MEASURING OF HEALTH-RELATED BENEFITS
OF PHYSICAL ACTIVITY IN HIGH SCHOOL STUDENTS

Petr R. Rehor , Zuzana Kornatovská

Abstract: *The health-related benefits of physical activity have been researched and proven on a number of occasions over the past thirty years. Despite this large quantity of evidence, much of society remains sedentary. The present study investigated the physical activity levels, TV/Computer viewing time and prevalence of smoking of Northern Tasmanian high school students. Blair's 7-day physical activity recall questionnaire was completed by 133 males and 129 females (N=262). The results showed that males were more physically active than females. It was also discovered that Northern Tasmanian high school students were highly physically active. There was no relationship between TV/Computer viewing and physical activity. There was also no significant difference between the physical activity levels of smokers and non-smokers. The study identified the need for future research to focus on multiple administrations of the 7-day recall questionnaire on a number of different population groups.*

Key words: *Health-related benefits of physical activity; High school students; Smokers; Non-smokers; Comparison of Males and Females; Blair's 7-day physical activity recall questionnaire.*

1 Theoretical background

The health benefits of physical activity are well accepted. Physiological benefits include the prevention of: coronary heart disease (CHD) (Leon et al., 2010), diabetes (Desjardins al., 2007), osteoporosis (Bone Health and Osteoporosis, 2004), cancers (Lee, 2011), high blood pressure (Hagberg, 2010), and obesity (Baranowski et al., 2007). Psychological benefits that have been found include improvement in self-esteem, self-concept (Calfas, Bess., 2011), depressive symptoms (Kelly et al., 2006), and anxiety/stress (Bone Health and Osteoporosis, 2004).

Despite this large quantity of evidence and the public's apparent acceptance of the importance of physical activity, millions of people around the world remain essentially sedentary. Recent surveys conducted in Australia, Canada, England, and the United States

indicated that only about 10% of the adult population of each country could be called "aerobically active" (McMurray et al., 2013).

Gender differences relating to physical activity have been found by a number of authors over the past fifteen years with females being found to be less active than their male counterparts (Pate et al., 2008). Studies further suggest that physical activity during childhood is a determinant of physical activity in adulthood (Jago et al., 2007).

A major competitor for leisure time hours is sedentary behavior in the form of television watching. Television watching alone consumes 3 hours per day in the 10-17 year old age group in America (Pate et al., 2008). The average Australian adult spends an average of 169 minutes per day watching television and videos (ABS Catalogue no. 4153.0). Of the few studies that have investigated the relationship between television viewing and physical activity in the adolescent age range all have failed to find a clear relationship (Pate et al., 2008).

Cigarette smoking has also been found to be directly related to participation in physical activity, with smokers being more likely than non-smokers to drop out of exercise programs (Pate et al., 2008). In 1996 Hill measured the prevalence of smoking amongst high school students across Tasmania. The results of the study showed that 26% of Tasmanian high school students were current smokers.

2 Purpose of the study

There were three purposes of the study. The main purpose of the study was to measure the current physical activity levels of Northern Tasmanian high school students using Blair's 7-day recall of physical activity questionnaire. An associated purpose was to measure TV/computer viewing time of Northern Tasmanian High School Students over a seven day period and to report the relationship between TV/computer viewing time and physical activity.

Another associated purpose of the study was to measure the prevalence of smoking in Northern Tasmanian high school students and to report any differences in the physical activity levels of smokers compared to non-smokers.

3 Methods

133 males and 129 females completed the questionnaire (N = 262). The subjects were from grades 7-10 and ranged in age from 12-16 years. The average age was 14.01 years. Of

the 262 subjects 16 were 12 year olds, 71 were 13 year olds, 82 were 14 year olds, 79 were 15 year olds and 14 were 16 year old.

All subjects that participated in the study were high school students from Northern Tasmanian high schools. The subjects were a representative sample of students from the following schools: Prospect High School, Queechy High School, Brooks High School, Port Dalrymple High School, Riverside High School, Deloraine High School, St. Mary's District High School and St. Helen's District High School. All of the schools sampled were public high schools.

Two PE classes were selected from each school. The chosen classes were those classes which appeared first on the weekly timetable (this ensured that the class groups were randomly selected, and experimenter bias was eliminated).

Data was collected during the months of June and July by the researcher and trained Health and Physical Education fourth year student teachers completing their internship. The Health and Physical Education internship teachers received training on how to administer the questionnaire in the week prior to data collection.

Blair's 7-day physical activity recall questionnaire was used as the assessment instrument. The questionnaire was interviewer–administered and took between 20 and 30 minutes to complete.

