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Levels of Sedentary Activity among Adolescent Boys and Girls in Bijapur, India

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Bachelor of Science
Georgia State University
2010

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Date

Abstract

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By

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Bachelor of Science in Biology
Georgia State University
2010

Thesis Advisor: Solveig Cunningham, PhD

An abstract of

A thesis submitted to the Faculty of the

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In partial fulfillment of the requirements for the degree of Master of Public Health

In Hubert Department of Global Health

Abstract

Levels of Sedentary Activity among Adolescent Boys and Girls in Bijapur, India

By Amal O. Jama

Background: Sedentary activity is one of the modifiable behavioral risk factors for Cardiovascular Diseases (CVDs) and has contributed significantly to the worldwide epidemic of overweight and obese children in both developed and developing countries. Specifically, high sedentary activity levels during childhood and adolescence has been known to increase cardio-metabolic risk factors in adulthood. Many studies conducted in the west and even the few conducted in India have shown gender and socioeconomic status to be determinants of the adolescents' levels of sedentary activity, but whether this is the case in the evolving city of Bijapur, India is largely unknown.

Objective: To identify what the levels of sedentary activity are among adolescent boys and girls and to explore whether there are differences in sedentary activity levels based on gender and whether the child attends private or public school in Bijapur, India.

Methods: STATA 12 was used to provide descriptive analysis on the 24 hour time use survey that was conducted on the 407 adolescent boys and girls. The adolescents were between the ages 12 and 17 years and came from 6 different schools, including 3 public and 3 private schools in the city of Bijapur city, India. Two-sided t-tests were done between the different activities between boys and girls and between public school and private school.

Results: Girls spent more bouts engaging in TV watching, sitting or standing while traveling compared to boys. Of the people who reported the sedentary activity of sitting in class at school, 58% were from private schools and 42% from public schools. Private school adolescents had a several significant differences in mean duration time of certain activities conducted while at school.

Discussion: As expected and found in previous research, girls engaged in more bouts and longer durations of sedentary activity than boys for selected sedentary activities. Most adolescents regardless of gender engaged in most of their sedentary activities while at school through activities such as sitting in class at school, homework, and tutoring.
In contrast, for other activities like tutoring and playing on the computer or mobile, boys spend longer durations engaging in these activities.

Keywords: adolescent health, sedentary activity, India

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INTRODUCTION

Noncommunicable diseases (NCDs), previously known to be a burden in primarily developed countries are now prevalent at an increasing rate in both developed and developing nations. In the past twenty years countries such as India, Nigeria, Mexico and Tunisia have seen drastic increases in number of overweight children [1]. More than 36 million people die annually due to NCDs and a staggering 80% of these occur in low-and middle-income countries. Cardiovascular diseases (CVDs) make up most of the NCD related deaths followed by cancers, respiratory disease and diabetes [2].

The modifiable behavioral risk factors for CVDs include tobacco use, unhealthy diet, sedentary activity, and the harmful use of alcohol [3]. In particular, special focus should be placed on the sedentary activity behavioral risk factor because it has contributed significantly to the worldwide epidemic of NCDs. In 2009 sedentary activity alone attributed to over 3 million preventable deaths and was recognized as the fourth leading risk factor of NCDs [4]. Although people of all ages are at risk of developing CVDs, the risk behaviors that are present during childhood and adolescence play a large role on the potential outcome of disease in adulthood [1]. In particular, sedentary activities during childhood and adolescence have been shown to be a precursor for the development of chronic diseases in adults [5]. There is also evidence that there are physiological effects from sedentary activity on metabolism and vascular health such as increased adipose tissue and an increased cardio-metabolic risk which makes one more likely to develop CVDs [6]. Furthermore, worldwide, sedentary activity tends to increase with age and this change has been more noticeable during adolescence for various biological and social reasons that will be discussed below.

Sedentary activity has only in the past 10 years been recognized as a public health problem, which is partly why there are not yet many research studies that explore sedentary activity levels in low-resource settings [4]. Sedentary activities have been classified as activities that do not require much physical movement or energy expenditure [7]. These are activities that can involve sitting, Television viewing, internet, computer games and wireless electronic devices among others [7]. In the United States increases in childhood obesity and overweight have been attributed to changes in the lifestyles of young children and additionally have been linked to increased sedentary activity levels[1]. Previously children were physically active and consumed home-cooked meals but now the majority of children spend more time engaging in sedentary activity while on the internet, playing video games and viewing television [1]. Urbanization and industrialization have also been identified as major contributors to sedentary activity in both the United States and India[8].

Throughout India and the U.S. there are factors that have been attributed to variations in sedentary activity levels and the prevalence of overweight children. These include but are not limited to differences in levels of physical activity, dietary patterns, socioeconomic status (SES), gender, and parental education level. While studies have been done in developed countries on how gender and SES contribute to sedentary activity, there is limited research based in developing countries such as India. Identifying sedentary activity levels among children and youth from a low-resource setting like India is valuable because physical activity is necessary for optimal growth and development and there has not been much research conducted on sedentary physiology in India [9]. Finding out what the levels of sedentary activity are among adolescents is also critical for identifying the scope of the problem. More importantly, researching potential underlying factors such as gender, SES that have shown to be associated with increased

sedentary activity levels is essential in discovering where the disparities lie within this population.

There is a growing epidemic of overweight and obese children in both developed and developing countries[10] which makes children susceptible to cardio-metabolic risk factors that could lead to CVDs[11]. Sedentary activity during childhood and adolescence is a major contributor to overweight and obesity and eventually CVDs[5]. Many studies conducted in the west and even the few conducted in India have shown gender and socioeconomic status to be determinants of the adolescents' levels of sedentary activity, but whether this is the case in the evolving city of Bijapur, India is largely unknown. For this project, the adolescent's school type, private versus public school, will be used as an indicator for SES. In India we lack data on the determinants of physical activity and sedentary activity at individual, family, and community levels. Therefore, an understanding of the factors that may influence sedentary activity levels across the age range that comprises childhood and adolescence will be important to develop successful intervention programs [5].

Research questions

1. How do sedentary activity levels differ among adolescent boys and girls in Bijapur, India?

2. How do sedentary activity levels differ among adolescents that attend private school versus those that attend public school in Bijapur, India?

Table 1

Definition of key terms.

Term	Definition
Sedentary Activity	Activities that do not require much physical activity or movement with Metabolic Equivalent Tasks (METs) of <1.5. (E.g. television or video viewing, computer games, tuition, homework and passive games).
Physical Activity	Activities that require body movement and exert energy with METs >1.5
Screen time	Collective term used for those activities that involve a screen of sorts, such as TV and video viewing, computer and videogame use.
Bout (of sedentary activity)	In this study defined as each time a participant spends a period of time engaging in an activity that is sedentary in nature.

