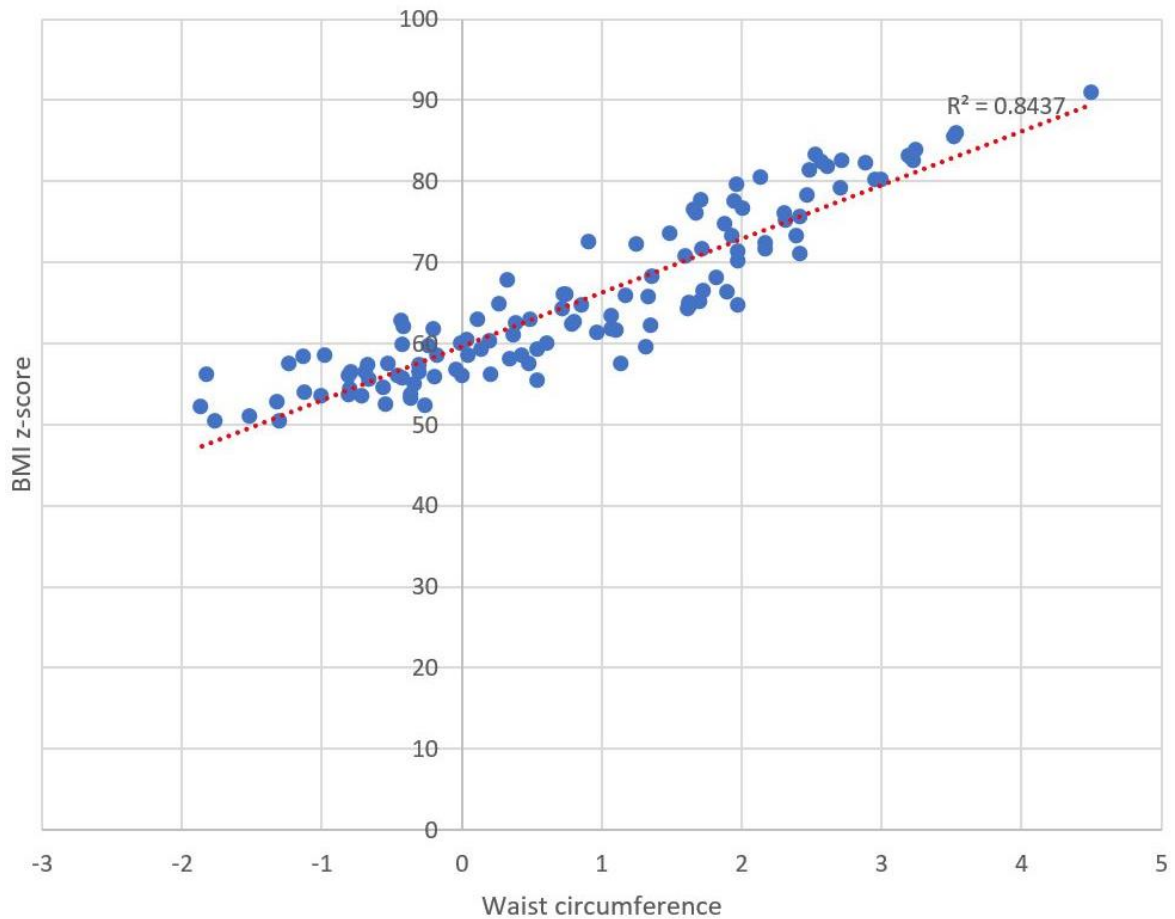
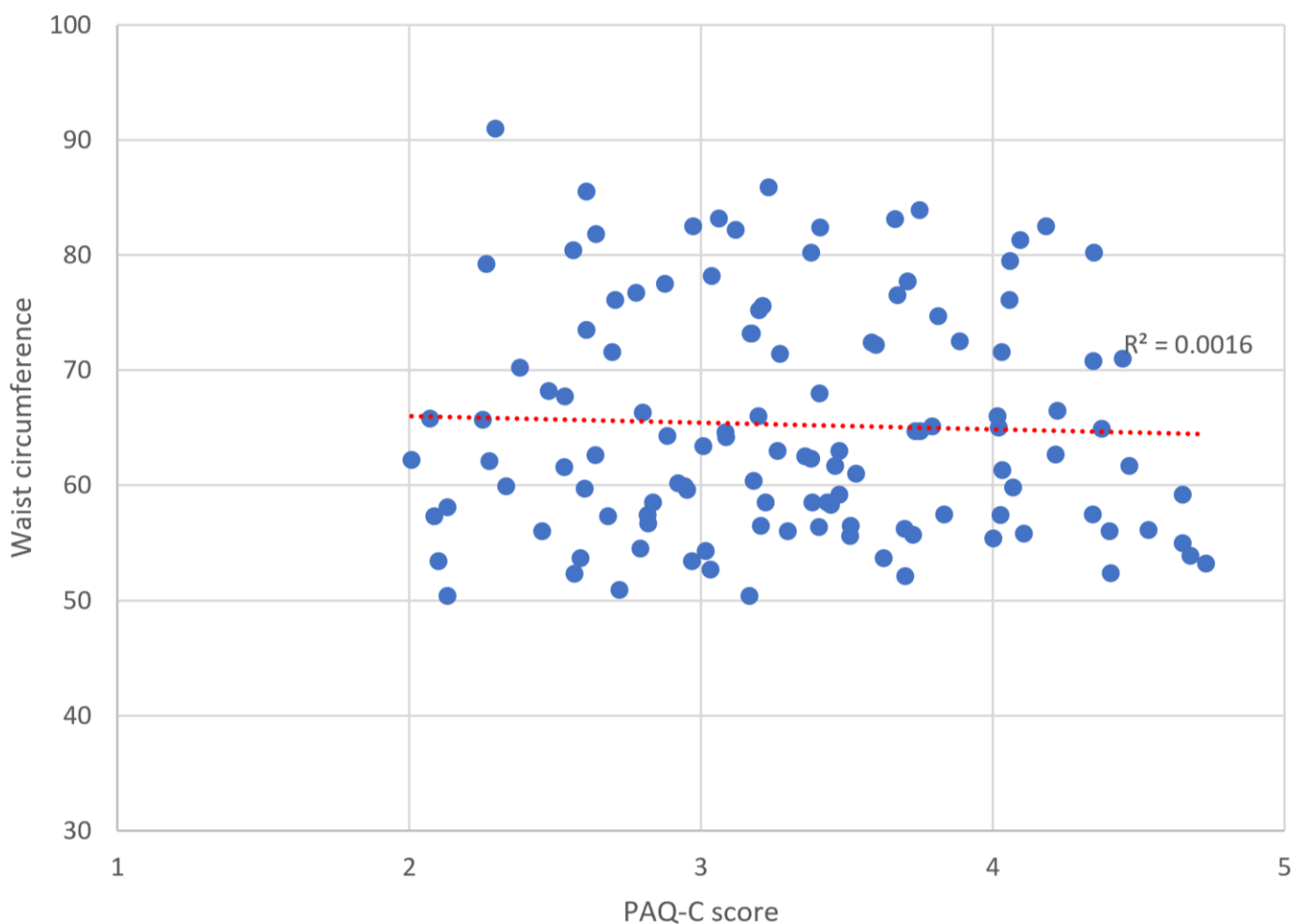**Figure 7**   Correlation between Waist Circumference and PAQ-C score

