ACCELEROMETER-MEASURED PHYSICAL ACTIVITY IN PORTUGUESE CHILDREN FROM A RURAL AREA: A SCHOOL-BASED CROSS-SECTIONAL STUDY

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Abstract

Young people are leading increasingly sedentary lives replacing physical activity with activities such as watching TV, internet surfing and video gaming. Of particular importance for physical activity promotion are schools where physical activity can be incorporated to improve student health outcomes and cognitive performance. The World Health Organization (WHO) recommends that children engage in at least 60 minutes per day of moderate to vigorous physical activity (MVPA) for children and adolescents (between 5-18 years of age). However, few children follow these recommendations. In Portugal, some data suggest that as few as 7% do so. Furthermore, most physical activity studies take place in urban areas, so little is known about how active children and adolescents are in more rural parts of the country. The Acti-Study is a collaboration between the Instituto Politécnico de Bragança (Portugal) and Ulster University (UK) with the primary aim of assessing MVPA levels in students (age 10-16) from a high school in a rural town, in the Northeast of Portugal. Data collection will take place between September 2022 and January 2023, using a cross-sectional design. Students will receive a study pack containing information materials, a sociodemographic questionnaire and consent form for parental completion, and an assent form for student completion. Optionally, the questionnaire may be completed online. Participants will be informed that participation is voluntary and that they can withdraw at any time. Once children have returned the relevant documents completed and signed, they will be instructed to wear a hip-worn accelerometer (ActiGraph®, either GT3X or GT1M), on an elastic belt, for seven consecutive days (including weekend). Children who return their accelerometer will be rewarded with a 5€ voucher, and with a second one if they wore the accelerometer for a minimum of three days (at least 6h/day and at least one weekend). Data will be analysed through descriptive statistics, mostly in tables, divided by gender. With participant consent, data on anthropometric measures (height and weight), available through the school, will also be used. Primary analysis will consist of percentage of students who meet MVPA guidelines; secondary analyses will include exploring the relationship between sociodemographic variables (e.g., parental education) and MVPA, between parent-reported MVPA and accelerometer MVPA, and between accelerometer MVPA and anthropometric data. The results are expected to provide an understanding of the levels and factors associated with MVPA in rural Portugal, to allow comparison with other samples (e.g., from urban areas), to raise awareness to the problem and stimulate more physical activity initiatives. Study with ethics approval by Ulster University (REC/22/0060).

Keywords: Physical activity, community, children, rural area.

1 INTRODUCTION

Physical inactivity and sedentary lifestyles have become a public health problem in developed countries [1,2]. Low physical activity levels and high levels of sedentary behaviour increases the hypokinetic diseases such as cardiovascular disease, diabetes mellitus, hypertension, and obesity [3]. The problem has been amplified when low levels of physical activity are reported in children and youth with serious consequences for the motor and cognitive development of the next generations [4,5]. In addition to physical health problems, there are mental health, learning difficulties and social disability that can arise from the lack of opportunity for physical activity, exercise, and recreational sports [6,7]. Nowadays, young people are leading increasingly sedentary lives replacing physical activity with activities such as watching TV, internet surfing and video gaming screen time exposure-based activities [8]. Of particular

importance for physical activity promotion are schools where physical activity can be incorporated to improve student health outcomes and cognitive performance [5,9,10]. The World Health Organization (WHO) guidelines recommends that children engage in at least 60 minutes per day of moderate to vigorous physical activity (MVPA) for children and adolescents (between 5-18 years) [11,12]. Also, WHO guidelines determined that these population should complete muscle-strengthening and bone-strengthening; for many purposes, this means aerobic and strength activities to increase energy expenditure, such as brisk walking, running, dancing, or sports. Yet, most children are insufficiently active. For example, data from 27,000 children across 10 countries, including Portugal and UK, showed that only 9% of boys and 2% of girls met physical activity guideline [13]; in both Portugal and the UK that number was around 7%. Sedentary children tend to become sedentary adults, and physical activity levels often decrease in adolescence and adulthood. Studying physical activity in children from different contexts and populations is essential for developing effective interventions. In Portugal, little is still known about youth physical activity in rural areas [14]. Also, the latest worldwide epidemiological reports concluded that few children follow these recommendations [11]. In Portugal, some data suggest that as few as 7% do so [15]. Furthermore, most physical activity studies take place in urban areas, so little is known about how active children and adolescents are in more rural parts of the country.