4 Results

The average energy expenditure of the subjects during their regular physical education class was 9.37kcal.kg.week. The average energy expenditure for light physical activity was 136.57kcal.kg.week. The average energy expenditure for moderate physical activity was 28.61kcal.kg.week. The average energy expenditure for hard activity was 33.63kcal.kg.day. The average energy expenditure for very hard physical activity was 26.03kcal.kg.day. The total average energy expenditure was 42.09kcal.kg.day. The average time spent viewing the TV or computer was 19.52hours per week (167minutes per day).

An independent t-test was used to calculate the difference between the males and females average energy expenditures (Table 1).

Table 1 *Summary Table of Statistics used in Independent t-test*
of Gender Differences of Physical Activity

	N	Average (kcal.kg.day)	SD	*df*	t-score
Males	133	43.65	8.27	261 (n-1)	3.39* (p<0.05)
Females	129	40.47	6.87		
Total	262	42.09	7.76		

Table 1 showed that males (M = 43.65, SD = 8.2) were significantly more active than females (M = 40.47, SD = 6.87), t (261) = 3.39, p < 0.05). Further investigation on the meaning-fullness of the t-score revealed an effect size (ES) of 0.05 that was classified by Thomas & Nelson, (1996) as very small.

The subjects were grouped into physical activity groups based on their energy expenditure (Gloria et al., 2012): Low physically active, moderately physically active and highly physically active. The distribution of the subjects across the 3 activity groups is displayed graphically (Figure 1).
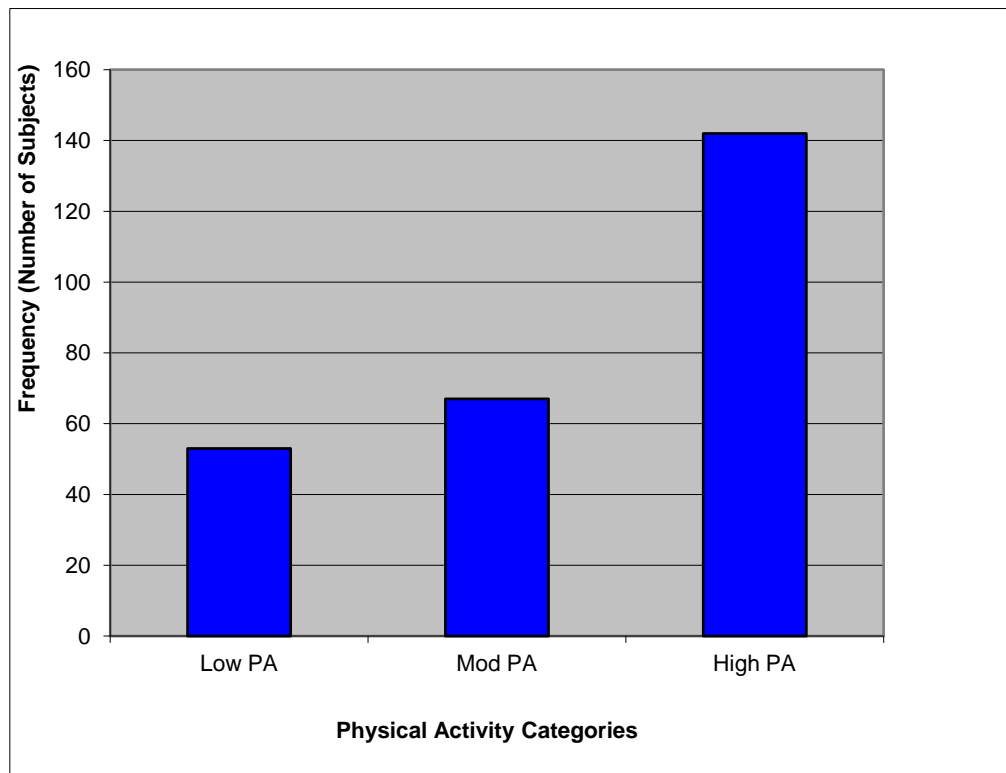
Figure 1 Distribution of the subjects across the three activity groups

Figure 1 showed that the majority of the subjects (142) were classified as highly physically active, whilst the remainder of the subjects were evenly distributed between the

moderately physically active (67 subjects) and low physically active (53 subjects) groups. The Low physically active group had the highest average TV/Computer viewing time (22.36 hours per week), followed by the highly physically active group (19.41 hours per week) and the moderately physically active group (17.51 hours per week).

A single factor Anova was used to determine the relationship between energy expenditure and TV/computer viewing time. The single factor Anova compared the average TV/computer viewing time for each of the three activity groups (see Table 2).