Table 3   PAQ-C scores according to weight status. SD = standard deviation; *n*=number of children

	Mean PAQ-C score	**SD**	***n***
Underweight	3.213	0.767	11
Normal weight	3.400	0.700	54
Over weight	3.248	0.705	30
Obese	3.270	0.622	25

On assessing PAQ-C scores according to weight status, the mean PAQ-C score and standard deviation were calculated for each weight category (Table 3).

Although children with normal weight have achieved the highest mean PAQ-C score, one-way ANOVA test determined that there were no significant differences of general PA between individuals of different weight status (p=0.564).

These results show that:

- Children perform minimal PA during their spare time. This is consistent with the latest HBSC study[2] which reported alarmingly high figures of daily television-watching of two hours or more during weekdays (sedentary behaviour) amongst Maltese children;
- Children perform more PA on Wednesdays and the weekend;

Higher quantities of general levels of PA were obtained during PE lessons and during school breaks when students are provided with scheduled time to divulge in physical activities.

DISCUSSION

This study investigated the PA and fitness levels in Maltese children at the Primary school level. Our results clearly highlight low levels of PA. Whilst the reasons for these low levels have to be explored in detail, pressure for academic achievements is a strong causative factor. In addition, socio-cultural issues and sedentary entertainment are some of the contributing factors.[29]

Currently, children only undergo physical activity once a week or less. This probably reflects the fast pace within the modern family, in which both mother and father work and thus less time is available for children to partake in physical activities.

There is no significant correlation between the BMI z-score of the participants and the general levels of PA performed. However, it is important to note that PAQ-C questionnaire does not reflect the intensity of PA done so there is no distinction whether PA is done in MVPA which is beneficial for health or with less intensity. Additional tools such as activity monitors or systemic observation such as System of Observing Fitness Instruction Time (SOFIT), should be used both during PE lessons as well as during breaks, in which children are involved in free play, in order to determine the MVPA intensities during such time-segments.

Another issue is that the time segments in which the children are most active, namely in PE lessons and school breaks, are very limited quantitatively when compared to time segments outside school. PE lessons are usually carried out twice a week, each lesson lasting around 40 minutes. Moreover, children have two breaks each day, having a combined duration of 20 minutes of time allowed for free play in the school grounds. In total, this adds up to 180 minutes in a week as opposed to 4,080 minutes of spare time available in one-week (14 waking hours x 7 days) minus (6 hours of school x 5 days) times 60 minutes). Furthermore, if we deduct one hour a day for homework/studying/reading, the amount of free time available for PA is 3,660 minutes. Therefore, although time is still available for children to undergo plenty of physical activity, children still choose, or have no choice, to entertain themselves with sedentary activities rather than undergo in PA during this time.

Participants were recruited from one region in Malta. This poses a limitation to both internal and external validity, as the sample was non-random and not completely representative of the target population. Ideally, private and church schools were also included and random

sampling taken across Malta and Gozo in order to be able to better generalize result findings. Nevertheless, randomization was applied for the selection of schools that were recruited in the study from within the college. The national prevalence of overweight and obese children in all Year 5 students attending state, independent and church schools from the population study carried out in 2016 was 45.4%, [1] whereas the prevalence of overweight and obesity in this study is 54.6%. This highlights the higher BMIs affecting children in southern towns. Furthermore, the PAQ-C questionnaire required to be slightly modified in view of the different cultural contexts. New validity and reliability reports with the modifications were ideally conducted before the questionnaire's implementation.

These findings, along with the contemporary crisis of childhood obesity in Malta, strongly urge the need for action. Suggestions from these findings are in line with the recommendations brought forward by The National Policy for Sports in Malta and Gozo:[30]

- PE lesson curriculum should be research-based so that children spend > 50% of lesson time in health-enhancing MVPA intensity;
- Minimum number of hours of participation in PE (5% of total lessons) should be enforced and additional opportunities should be given;
- Schools should offer PA opportunities and sport clubs during breaks;
- Schools should consider offering after school PA opportunities;
- School playgrounds should be well equipped and with playground markings so as to provide multiple opportunities for children to employ in PA;
- Active school transport should be urged and promoted as it provides abundant opportunities for increased overall daily PA in children.

- Improve image of sports in Maltese mentality as one aiding academic achievement rather than detrimental.

In conclusion, this study plainly shows the limited amount of PA undertaken by children in Malta. In their spare time, children prefer to take up activities that do not involve exercise. Sedentary behaviour further exacerbated by the urbanisation of Maltese villages with ever-decreasing safe areas for children to play in. Parks and play areas should be actively created in each village and they should be repeatedly tended and updated, in order to attract families and promote physical exercise during play.[30]

It is also important to note the high quantities of PA obtained during PE lessons and school breaks. These particular time periods should be used to their best potential. Malta should make use of schools by implementing school-based interventions as a public health strategy to increase national quantities of physical activity levels and combat childhood obesity.

SUMMARY BOX

- Malta is currently faced with epidemic rates of childhood obesity
- Increased prevalence of sedentary behaviour in Maltese children from previous years
- High academic pressure is directed towards Maltese school children
- Maltese children participate in physical activity only 3-4 times in a week – less than once daily
- During their week, children undergo physical activity mostly during school breaks and Physical Education lessons
- These two time-segments should be used to their full potential; researched school-based physical activity interventions should be implemented in Maltese schools as part of a public health strategy against childhood obesity

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