CONCEPTUAL FRAMEWORK
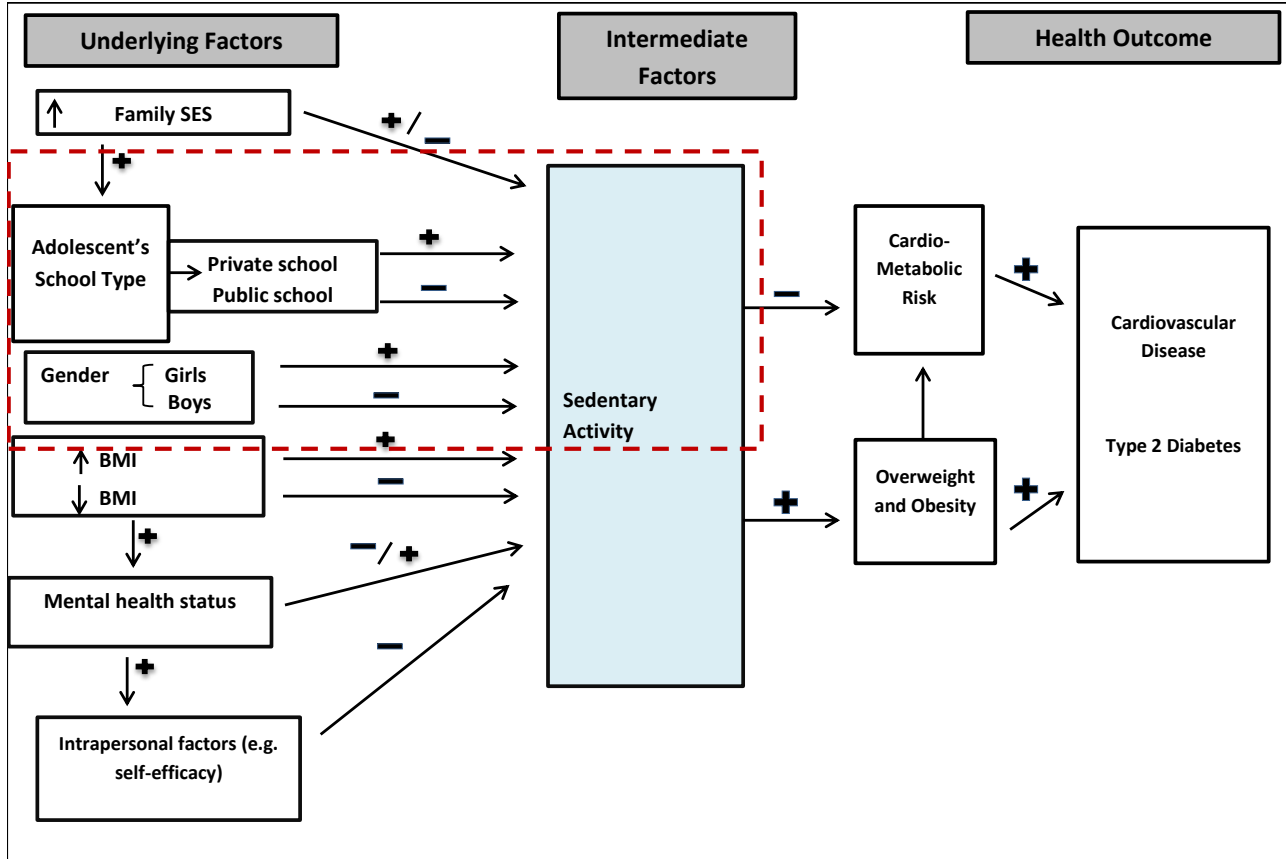
Figure 1

Conceptual Framework Pathway

The above conceptual framework highlights the underlying factors and pathways that may play a role on the levels of sedentary activity that an adolescent engages in. The extent of the focus of this research project along with the hypothesized associations can be found inside the dotted red rectangle. We expect that a family's SES is strongly correlated with whether a child attends private school versus public school. In an example of a dental caries study, it was shown that school type could be used as an indicator for SES [12]. On these grounds we will let school type serve as an indicator for SES, assuming that children that attend private school are most likely from a family with a higher SES. We expect adolescents who attend private schools to be more

likely to engage in more frequent sedentary activities and for longer periods of time compared to adolescents from public schools. Furthermore, it is expected that girls engage in more sedentary bouts and for longer periods of time compared to boys.

Outside of the red dotted rectangle we find other possible factors that may play a role on sedentary activity levels and the possible effects of sedentary activities on health that have been discussed in literature.

REVIEW OF THE LITERATURE

Definition of sedentary activity

In literature from Western settings, namely the United States and Canada, sedentary activities have been characterized as activities with low energy expenditure and little physical movement [6, 13]. TV viewing, computer use, video game use, automobile and workplace sitting have all been identified as sedentary activities according to various research studies[6, 14]. Pate et al describe sedentary activities as those that do not elevate energy expenditure substantially above the resting level and in addition to the aforementioned activities; sleeping and lying down are included in their definition [15].

Most of the physical activity research that has been done in the exercise physiology field quantify the energy expenditures of activities as metabolic equivalent tasks (METs)[6]. This same measurement can also be applied to studies in the sedentary physiology field where sedentary behaviors are characterized as those activities that necessitate ≤1.5 METs [6]. Both Owen et al. and Pate et al. agree on assigning sedentary activity a more specific range of 1.0 to 1.5 METs where 1.0 MET equates to the energy cost of a resting metabolic rate [14, 15].

Sedentary activities can be split up as being of two types, leisure or productive, depending on the purpose of the activity. Reading and using the computer for work or homework are examples of productive sedentary activities, whereas watching television or playing non-educational video games are considered leisure sedentary activities. Productive sedentary activities are associated with lower levels of inactivity, whereas leisure-time sedentary activities have been associated with higher levels of inactivity[16].

Sedentary activity versus physical activity

Tremblay et al. portrays sedentary activity, light physical activity and moderate to vigorous physical activity (MVPA) in a physical activity movement continuum. In this continuum the authors place sleep on the far left with the lowest METs, followed by sedentary activities, light physical activity, MVPA and finally intense exercise on the far right end of this movement continuum [6].

Light physical activity is thought to be distinct from sedentary activities that are found in the lowest end of the physical activity movement continuum because light physical activity require a higher energy expenditure in the range of 1.5 to 3 METs compared to sedentary activities [6]. Light physical activities are lifestyle-embedded activities, or incidental activities such as daily chores or incidental walks [6]. MVPA can include brisk walking, hiking, jogging, cycling and running and are found higher in the continuum because requires an energy expenditure of 3 to 8 METs and in turn should also be viewed as distinguishable from light physical activity [6, 14].

In the physical activity research field there has been a long-standing assumption that sedentary behaviors are synonymous to a lack of physical activity or being less physically active.

Most studies have not actually measured sedentary activities nor viewed these behaviors as being distinct from light physical activity and this may have led researchers to this assumption. Furthermore, the previous lack of objective instruments to monitor and measure a wide range of activities may have also contributed to the notion that sedentary activity is indistinguishable from a lack of physical activity[15]. Many research projects on physical activity have focused on activities that have an energy expenditure of 3 METs or more and consider those people who engage in less than the 3 METs threshold to be engaging in sedentary activities. However by doing this one does not account for potentially beneficial health effects of participating in light physical activity in the 1.5 to 2.9 METs range [14].

An example of the view that being less physically active equates to being sedentary is The Harvard Alumni cohort study of 16,936 Harvard alumni. This study took place from 1962 to 1978 and examined the relationship of physical activity and the incidence of heart attack. Paffenberger's study participants were in the 35-74-age range and were considered to be engaging in sedentary activities if they had an energy expenditure of less than 2000 kcal per week [6, 17]. A second study of health behaviors and physical activity in youth analyzed data from the Youth Risk Behavior Survey of 1999 in the U.S. and classified those 15-19 year old adolescents who reportedly did not engage in recommended levels of MVPA as being sedentary[16].