Accelerometers are a 'gold standard' in physical activity assessment because they provide an objective measure of MVPA based on body movement, with ActiGraph models being the most popular (Migueles et al, 2017). Recent ActiGraph accelerometers are tri-axial (e.g., GT3X), e.g., based on three movement axes and therefore more accurate. However, data suggest that, in physical activity assessment, one-axial accelerometers (ActiGraph® GM1) can be just as valid [16,17]. Another consideration is the MVPA cut-point, i.e., level above which body activity is considered to be moderate or vigorous, and the epoch, e.g., how frequently information on MVPA should be recorded. For children, data suggest ≥ 2296 as MVPA cut-point and a 15s epoch [18,19]. Because children often fail to wear the accelerometer, they are usually instructed to wear it for a week; those who comply with a minimum wear time are then included in the analysis. In many cases, a wear time of three days, with at least 8h/day, has been found to be sufficient [18]. However, most studies on physical activity physical activity studies take place in urban areas, so we still know relatively little about how active children and young people are in places like in places like Alfândega da Fé.

Thus, a research project was developed to with the primary aim of assessing MVPA levels in students (age 10-16) from a high school in a rural town, in the Northeast of Portugal. The primary outcome is to determine percentage of participants who meet international PA guidelines (%). The secondary outcomes are to assess the average daily number of MVPA minutes (accelerometer based and parent reported), percentage spent in MVPA (accelerometer based), number of steps (accelerometer based) to identify factors associated with PA levels, such as sociodemographic variables and anthropometric indicators. As a research hypothesis, higher levels of regular PA are defined for children in rural areas. Specifically, we hypothesized that children and young people in this rural area of the Bragança county have values within the daily recommendations for physical activity practice for average daily number of MVPA minutes (accelerometer based and parent reported), percentage spent in MVPA (accelerometer based), number of steps (accelerometer based).

2 METHODOLOGY

2.1. Research project and sample

The Acti-Study is a collaboration between the Instituto Politécnico de Bragança (Portugal) and Ulster University (UK) with the primary aim of assessing MVPA levels in students (age 10-16) from a high school in a rural town, in the Northeast of Portugal. We will aim to carry out this study in the town and municipality of Alfandega da Fe, in the Bragança district (Northeast Portugal); where some of us in the team already have contacts. This is a highly rural municipality, with around 5,000 inhabitants, a strong agricultural activity, and an ageing population; for that reason, it provides an ideal place to carry out the research and address the rural-urban gap in terms of where previous studies have been conducted. The only high school in the municipality is the 'Escola EB2,3/s de Alfândega da Fé', which has around 300 students. Study with ethics approval by Ulster University (REC/22/0060).

2.2. Data collection

Data collection will take place between September 2022 and January 2023, using a cross-sectional design. Students will receive a study pack containing information materials, a sociodemographic questionnaire and consent form for parental completion, and an assent form for student completion. Optionally, the questionnaire may be completed online. Participants will be informed that participation is voluntary and that they can withdraw at any time [16,17]. Once children have returned the relevant documents completed and signed, they will be instructed to wear a hip-worn accelerometer (ActiGraph®, either GT3X or GT1M), on an elastic belt, for seven consecutive days (including weekend). Children who return their accelerometer will be rewarded with a 5€ voucher, and with a second one if they wore the accelerometer for a minimum of three days (at least 6h/day and at least one weekend) [20].
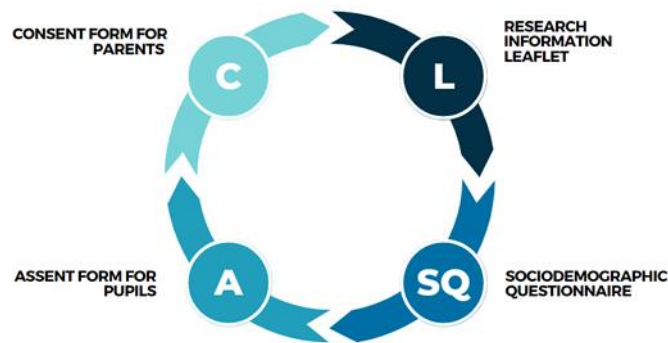

Figure 1. Content of the pack.