Table 2 *Results of Single Factor ANOVA of Average TV/computer viewing time and energy expenditure*

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	698.93	2	349.47	2.50	0.08	3.03
Within Groups	36204.1	259	139.78			
Total	36903.04	261				

The results of the ANOVA found no statistically significant differences, $F(2, 259) = 3.03$, $P = 0.08$.

A scatter plot was used to show the relationship between energy expenditure and TV/computer viewing time (Figure 2).
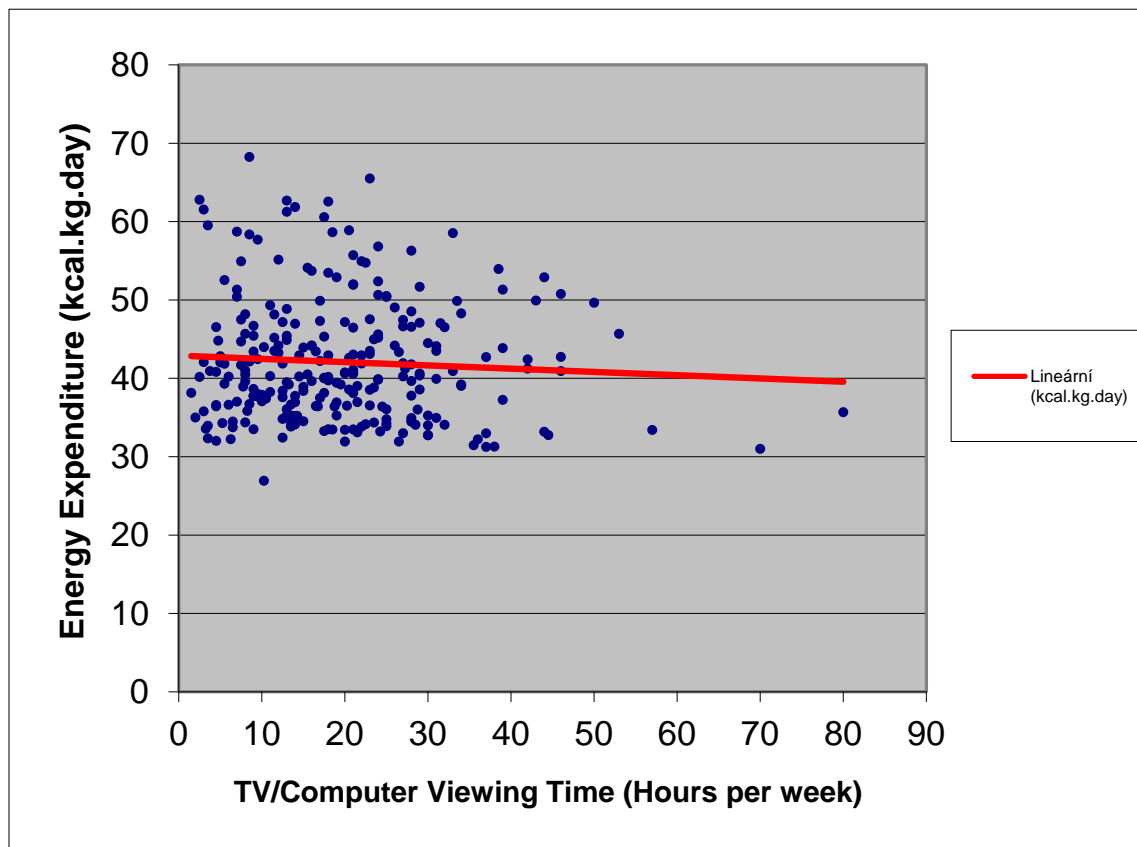
Figure 2 *Scatter plot of TV/computer Viewing Time and Energy Expenditure*

Figure 2 showed that there was no clear relationship between TV/computer time and energy expenditure, highlighted by the large variability in the scores.

Of the 262 subjects 50 (19%) were smokers and 212 (81%) were non-smokers An independent t-test was used to calculate the difference between the average energy expenditures of smokers and non-smokers (Table 3).

Table 3 *Summary Table of Statistics used in Independent t-test of Average Energy Expenditure of Smokers and Non-smokers*

Groups	Count	Average (kcal.kg.day)	SD	*df*	t-score
Non-smokers	212	42.11	7.85	261(n-1)	0.084 (p<0.05)
Smokers	50	42.01	7.46		
Total	262	42.09	7.76		

Table 3 showed that smokers (M = 42.01, s = 7.85) were not significantly more active than non-smokers (M = 42.11, s = 7.46), t (261) = 0.084, p<0.05.