Contrary to this perspective, there is now emerging evidence that indicates that engaging in sedentary activity is distinct from a lack of physical activity[6, 14, 15, 18, 19]. A supportive argument for this viewpoint is the idea that the effects of sedentary behaviors on a person's metabolism, their physical function and health outcomes are independent, and distinguishable from those effects that MVPA may have on a person [6]. An increasing number of researchers in

the sedentary physiology research field agree that individuals can partake in high levels of MVPA but at the same time can still display very high levels of sedentary behavior. In other words, one behavior doesn't necessarily take the place of another behavior [6, 13, 15, 19, 20].

Declining physical activity during adolescence

Physical activity in both boys and girls is known to decline with increasing age and this change becomes even more apparent during adolescence than in children of younger ages [5]. More specifically some of the factors found to be barriers to physical activity in adolescents are: a lack of time due to homework, negative experiences in school, peer pressure, competitive classes, lack of energy and preference for sedentary pursuits [5]. Additionally a child's gender, family income, maternal education, birth order and reported activity at age 4 have all been linked to influencing physical activity patterns of adolescents. Girls are found to be affected by this decline in physical activity more than boys and irregular menstruation cycles are thought to play a part in their declining physical activity patterns[5]. Body aches due to menstruation are likely to play a role in the decline of adolescent girl's physical activity levels. In addition, body dissatisfaction, especially for girls, appears to be associated with increased sedentary activities [21].

A cross-sectional study in the U.S. on 984 adolescent girls aged 12-14 years old followed the girls' physical and sedentary activity patterns from 6th to 8th grade through accelerometers and self-report measurement. The study found that over the course of two years, there was an increase of 51.5 minutes in time spent engaging in sedentary activities[22]. The apparent shift in physical activity and sedentary activity patterns during adolescents can be attributed to the various aforementioned factors and make this an important age group to study and to gather

more information on regarding the associations of sedentary activity patterns. Adolescence has shown to be a critical age period that sets behavior patterns for adulthood. The fact that there is very little known about sedentary activity patterns in India serves as an additional motivator.

Sedentary activities as cardio-metabolic risk factors

Early studies, such as the Harvard Alumni Study from 1962-78 focused on the health benefits of physical activity but less on the effects of engaging in sedentary activities. The Harvard Alumni study found that physically active men had lower mortality rates due to cardiovascular diseases such as heart attack, than those men who were less active[19]. However, over the past decade, more research has been conducted to determine health outcomes of those that engage in various levels of sedentary behaviors compared to those people who are physically active. Research has shown that physical inactivity or sedentary behaviors are a determinant for cardio-metabolic risk factors such as obesity, hypertension and glucose intolerance [13]. These cardio-metabolic risk factors, especially in adolescents, predict the development of cardiovascular diseases [13]. Perpetuated sedentary time in the absence of vigorous activity results in an increased cardio-metabolic risk in adults [6, 13].

Hill attributes the emergence of type 2 diabetes mellitus and obesity in adolescents to the industrialized and 'Westernized' lifestyle that consists of high amounts energy intake and sedentary behavior [20]. Carson and Janssen's study on cardio-metabolic risk factors explores this further by assessing whether the volume (the frequency), pattern (amount of time in bouts of sedentary behavior) and type of sedentary activity has an independent effect on cardio-metabolic risk. The study used data from the 2003/04 and 2005/06 National Health and Nutrition Examination Surveys (NHANES) and included 2527 children and adolescents in the 6 to 19 year

age range. The results showed that neither the volume nor pattern of sedentary activities were independently related to higher levels of cardio-metabolic risk – that is the prevalence of high cardio-metabolic risk score did not vary for different volumes or patterns of sedentary activities, after adjusting for various confounders (age, gender, SES) and MVPA [13]. However, the type of sedentary activity, particularly TV viewing, proved to be important because it was related to higher levels of cardio-metabolic risk. The idea that TV viewing may be at the lowest end of the energy expenditure spectrum and that TV encourages people to snack between meals may be two possible explanations for this association[13].

Sedentary activity patterns in adolescents from Western settings

The American Academy of Pediatrics (AAP) recommends no more than two hours per day of TV for young people, in part due to the relationship between screen time and health risk [16]. Screen time is a collective term for those activities that involve a screen of sorts, such as TV and video viewing, computer and videogame use.

In Canada 6-19 year olds are spending a daily average of 8.6 hours, approximately 62% of their waking hours being sedentary. In research studies conducted in 6-19 year old children and adolescents in the U.S., comparable results have been witnessed with youth spending a daily average of 6-8 hours being sedentary [7, 22, 23]. Data analysis of the NHANES survey from 1988 to 1994 showed that 25.9% of young people in the 8 to 16 years age range watched ≥ 4 hours of TV per day and 39.1 % watched ≤ 1 hour per day [16].

Sedentary activity patterns in adolescents in India

There are gaps in our knowledge of childhood and adolescent physical activity and sedentary activity patterns in India. There is also a lack of information on physical activity across its four domains which are classified as occupational (work-related), domestic (housework, yard work, chores), transportation (mode of transport when going somewhere), leisure-time (recreational time for hobbies, sports, and exercise)[5, 24]. Most of the studies from India focused more on physical activity and much less on sedentary behaviors. The majority of physical activity studies have been performed in major cities, utilizing various methods across a range of sample sizes. Physical activity patterns are shown to be lower in girls than boys and an association has been found between SES and sedentary activities just as it was in Western settings although in non-Western settings it is a contrasting association [5].

Gender and sedentary activity in Western settings

Assessing whether there are health disparities in a population is critical because evidence of disparities necessitate an investigation to discover what the underlying causes of these health inequities are in order to make interventions to address the problem. This is especially important because excess sedentary activities may contribute to disparities in cardiovascular disease risk factors [23]. *Healthy People 2010*, the national health promotion and disease prevention initiative, confirms the need to bring health disparities to the forefront by setting a goal to eliminate health disparities entirely[23].The gender of adolescents has proven to be associated with sedentary activity patterns. Results from the largest and most detailed time-use analysis of 10-18 year old adolescents in Australia showed that boys spent more time than girls participating in sedentary activities. The study collected data from 6,024 adolescents and sedentary variables

were grouped as TV, screen time, passive transport and waking time [25]. Similar findings of boys spending a higher proportion of their time in sedentary activities was found in the study of the 2001-2006 NHANES survey which collected data on 8,707 children and adolescents aged 2 to 15 years. Boys viewed more than 2 hours of TV/video daily than girls (34.1% versus 31.7%) and they spent more time in total screen time compared to girls (49.4% versus 45.0%) [16]. An interesting point to note here is that even though boys are engaging in more sedentary activities than girls, boys also reported higher physical activity levels and sports than girls [16]. Additionally the increase of sedentary activities that boys and girls encounter during adolescence was more substantial in girls than in boys [26].

Gender and sedentary activity in India

The association between gender and sedentary activities in India has shown some varying results. In Corder's study on 30 adolescents from Chennai, India set out to measure physical activity and sedentary activity energy expenditures of this adolescent group. The group included 15 boys and 15 girls with a mean age of 15.8 years [27]. Among this group of 30 adolescents from urban schools there were no significant differences between boys and girls for sedentary and light intensity activities. Although no significant differences for sedentary activities were found in relation to gender, girls were less physically active than boys with the study's three methods used to assess physical activity (previous week recall questionnaire, doubly labeled water, and accelerometer) [27].