2.3. Methodology and procedures

Data will be analysed through descriptive statistics, mostly in tables, divided by gender. With participant consent, data on anthropometric measures (height and weight), available through the school, will also be used. Primary analysis will consist of percentage of students who meet MVPA guidelines; secondary analyses will include exploring the relationship between sociodemographic variables (e.g., parental education) and MVPA, between parent-reported MVPA and accelerometer MVPA, and between accelerometer MVPA and anthropometric data. The results are expected to provide an understanding of the levels and factors associated with MVPA in rural Portugal, to allow comparison with other samples (e.g., from urban areas), to raise awareness to the problem and stimulate more physical activity initiatives [20,21].

The project contemplates two phases: (1) Implementation of sociodemographic questionnaire to obtain general information about the target population; (2) An intervention phase through the assessment of the PA levels using accelerometry (ActiGraph® and body composition by anthropometric measures. In this first phase of data collection, questionnaires will be applied for sociodemographic characterization to students' guardians, in order to study the determinants for the practice of PA and, in a second phase, daily data will be collected for 7 consecutive days through accelerometry, in order to be possible to characterize the levels of PA of the children accelerometer (ActiGraph®, either GT3X or GT1M) [16,17].
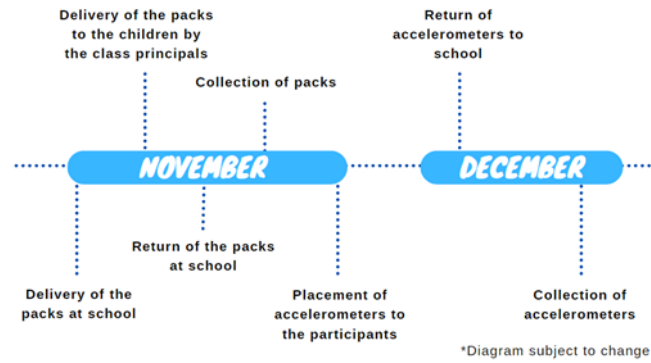
Figure 2. Acti-Study timeline.

2.4. Statistical analysis

Most analysis will be descriptive children who meet PA Guidelines, children with healthy Body Mass Index (BMI), for the categorical sociodemographic variables (parental education occupation etc.) These percentages will be relative to the number of those who provided valid data for each outcome variable. Chi-squared tests will be used to investigate the relationship between meeting PA Guidelines based on accelerometer and meeting PA Guidelines based on parental report meeting PA Guidelines based on accelerometer and each of the sociodemographic variables etc. T-test will be used to look at the relationship between percentage of body fat and average minutes of MVPA per day [22].

3   RESULTS

3.1   Expected findings

The results are expected to provide an understanding of the levels and factors associated with MVPA in rural Portugal, to allow comparison with other samples (e.g., from urban areas), to raise awareness to the problem and stimulate more physical activity initiatives. We expect that this study will allow comparison with other studies conducted in Portugal (e g in urban areas), and internationally. We also hope that it will raise awareness about the importance of PA and result in more PA promotion activities in the region.

3.2   Preliminary findings

Preliminary findings demonstrated a large amount of time spent in sedentary behaviour (86.35%) and a low percentage of time spent in MVPA (8.79%). About the other exercise intensity ranges, the highest percentage of time spent doing physical activity (> 1.5 MET) is done at light (4.85%) and moderate (8.06%) intensity. Vigorous (0.68%) to very vigorous (0.05%) physical activity was showed very low values in the first data collection.
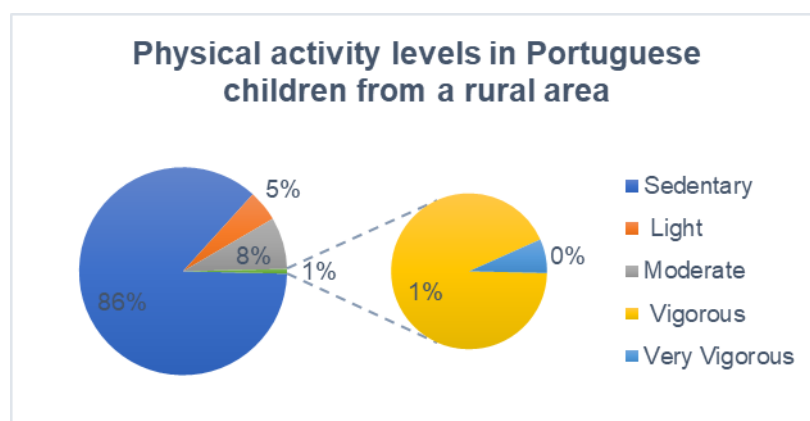

Figure 3. Physical activity levels in Portuguese children from a rural area.