5 Discussion

In line with previous research the results of the study showed that male Northern Tasmanian high school students were more active than their female counterparts. A limitation of this finding was the very small effect size of 0.05 that was calculated in order to determine the meaning-fullness of the t-score. The significance of the effect size was that it limits the generalisation of the finding that males are more physically active than females. For example there are some females who are more active than most males and vice versa. Therefore it could be concluded that the generalisation that males are more physically active than females 95% (as determined by the p<0.05 alpha level) of the time would be a misconception.

The findings of the present study paralleled the findings of Myers et al., (2012) who also found males to be more physically active than females. In line with the present study, they studied the physical activity levels of school children in grades 5-8 (9-15 years) in Bogalusa, Los Angeles.   The assessment instrument used by Myers et al., (2012) was a 24-hr recall instrument (Self – Administered Physical Activity Checklist). A limitation of Myers' study that was identified was the use of a 24-hour re-call. It was concluded that this time period might not capture an accurate portrait of average activity for a given individual (Myers et. al., 2012). The use of a 7-day re-call in the present study ensured that the recall was a more accurate portrait of average physical activity.

It is plausible that the gender difference could be attributed to males participating in more vigorous physical activities and sports than females. As explained by Myers et al., (2012), males tend to be involved in more team sports than females. For example males tended to participate in team sports such as football, basketball, baseball as well as running and outdoor play as opposed to females who reported jump rope, volleyball, dance and gymnastics (Myers et al., 2012).

Northern Tasmanian high school students reported an average of 167 minutes of television or computer viewing each day. This result was consistent with the findings of past research conducted in both Australia and the United States that reported values in the range of 2-3 hours of TV viewing per day

Using the physical activity classification system of McCalister (2006) the majority of subjects (142 or 54% of the subjects) were classified as being highly physically active. From this result of it was concluded that Northern Tasmanian high school students were highly

physically active. This finding provides a positive reflection of the current health and physical education programs being administered in Northern Tasmanian high schools. A limitation of this finding was the use of physical education students as the subjects. The use of only physical education students probably provides a misleading picture of the overall physical activity levels of Northern Tasmanian high school students.

The results of the study also showed that there was no clear relationship between the average TV/computer viewing time and physical activity. The main reason attributed to the lack of relationship was the high variability in the scores. The findings of the present study matched the findings of Pate et. al., (2011) who revealed two other studies that failed to demonstrate a relationship between TV viewing and physical activity.

The results of the present study revealed that 19% of the Northern Tasmanian high school students were smokers. The results were lower than the previous findings of Bailey (2009) who discovered that 26% of Tasmanian high school students (aged 12-17 years) were current smokers. The results of the present study were also lower than the findings of the ABS (Cat No 4364.0), who discovered that in 1995, 24% of adults in Australia were smokers.

It is possible that the results of the present study are not a true indication of the percentage of smokers amongst Northern Tasmanian high school students. The use of PE students as the subjects may have provided a misleading picture of the prevalence of smoking in Northern Tasmanian high school students.

The results showed that there was no significant difference between the average physical activity levels of smokers and non-smokers. Although this seems unreasonable, the smokers may have overestimated their physical activity in order to account for their smoking status.

6 Conclusion

It is recommended that research into current physical activity levels continues so that the health related benefits of physical activity can be measured. Research needs to focus on children and adolescents because many lifestyle habits are established in the younger years. The identification of the children at risk of becoming physically inactive adults might allow intervention programs to focus on these children. It is recommended that future research into physical activity focuses on the effect other health risk behaviours such as drugs, alcohol and wearing seat belts have on physical activity.

Multiple administrations of the 7-day recall questionnaire are needed in order to determine the current physical activity levels across a range age groups and populations. An

interesting study would be to administer the 7-day recall questionnaire to high school students from different regions of Tasmania such as Southern Tasmania and North-Western Tasmania. These regions could then be compared to the results of the present study to highlight differences between the regions in relation to physical activity levels, TV/computer viewing and smoking.

It is further recommended that future research uses the 7-day recall in an interventional research design. For example, the 7-day recall questionnaire would be

a reliable tool to measure the changes in physical activity of a group following the administration of an fitness unit in a physical education class. The recall is easy to administer, cost effective and is a reliable measure of physical activity which makes it is a useful assessment instrument in the Health and Physical Education learning area.

7 References

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Contacts

Prof. Petr R. Rehor, PhD.

Camosun College/Pacific Institute for Sport Excellence Interurban Campus

4371 Interurban Road Victoria, BC

Canada

E-mail: rehor@camosun.ca

Ass. Prof. Zuzana Kornatovská, MA, DiS.

University of South Bohemia

Faculty of Education, Dept. of Health Education

Jeronymova 10, 371 15 České Budejovice

Czech Republic

E-mail: zkornatovska@pf.jcu.cz