Swaminathan's research on 8 to 15 year old urban South-Indian children, with a sample size of 256, boys spent a longer time viewing TV/video and engaging in total sedentary activities compared to girls[28]. Differences in the outcomes of these studies may be due to the different

ways of categorized sedentary activities and additionally the researchers may have not taken confounding factors such as the SES of the adolescents into consideration.

SES and sedentary activity in Western settings

The relationship of socioeconomic status (SES) and sedentary behavior patterns in Western settings versus those in non-Western settings are contrasting. In Western settings adolescents that come from a family with a lower SES engage in more sedentary activities than those from a higher SES[26]. In a 5 years study in England on 5,863 children that were 11-12 years old at the beginning of the study in 1999, boys from the lower SES group on average spent 2.29 more hours per week engaging in sedentary activities than those from the higher SES group. Girls from the lower SES group spent 4.09 more hours per week engaging in sedentary activities compared to boys from the higher SES group [26].

A larger study from the U.S. with 8,707 boys and girls from ages 2 to 15 years used data from the 2001 to 2006 NHANES surveys to describe sedentary activity patterns in terms of SES. The proportion of boys and girls from families with low and medium household incomes (earning <$25k and $25-45k respectively) that watched more than 2 hours of TV/video or total screen time per day was higher than those children with higher family incomes (>$45k) [16]. A lack of resources in the family's neighborhood, such as affordable health facilities or playgrounds, may play a role in this occurrence[29]. In a study researching household and physical environmental barriers to physical activity in the U.S., 12 African American girls with a mean age of 7.8 years were interviewed along with their caregivers. The girls and their caregivers perceived lack of affordable and accessible recreation facilities both at home and in their neighborhoods were considered barriers to physical activity [29]. Although the family's

SES was not taking into consideration in the last study, SES may still be related to why a caregiver perceives lack of affordable recreation facilities to be a barrier to physical activity.

SES and sedentary activity in India

The implications of SES on sedentary behavior in India are quite opposite of those that were mentioned above in Western settings. A study of 3,127 school girls 6 to 18 years old from New Delhi, related the girls' SES to their nutrition and lifestyle and found that 92.8 % of girls from lower SES participated in outdoor activities versus 64% of those from the upper SES [30]. Girls from the upper SES had a propensity to spend less time on outdoor physical activity and more time on engaging in sedentary activities like watching television, playing computer games, indoor tuition and recreational activities compared to girls from lower SES [30]. Familial expectations and the importance that is placed on educational performance in families of higher SES in India may play a role in why parents provide their children with indoor tuition thus increasing their time spent engaging in sedentary activities. Furthermore, those families from the upper SES are able to afford tuition for their children, whereas those from lower SES most likely do not have the resources to do so. In conjunction with the adolescents from a higher SES being more sedentary, Laxmaiah et al found that adolescents studying in private schools also had a higher prevalence of overweight compared to those students from public schools. [31] This study also found that those adolescents from a higher SES had a significant higher prevalence of being overweight compared to those children from public schools. [31]

Objective and Subjective Measurement of Sedentary Activities

In physical activity and exercise studies, the measurements of physical activity patterns are classified using the FITT formula (Frequency, Intensity, Time, and Type of activity). Tremblay et al recognize that sedentary behaviors however do not show variation in their intensities and therefore the FITT formula is adapted to the acronym SITT. The SITT acronym stands for sedentary behavior frequency (number of bouts of a certain duration), interruptions, time (the duration of the sedentary activity), and type (mode of sedentary activity such as sitting, or computer use[6].

A study of the 2001 through 2006 NHANES surveys used a single primary measure for measurement of sedentary behaviors. Sisson et al in this case looked at several variables such as TV viewing, computer use, age, ethnicity, and body mass index and combined them to form the single total screen time outcome variable[16]. A criticism of this approach is that we are unable to distinguish whether it is one particular type of sedentary activity that may be increasing the risk for a particular health outcome such as obesity or cardiovascular disease. Other researchers such as Feldman et al discuss that most studies researching the associations between physical activity and sedentary behavior choose to focus on TV watching (at times including videogame use) and use this activity as a proxy for sedentary behavior[14]. Feldman et al and Owen et al agree that different sedentary behaviors should not be clumped together but rather measured independently of one another [14, 32].

When it comes to the mode of data collection for sedentary activities there has been a shift from questionnaires to an objectively measure of activities using accelerometers[28]. While accelerometers have been used in studies in developed countries, they have rarely been used in India. The benefit of accelerometers is that they more precisely measure the entire range of

activities at various intensity levels (sedentary, light, moderate and vigorous) [15]. In other words accelerometers describe not only the amount of movement but also the intensity, duration, frequency and patterns of movement[6]. A limitation of accelerometers is that they are unable to capture contextual information on the type of sedentary activity and are unable to distinguish between sitting, lying, or standing still. The contextual information is an important aspect of the design of successful intervention strategies on the reduction of sedentary time [6].

This contextual information that accelerometers fail to provide can be found through the self-report of sedentary activities as it gives more specificity regarding the domains of physical activity [28]. There is reasonably strong evidence on the reliability and validity of brief self-report measures, which could be in the form of a time use survey of TV viewing time, leisure-time computer use, and video game playing that would be suitable for use in population surveys [6]. Although self-report data should be interpreted with caution because of its vulnerability to misrepresentation, particularly exaggeration of the time spent in activity [33].

METHODOLOGY

The purpose of the larger research study which collected the data being utilized for this thesis paper was to address how differences in home environments, socioeconomic status, and gender differences relate to unhealthy weight (underweight and overweight/obesity) risks in adolescents in India. The overarching study explored dietary habits of the adolescents, anthropometric measurements, and socioeconomic status of the families. This thesis however focuses on a smaller part of the larger research project and utilizes one portion of the collected data. This method chapter includes a review of the research method and design appropriateness,

the study population and the sample drawn from it, the study setting, data collection instruments used, and data analysis steps

Study Setting

The study took place in Bijapur City located in the Bijapur district within Karnataka, a South Western state in India. The district of Bijapur and Bijapur City have a population of 1,806,918 and 569,348 respectively [34]. There are 102,401 households in Bijapur city and of these 46,236 are located in urban areas and 56,165 are living in rural areas. The city has a decennial growth rate of 20.35%[34]. Although Bijapur city had few professional education institutions prior to the 1980s, it now has a variety of undergraduate and graduate universities and the city is now emerging as a hub for professional education [35]. The expansion in educational institutions contributes to the changing social and developmental dynamics of this city making it an important setting for the research study.

A stratified random sample of school-going adolescents aged 12-17 years along with their mothers or primary caretakers was drawn as part of the study population. The sample was drawn from three private and three public schools that were randomly selected from a pool of 87 schools in Bijapur city. A total of 201 students were recruited from the public schools and 206 came from private schools adding up to a sample size of 407 adolescents. This adolescent population in India was chosen because there is not much known about underweight and overweight/obesity risks of this age group and the socioeconomic and cultural factors that play a role in these risks of adolescents in India.

The overall aim of the larger study was to design and validate a culturally appropriate instrument in order to collect preliminary data on social and cultural influences of the home environment on underweight and overweight risks in boys and girls.