Regarding the time in sedentary behaviour, mean total time sedentary bouts was 7935.53 minutes during 3-days monitored period with an average length of sedentary bouts of 90.28 minutes with a higher value for girls than boys (91.75 and 87.83 minutes, respectively).
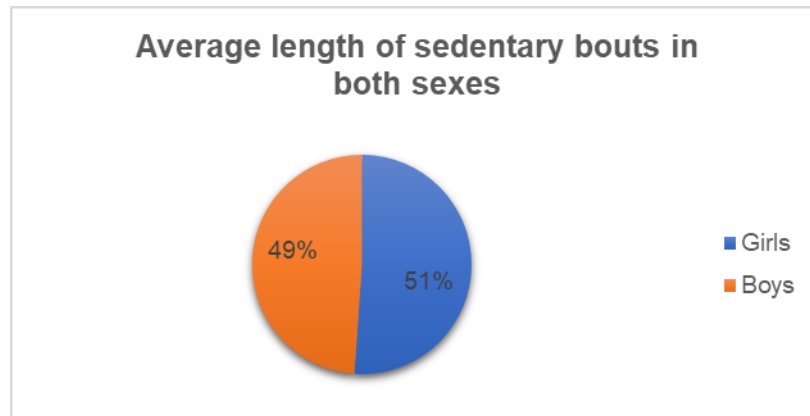

Figure 4. Average length of sedentary bouts in both sexes.

4   FUTURE OUTCOMES

Future outcomes expected low average daily number of MVPA minutes (accelerometer based and parent reported), percentage spent in MVPA (accelerometer based), and number of steps (accelerometer based). Also, a relationship between accelerometer based-values and parent report should consider for future analysis. The impact of dependent variables such as anthropometric, sociodemographic, and parental perception on physical activity levels and time spent in sedentary behaviour will be further explored. The comparison of this rural area with other rural areas in other parts of the country and other countries may be something to explore in future studies. More importantly, one should try to understand if the differences between rural and urban contexts are maintained with the socio-demographic transformations of the last decades.

5   FINAL CONSIDERATIONS AND CONCLUSIONS

As a research hypothesis, higher levels of regular PA are defined for children in rural areas. However, preliminary findings reject partially the hypotheses raised given the low levels of physical inactivity (especially above moderate intensities) and high levels of sedentary behaviour. Also, the average length of sedentary bouts exceed the recommended values for children and young people in both sexes. Indeed, the sociodemographic transformations in Portuguese population may have an extensive impact on the levels of physical activity and sedentary lifestyles [14,23]. First, because the migration to urban centres has caused a change in rural areas [24]. Secondly, because access to screen-based technologies, busy schedules, and sedentary lifestyles may no longer be associated only with urban centres [14]. The parents' own work activity profile has changed completely in the last few years, which also influences the practice opportunities. The schools themselves are different, so playgrounds have been reduced in time and filled with technological distractors [25]. In contrast to the past, children from rural backgrounds may no longer have such good motor skills that set them far apart from their peers in urban areas [9,13]. Another hypothesis may be associated with the fact that the levels of physical inactivity and sedentary lifestyles have such a widespread impact on the general population that the rural youth population already shows the same trend, although the extent of the problem may not be as extensive as in urban areas [12]. Collecting data during school time can also influence the data, reporting on the one hand a current problem with how long we sit and stand still. Thus, the trends for a greater sedentary behaviour among girls had already been reported previously in the district of Bragança [6,8,25]. Indeed, girls tended to show more sedentary behaviours than boys, spending more time watching TV during the week. Another factor may be associated with the children exercising only in extracurricular and federated sports activities, which occupies a very small percentage of the 24 hours [26–28]. Exercise and sport tend to be considered a "pill" where you take it at one time and don't need to take any more [28]. It is important to implement strategies for the implementation of mediated to

increase levels of utilitarian physical activity and not just leisure-time physical activity [16]. Implement active travel to school can increase children's levels of physical activity, for example [21,29,30].

Preliminary data collection showed low levels of physical inactivity (especially above moderate intensities) and high levels of sedentary behaviour in this rural area children and youth. Thus, rural environments may already have quite a few barriers to physical activity and lifestyles, however more data is still needed to conclude this. Also, it is important to develop for multidisciplinary interventions for the development of a healthy lifestyle from school and home.

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