The purpose of this portion of the project was to present descriptive statistics on the levels of sedentary activities of the adolescents of Bijapur. Furthermore the analysis aimed to ascertain whether the sedentary activity levels of girls were different than those of boys and whether the adolescent's sedentary activity levels varied depending on whether the children attended private school versus public school.

Research Design

The adolescent module consisted of demographic characteristics, 24-hour time use recall, 24-hour food recall, anthropometric measurements and 24-hour pedometer results. The main focus of this thesis project is the exploration of the levels of sedentary activities that Indian adolescents engage in and to ascertain whether there is a significant difference in the bouts and duration of engaging in sedentary activities if the adolescents attend private versus public school. Although one of the modules collected information on the family's SES, for the purposes of this research we used the school type (public versus private) as an indicator for Furthermore the aim was to explore if the gender of the participant affects the bouts and duration of sedentary activity that adolescents are engaging in.

The 24-hour time recall or time use survey was used for data analysis. The 24-hour time use survey measured both physical activity and sedentary activities and asked participants to list all the activities that they took part in the previous day from the time they woke up until they

slept. The time use survey also asked participants for the duration and location of the activity or inactivity, who they were with and what else they were doing while engaging in the activity.

Data Collection Instruments

The 24 hour recall was adapted from the American Time use survey. Time use surveys are used in assessment of physical activity in public health research. The American Time Use Survey interviewers uses a Computer Assisted Telephone Interviewing (CATI) system to ask standardized questions that are used to lead the respondent in a 24 hour recall period of each activity done in this period, the duration, where it was done and with whom. The advantage of this methodology is that it can be used to assess the relationship between the environment and specific behavior. Single day time use recalls enables memory related errors to be reduced [4].

Variable selection and coding

An activity codebook (see table 2) was created from the responses of the time use/ activity recall. From this codebook a list of 14 variables were chosen because they were considered to be sedentary activities based on justification from literature or importance of inclusion for the research objectives and data analysis purposes. The two main criteria for inclusion were for the activities to have an energy expenditure of less than 1.5 METs in order to fit the sedentary behavior definition and/or have been defined as sedentary activities in literature. The 14 selected sedentary activities were divided and grouped into four domains that best described the nature of the sedentary activity. The four group domains are as follows: Passive, School, Play/Social and Travel Domain. All four domains, as well as gender and school type were coded dichotomously.

The respondents' observations were listed vertically in long form along with each respondent ID. The early steps that were taken to prepare for data analysis included the creation of variables for each sedentary activity as well as editing the duration start and end times in the correct format for *STATA* to be able to calculate the duration. For the bouts of sedentary activities and the mean durations of sedentary activities, the sedentary domains, the14 separate sedentary activities, gender, and school type variables were taken into consideration for analysis purposes. The p-value for all statistical tests was set at a significance level alpha of 0.05.

Code #	Activity	Description	Citation (justifying inclusion as "sedentary")
Table 2: Sedentary activity codebook, with description and justification for inclusion			
	Sleeping and passive activities domain		
0	Going to bed or waking up	Lying in bed not yet asleep or trying to get up	EE is 1 MET
3	Watching someone work or do tasks	Passive watching without helping	EE is roughly 1 METs
27	Doing nothing	Doing nothing, thinking, waiting	EE is 1 METs
	School		
60	Sitting in class at school	Sitting in the classroom with minimal movement	EE is roughly 1.8 METs[10]
61	Tutoring	Receiving tuition	Longitudinal trends in PA patterns in selected urban South Indian school children [28]
62	Homework	Studying at home or elsewhere outside of class time, doing research, reviewing homework with parent	Longitudinal trends in PA patterns in selected urban South Indian school children [28]
63	Training	Being taught other than school, e.g. apprenticeship	If seated with very low movement then yes
64	Meetings	Attended meeting or assembly in school, youth group, other	If seated with very low movement then yes
	Play and social activities		
70	Playing on computer or mobile	Includes games, chatting, texting, Facebook	Physiological and health implications of a sedentary life[6, 14]
71	Reading and writing	For pleasure or for school work	Longitudinal trends in PA patterns in selected urban South Indian school children [28]—a justification to include Homework from the literature and this would be the same EE as doing homework
75	Non-active game	Chess, Carrom, card games, guessing games	EE or METs
77	Watching games	Watching others play or an organized game, or parade, fair, not on TV	Not specifically in literature but making the assumption that is has the same EE as watching TV
78	Watching TV	Watching TV or movies	Physiological and health implications of a sedentary life[6, 14]
	Travel		
81	Sitting or standing while traveling	Waiting for bus, sitting in car or on bus	Physiological and health implications of a sedentary life[6, 14]

Data analysis

From the initial sample of 407 adolescent boys and girls, 399 remained in the final analysis which was comprised of 199 boys and 200 girls. The participants were all in the 12 to 17 year age range and of the 399 sample, there was an almost equal distribution of boys and girls from each school type- 101 girls and 100 boys from the 201 private schools, and 99 boys and 99 girls from the 198 public schools that participated.

The analysis for this project was conducted using *STATA* 12. The observations that contained missing data values were deleted from the dataset along with observations that contained negative duration times of the sedentary activities. The physical activities reported in the 24-hr recall were not the focus of this project and therefore were also deleted from the dataset. Once missing data and the observations pertaining to physical activities were deleted and the data were expanded to provide each respondent with additional 100 activity slots so that the mean duration and bouts could be calculated correctly by including those people who did not engage in the activity in the denominator as well resulting in a more accurate average. Once all the activity variables were created dichotomously (whether the adolescent participated or not), the dataset was collapsed in order to transform the long form to a wide form of data so that the dataset was in individual level state.

The descriptive statistics presented for this project consisted of first assessing whether the duration and frequency of the various sedentary activities were distributed normally. Once it was found that the data were normally distributed the investigator conducted two sided T-tests for the mean duration of sedentary activities by gender and school type variables to see whether there was variance in the level of sedentary activity between boys or girls and between adolescents from private and public schools. The mean durations of the different activities stratified by

gender and school type will also be presented in a data table to show the distribution of time

spend on sedentary activities along with standard deviation, 95% Confidence Intervals and P-

values.

Table 3 Classification of variable coding type

Variables	Coding Type
Duration of 14 selected sedentary activities of the recall*	*Linear (duration)*
Frequency count of the 14 selected sedentary activities	*Linear*
School type (Private vs. Public)	*Dichotomous*
Gender (Male vs. Female)	*Dichotomous*
Weight	Linear
BMI	Linear

*=The 14 selected sedentary activities are in the table above and the variables in italics are the ones used for this data analysis.

The research team submitted the Bijapur project to the Institutional Review Board (IRB)

for ethical review and the use of the de-identified data for this analysis project does not involve

human subjects and therefore was administratively withdrawn and did not require further

approval.

RESULTS

From the initial sample of 407 adolescent boys and girls, 399 remained in the final analysis which was comprised of 199 boys and 200 girls. The participants were all in the 12 to 17 year age range and of the 399 sample, there was an almost equal distribution of boys and girls from each school type- 101 girls and 100 boys from the 201 private schools, and 99 boys and 99 girls from the 198 public schools that participated.

From the mean durations of time spent in each activity seen below, it is evident that the longest time spent engaging in an activity was 213.85 minutes. This was among all adolescents, including the people who did not engage in the activity. Among the adolescents who actually reported doing the activity, a time of 274.36 minutes was spent on sitting in class at school. The other two activities that weren't far behind in terms of a higher mean duration were reading and writing from the play/social domain and homework from the school domain.

The activities, non-active games and watching games weren't reported in any of the adolescents and an average of 0.55 minutes was spent doing nothing among all participating adolescents. Overall most of the adolescent's time was spent in the school domain activities, with an average of 409.38 minutes, compared to an average of only 12.55 minutes spent in the passive domain activities.

Table 4 Mean duration in minutes spent engaging in each sedentary activity among all participating adolescents in Bijapur, India, 2012. (n=399)

Activity	Mean	Std. Dev.	Min	Max
Going to bed or waking up[a]	9.15	23.09	0	156
Watching someone work or do tasks	2.52	18.12	0	240
Doing nothing	0.55	4.94	0	60
Passive domain	12.23	29.96	0	240
Sitting in class at school	213.85	139.06	0	540
Tutoring	27.01	59.67	0	395
Homework	124.28	106.52	0	455
Training	31.93	56.09	0	505
Meetings	12.30	29.84	0	215
School domain[b]	409.38	169.46	0	1085
Playing on computer or mobile	4.42	20.12	0	210
Reading and writing	34.05	88.87	0	690
Non-active game	0	0	0	0
Watching games	0	0	0	0
Watching TV	71.12	73.69	0	435
Play Domain	109.59	114.69	0	750
Sitting or standing while traveling	34.62	64.11	0	560
Travel Domain	34.62	64.11	0	560

[a]Defined as
[b]Dropped 2 observations due to missing

Table 5 Mean duration in minutes spent engaging in each sedentary activity among those adolescent boys and girls who participated in the specified activities in Bijapur, India, 2012.

Activity	N	Mean	Std. Dev.	Min	Max
Going to bed or waking up[a]	110	33.22	33.78	3.0	156.0
Watching someone work or do tasks	14	71.79	68.52	10.0	240.0
Doing nothing	6	36.67	18.89	15.0	60.0
Passive domain	124	39.35	42.75	3	240.00
Sitting in class at school	311	274.36	90.40	10.0	540.0
Tutoring	89	121.10	67.68	5.0	395.0
Homework	304	163.12	92.45	0	455.0
Training	294	43.34	61.46	0	505.0
Meetings	106	46.28	42.27	1.0	215.0
School domain[b]	391	417.75	160.61	15	1085
Playing on computer or mobile	31	56.94	47.76	0	210.0
Reading and writing	84	161.74	130.26	10.0	690.0
Non-active game	0	0	0	0	0
Watching games	0	0	0	0	0
Watching TV	290	97.84	69.67	10.0	435.0
Play Domain	318	137.50	112.54	10	750
Sitting or standing while traveling	166	83.20	76.46	5.0	560.0
Travel Domain	166	83.20	76.46	5.0	560.0
[a]Defined as					
[b]Dropped 2 observation due to missing					

Bouts of engaging in specific sedentary activities

Out of the 399 sample of adolescents there were 110 bouts of going to bed or waking up, which was defined as lying in bed not yet asleep or trying to get out of bed. Of the adolescents that engaged in this activity, the proportion of boys that engaged in this activity was 40% as opposed to 60% of girls at a significant p-value of 0.02. As for the activity of watching someone do work, only 14 people reported engaging in this activity, but 78.6 % of those were girls and 21.4% were boys and this difference was statistically significant at a p-value of 0.03. Among the activities that were opposite of the predicted hypothesis were tutoring and playing on a computer or mobile. Boys represented 59.6 % of those that engaged in tutoring, whereas girls were 40% of these people. Similarly boys were more likely to play on a computer or mobile, with 67.7% of boys engaging in this compared to 32.3% of girls.

In the overall passive domain, girls engaged in a total of 73 bouts of any of the three activities under that domain, and boys engaged in 51 bouts at a P-value of 0.0190. When it comes to the school domain, girls engaged in a combined 195 bouts of sedentary activities such as homework, trainings, and tutoring compared 194, a similar number of bouts for boys.

Table 6. Frequency (bouts) of engaging in sedentary activities and sedentary domains stratified by gender, n=399

Activity	Yes	Boys(n=199)	Girls(n=200)	P-Value
Going to bed or waking up[a]	110	44 (40.0%)	66 (60.0%)	0.0149*
Watching someone work or do tasks	14	3 (21.4%)	11 (78.6%)	0.0302*
Doing nothing	6	5 (83.3%)	1 (16.7%)	0.0986
Passive domain	124	51 (41.1%)	73 (58.9%)	0.0190*
Sitting in class at school	311	157 (50.5%)	154 (49.5%)	0.6481
Tutoring	89	53 (59.6%)	36 (40.5%)	0.0383*
Homework	304	154 (50.7%)	150 (49.3%)	0.5757
Training	294	151(51.4%)	143 (48.6%)	0.3206
Meetings	106	49 (46.2%)	57 (53.8%)	0.3807
School domain	389	194 (49.9%)	195 (50.1%)	0.1268
Playing on computer or mobile	31	21 (67.7%)	10 (32.3%)	0.0383*
Reading and writing	84	42 (50.0%)	42 (50.0%)	0.9794
Non-active game	--	--	--	
Watching games	--	--	--	
Watching TV	290	140 (48.3%)	150 (51.7%)	0.2975
Play Domain	319	156 (48.9%)	163 (51.1%)	0.4382
Sitting or standing while traveling	166	78 (47.0%)	88 (53.0%)	0.3303
Travel Domain	166	78 (47.0%)	88 (53.0%)	0.3303

[a]Defined as lying in bed not yet asleep or trying to get up
[b]Dropped 2 observation due to missing

Among those adolescents who reported to have participated in the activity, approximately 70% of private school students reported bouts of the sedentary activity of going to bed or waking up compared to about 30% of public school students (P-value<0.0001). Overall the bouts of sedentary activity from the school domain in particular are the highest among all of the four sedentary domains and adolescents from private schools in comparison to public schools have a

higher representation of bouts of sedentary activity. The number of bouts of sitting in class at

school among those who did the activity is significantly different between adolescents from

private and public schools. Of the people who reported sitting in class at school, 58% were from

private schools and 42% from public schools. The activities, tutoring and meetings were also

significantly different between private and public schools, with adolescents from public schools

Table 7 Number of adolescents that have participated in various sedentary activities stratified by School type, (n=399) *only those that said they engaged in these activities are included

Activity	Yes	Private (n=201)	Public (n=198)	P-Value
Going to bed or waking up[a]	110	77 (70.0%)	33 (30.0%)	<.0001*
Watching someone work or do tasks	14	2 (14.3%)	12 (85.7%)	0.0060*
Doing nothing	6	3 (50.0%)	3 (50.0%)	0.9852
Passive domain	124	79 (63.7%)	45 (36.3%)	0.0003
Sitting In class at school	311	181 (58.2%)	130 (41.8%)	<.0001*
Tutoring	89	62 (69.7%)	27 (30.3%)	<.0001*
Homework	304	147 (48.4%)	157 (51.6%)	0.1487
Training	294	153 (52.0%)	141 (48.0%)	0.2657
Meetings	106	31 (29.3%)	75 (70.8%)	<.0001*
School domain[b]	389	195 (50.1%)	194 (49.9%)	0.7866
Playing on computer or mobile	31	16 (51.6%)	15 (48.4%)	.8859
Reading and writing	84	48 (57.1%)	36 (42.9%)	0.1627
Non-active game	--			
Watching games	--			
Watching TV	290	142 (49.0%)	148 (51.0%)	.3580
Play Domain	319	159 (49.8%)	160 (50.2%)	.6079
Sitting or standing while traveling	166	152 (91.6%)	14 (8.4%)	<.0001*
Travel Domain	166	152 (91.6%)	14 (8.4%)	<.0001*
[a]Defined as lying in bed not yet asleep or trying to get up [b]Dropped 2 observation due to missing				

Mean sedentary activity duration and gender

Girls reported spending more time engaging in sedentary activities in the passive sedentary

domain with an average   homework, tutoring, going to bed or waking by boys. Boys however

reported spending more time 'doing nothing' compared to girls at a significant p-value of 0.03.

The school domain consisting of activities such as sitting in class at school, homework and

tutoring among others, is the domain with the highest mean duration of time spent in sedentary

activities compared to the passive, play/social and travel domains. The activity within the school

domain that is responsible for the highest mean duration is 'sitting in class at school' with boys

spending an average of 219 minutes sitting in class at school, and girls spent a slighter lower 209

minutes with a non-significant p-value of 0.23.

Table 8 Mean duration (minutes) spent in various sedentary activities grouped in domains and stratified by gender. (n=399, Boys=199, Girls=200)* Among all participants-even those who did not engage in the activity.

Activity	Gender	Mean	Std.Dev	P-value
Going to bed or waking up	Boys	6.57	19.31	0.98
	Girls	11.73	26.12	
Watching someone work or do tasks	Boys	1.51	13.88	0.87
	Girls	3.53	21.51	
Doing nothing	Boys	1.03	6.90	0.03*
	Girls	0.08	1.06	
Passive Domain	Boys	9.11	24.39	0.98
	Girls	15.33	34.40	
Sitting in class at school	Boys	218.96	142.35	0.23
	Girls	208.77	135.88	
Tutoring	Boys	28.62	54.33	0.30
	Girls	25.41	64.65	
Homework	Boys	124.45	106.57	0.49
	Girls	124.12	106.74	
Trainings	Boys	36.94	64.69	0.04*
	Girls	26.95	45.59	
Meetings	Boys	12.61	31.19	0.42
	Girls	11.99	28.50	
School Domain	Boys	421.59	160.356	0.08
	Girls	397.23	177.62	

Playing on computer or mobile	Boys	6.11	24.51	0.05
	Girls	2.75	14.36	
Reading and writing	Boys	35.09	90.34	0.41
	Girls	33.02	87.59	
Non-active game	Boys	-	-	-
	Girls	-	-	
Watching games	Boys	-	-	-
	Girls	-	-	
Watching TV	Boys	62.53	64.36	0.99
	Girls	79.66	81.20	
Play Domain	Boys	103.73	111.40	0.85
	Girls	115.42	117.86	
Sitting or standing while traveling	Boys	36.59	72.19	0.27
	Girls	32.65	55.01	
Travel Domain	Boys	36.59	72.19	0.27
	Girls	32.65	55.01	

Table 9 Mean duration in minutes spent in various sedentary activities grouped in domains and stratified by gender in Bijapur, India. 2012(n=399, Boys=199, Girls=200) *Among the adolescent boys and girls who participated in the activity***

Activity	Yes	Gender	Mean	Std. Dev.	P-value
Going to bed or waking up[a]	110	Boys	29.73	31.83	0.38
		Girls	35.55	35.06	
Watching someone work or do tasks	14	Boys	100.00	65.57	0.44
		Girls	64.09	70.28	
Doing nothing	6	Boys	41.00	17.46	-
		Girls	15.00	-	
Passive Domain		Boys	35.55	37.37	0.41
		Girls	42	46.21	
Sitting in class at school	311	Boys	277.54	96.72	0.53
		Girls	271.12	83.65	
Tutoring	89	Boys	107.47	51.01	**0.02***
		Girls	141.17	83.40	
Homework	304	Boys	161.87	93.86	0.73
		Girls	165.49	91.24	
Trainings	294	Boys	48.69	70.34	0.15
		Girls	38.22	50.04	
Meetings	106	Boys	51.20	44.67	0.27
		Girls	42.05	40.04	
School Domain		Boys	428.05	152.75	0.20
		Girls	407.41	167.90	

Playing on computer or mobile	31	Boys	60.75	52.95	0.76
		Girls	55.0	36.97	
Reading or writing	84	Boys	166.26	130.65	0.75
		Girls	157.21	131.30	
Non-active Games	0	Boys	0	0	0
		Girls	0	0	
Watching games	0	Boys	0	0	0
		Girls	0	0	
Watching TV	290	Boys	88.89	59.50	0.03*
		Girls	106.21	77.25	
Play Domain		Boys	133.17	109.58	0.50
		Girls	141.62	115.46	
Sitting or standing while traveling	166	Boys	93.36	89.63	0.11
		Girls	74.20	61.67	
Travel Domain		Boys	93.36	89.63	0.11
		Girls	74.20	61.67	
[a]Defined as lying in bed not yet asleep or trying to get up					

From the mean duration of time spent in sedentary activities by all adolescents, stratified by school type, there were several activities and domains that resulted in a significant trend in the predicted direction of private school children spending more time being sedentary than public school children. Adolescents from private schools reported spending roughly 70 minutes longer sitting in class compared to children from public school. Furthermore, time spent doing homework by private students was 175.11 minutes compared to 151.90 minutes by public school students. Tutoring had similar findings in that private students spent 30 minutes longer receiving tutoring compared to public school.

For several activities the results show that the public school students spent a longer time in sedentary activities, an example of this are the activities; watching someone work or do tasks, doing nothing, trainings, meetings, reading or writing as well as sitting or standing while traveling.

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Of the students who actually reported the activities, there were several significant differences between the mean duration times from public school and private school. The activities; sitting in class, tutoring and homework, which all come from the school domain, showed a significant difference in mean durations when comparing private and public school. For all three activities those adolescents from private schools spent close to an average of 30 additional minutes engaging in them.

Table 10 Mean duration (in minutes) spent in various sedentary activities grouped in domains and stratified by school type, Bijapur, India, 2012 (n=399, Boys=199, Girls=200)
Among all the adolescent boys and girls—even those that didn't engage in the activity

Activity	School Type	Mean	Std. Dev.	P-value
Going to bed or waking up	Private	12.78	27.74	<0.001*
	Public	5.48	16.41	
Watching someone work or do tasks	Private	0.27	3.01	0.99
	Public	4.80	25.37	
Doing nothing	Private	0.52	4.83	0.55
	Public	0.58	5.07	
Passive Domain	Private	13.58	28.36	0.18
	Public	10.86	31.50	
Sitting in class at school	Private	273.45	122.17	<0.001*
	Public	153.35	128.89	
Tutoring	Private	40.44	73.05	<0.001*
	Public	13.38	37.49	
Homework	Private	128.0	110.40	0.24
	Public	120.44	102.56	
Trainings	Private	24.81	45.48	0.99
	Public	39.17	64.42	
Meetings	Private	5.42	18.21	1.0
	Public	19.28	36.94	
School Domain	Private	472.18	160.36	<0.001*
	Public	345.63	154.27	
Playing on computer or mobile	Private	4.60	21.11	0.43
	Public	4.24	19.12	
Reading and writing	Private	36.83	94.93	0.26
	Public	31.23	82.40	
Non-active game	Private	-	-	
	Public	-	-	

Watching games	Private	-	-	
	Public	-	-	
Watching TV	Private	68.83085	73.84	0.73
	Public	73.43	73.65	
Play Domain	Private	110.26	117.63	0.45
	Public	108.90	111.92	
Sitting or standing while traveling	Private	61.33	72.19	<0.001*
	Public	7.5	39.32	
Travel Domain	Private	61.33	72.19	<0.001*
	Public	7.5	39.32	

Table 11 Mean duration in minutes spent in various sedentary activities by adolescents stratified by school type in Bijapur, India, 2012 (n=399) *Among those adolescent boys and girls who reported engaging in the activities*

Activity	Yes	School Type	Mean	Std. Dev.	P-value
Going to bed or waking up[a]	110	Private	33.36	36.45	0.95
		Public	32.88	26.98	
Watching someone work or do tasks	14	Private	27.50	17.68	0.34
		Public	79.17	71.44	
Doing nothing	6	Private	35.00	22.91	0.86
		Public	38.33	18.93	
Passive Domain		Private	34.54	36.46	0.09
		Public	47.78	51.38	
Sitting in class at school	311	Private	303.67	85.77	<0.001*
		Public	233.56	80.57	
Tutoring	89	Private	131.10	73.60	0.03*
		Public	98.15	44.81	
Homework	304	Private	175.11	91.67	0.02*
		Public	151.90	92.06	
Trainings	294	Private	32.59	49.67	0.001*
		Public	55.01	70.45	
Meetings	106	Private	35.13	33.64	0.08
		Public	50.89	44.75	
School Domain		Private	484.22	143.22	<0.001*
		Public	350.94	149.30	
Playing on computer or mobile	31	Private	57.81	51.57	0.90
		Public	56.0	45.13	
Reading or writing	84	Private	154.23	140.91	0.55
		Public	171.75	115.74	

Non-active Games	0	Private	0	0	0
		Public	0	0	
Watching games	0	Private	0	0	0
		Public	0	0	
Watching TV	290	Private	97.43	70.20	0.92
		Public	98.24	69.40	
Play Domain		Private	139.39	115.89	0.77
		Public	135.62	109.41	
Sitting or standing while traveling	166	Private	81.10	72.72	0.24
		Public	106.07	110.32	
Travel Domain		Private	81.10	72.72	0.24
		Public	106.07	110.32	

DISCUSSION

Findings

This study set out to examine whether levels of sedentary activity varied among boys and girls and among those who attend private school versus public school. The variables that were looked at were mean duration time of the sedentary activities as well as bouts of sedentary activity by child and more specifically by gender and school type. As expected and previously found in literature, girls spent more bouts engaging in various sedentary activities compared to boys. A notable difference is that 58.9% of those that reported engaging in activities from the passive domain were girls, compared to 41.1% of those being boys. The activities that showed a significant differences in the level of sedentary activity between genders were; going to bed or waking up and watching someone work or do tasks. Girls engaged in a higher number of bouts than boys for these activities. Contrary to this, tutoring and playing on the computer or mobile showed significant difference in number of bouts with boys engaging in these sedentary activities more than girls.

From the mean duration of time spent in sedentary activities stratified by school type there were several activities and domains that supported the predicted hypothesis of private school children spending more time being sedentary than public school children. Singh et al. explain that a changing lifestyle in developing countries with influences from the Western societies has changed the way people spend their time. People tend to be more homebound, spending more time watching TV, on the internet, and playing videogames. It was also noted that those adolescents from a more affluent class or higher SES can more readily afford these type of entertainment amenities[1]. This is partly an explanation why adolescents from higher SES and those who attend private schools are more likely to engage in sedentary activities. Not only are they exposed to more technology that can support a sedentary life, but these children also spend prolonged periods of time engaging in the activities from the school domain which can be seen from the results.

Limitations and delimitations

This study involves a cross-sectional sample of the population, which means that no cause-and-effect relationships can be identified; instead only associations can be made. These associations however can identify if factors such as school type (indicator of SES) and gender attribute to adolescents' tendency to engage in sedentary activities and these findings will be very useful in designing future interventions to reduce sedentary activities among adolescent boys and girls. The results of the research study may also not be generalizable to India as a whole since the study was conducted in just one city. The data collection instrument and preliminary therefore may also not be valid in other parts of India.

Recommendations

Further research is needed on the factors that may affect the sedentary levels of adolescents. As developing countries are showing more Westernized tendencies it would be interesting to see whether the results of this study hold true in other regions of India that may have been influenced at higher or lower levels. As the city of Bijapur and the surrounding region continues to evolve and grow, it would be imperative to look at the type of research over the course of several years. These types of studies can serve as a source of information for those public health practitioners that aim to prevent chronic disease in adulthood by tackling issues that may be taking place at the root. The identification of at- risk groups is important in order to successfully develop interventions according to what the levels of sedentary activity are in the community.

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APPENDIX A

24-hour Time-Use Recall

We would like to know about what you do during a day. Let us talk about yesterday. Please tell me everything you did from the time you woke up in the morning to the time you went to sleep at night. I would also like to know how long each activity took, where you were when you did it, who you were with, and what else you were doing at the same time.

Here is an example of a day given by someone your age.

TIME	A	B	C	D	E	F	G
Midnight	*What did you do?*	*Time Began*	*Time Ended*	*Where were you?*	*Who was doing this with you?*	*Who else was in the same room but not doing the same thing?*	*What else were you doing at the same time?*
	1. Sleeping	12:00	7:10	At home	----------------	-----------------	-----------------
	Trying to wake up	7:10	7:20	At home	-----------------	-----------------	-------------------
	Showering	7:20	7:35	At home	----------------	-----------------	-------------------
	Getting dressed	7:35	7:40	At home	-----------------	------------------	------------------
	2. Eating breakfast	7:40	7:55	At home	Mother, sister	X	Talking, watching TV
	3. Driving to school	7:55	8:05	In car	X	X	Listening to CDs
	4. At school	8:05	2:35	At school	--------------	-----------------	----------------
	Going to track practice	2:35	2:45	Walking	Friends, teammates	Other kids	Talking, goofing around
	Changing into track uniform	2:45	3:00	Field locker room	----------------	-----------------	-------------------
	Track practice	3:00	4:15	High school's track field	Friends, teammates, coaches	Other friends, teammates, coaches	X
	Going home	4:15	4:25	In car	X	X	Listening to CD's

| | 5. Eating dinner | 4:25 | 5:00 | At home | X | X | Checking email, using IM's |
| 5 P.M. | Playing computer | 5:00 | 5:20 | At home | X | Sister | Chatting, playing games |

Now think about yesterday. DAY OF THE WEEK:_____
Please complete the table, indicating all activities you did yesterday, for the entire day. Don't leave anything out!

A	B	C	D	E	F	G
What did you do?	*Time Began*	*Time ended*	*Where were you?*	*Who was doing this with you?*	*Who else was in the same room but not doing the same thing?*	*What else were you doing at the same time?*
	Midnight					

	Midnight					