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HEALTH RELATED FITNESS AND PHYSICAL ACTIVITY LEVELS OF URBAN AND RURAL BOYS

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Acknowledgements

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Abstract

The study aimed to investigate the health related fitness level and physical activity behaviour of urban and rural Welsh schoolboys. The sample comprised of 31 urban and 21 rural boys, all aged 11-12 yrs. The health related fitness components tested were body composition (bio-electrical impedance analysis), flexibility (sit and reach), muscular endurance (timed sit ups), muscular strength/power (vertical jump) and cardiorespiratory endurance (multistage fitness test). No significant differences were seen in the height, body mass and fat mass of urban and rural boys. Although no significant differences were found, the rural group were classified as overweight according to body mass index measurements. The vertical jump test showed a significant difference, with urban boys outperforming rural counterparts. Other measures of health related fitness did not display significant differences between both groups. Physical activity behaviour data was obtained through questionnaires. Questions investigated transportation to school, amount of moderate and vigorous activity, sedentary behaviour and sports participation. Rural boys reported to be significantly more active when travelling to school. Although no statistically significant difference was observed in the sedentary measure, rural boys spent more hours watching television and playing video games, and were therefore more sedentary than urban counterparts. Urban boys reported to engage in more vigorous PA than those from the rural area, which was linked with urban boys participating in more sports at a competitive level. The results of the study suggest that urban and rural boys differ in ways which impacts health related fitness and physical activity patterns.

CHAPTER I

INTRODUCTION

1.0 Introduction

Physical fitness and physical activity are often used interchangeably, as highlighted by Thomas *et al.* (2003). Physical activity (PA) is defined by Casperson (1989) as 'any bodily movement produced by the skeletal muscles that results in caloric expenditure' (p. 424). This is a broad definition which encompasses all aspects of PA. PA is seen as behaviour (Freedson and Melanson, 1996) where as physical fitness is referred to as an attribute (Thomas *et al*., 2003). The relationships between PA, physical fitness and health have been documented as being complex (Armstrong and Welsman, 1997). This is supported by Riddoch (1998) in the statement that 'the evidence confirming a positive association between childhood activity and the immediate or future health status of children is suggestive, but weak' (p. 39). But 'obesity can be considered a health compromising condition for children in its own right' (Riddoch, 1998, p. 32). Health and wellness areas of fitness are referred to as health related fitness (HRF). HRF is defined by Warburton *et al*. (2006) as 'the components of physical fitness that are related to health status' (p. 809). The components of HRF commonly recognised are cardiorespiratory endurance, body composition, flexibility and muscular strength/endurance (Pate, 1988).

To assess HRF levels in youth, test batteries can be used. There are various testing batteries used by established testing programs such as the Prudential FITNESSGRAM, YMCA Youth Fitness Test and the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) Physical Best Program (Safrit, 1995). Many of the tests used by the programs are similar in three of the recognised components by Pate (1988), but differ in the assessment of muscular strength/endurance. Cardiorespiratory endurance is measured through the one mile walk/run in the three batteries, with the Prudential FITNESSGRAM also using the multistage fitness test (MSF). Body composition is assessed through

skinfold measures of the triceps and calf in all three tests, with only the Prudential FITNESSGRAM including the calculation of body mass index (BMI). Sit and reach tests are used in all three for measures of flexibility, although protocols differ slightly. The AAHPERD Physical Best Program use pull ups and a modified sit up test to assess muscular strength/endurance, whereas the YMCA Youth Fitness Test use curl ups and a modified pull ups test. Curl ups, 90 degree push ups, pull ups, flexed arm hang and modified pull ups are all options included in the Prudential FITNESSGRAM, but when testing the tester is able to choose which ones to assess the youth in (Safrit, 1995).

The assessment of youth through established tests 'are used with the intent to motivate children to achieve higher levels of fitness and to include optimal levels of physical activity in their present and future lives' (Docherty, 1996, p. 285). With the increased media coverage over recent years on the level of obesity prevalent in youth, HRF testing has become of increased importance in the identification of the HRF state of youth and to encourage positive attitudes and increased understanding about the principles underlying HRF (Harris and Cale, 2006). Recent figures that have been documented on British children state that 'the number of obese children has increased from 9.6% in 1995 to 13.7% in 2003' (www.news.bbc.co.uk). In specifically Welsh adolescents, the health behaviour in school aged children (HBSC) study found that in the year 2000, Wales was ranked fifth overall out of 35 other countries with regards to the percentage of obese 15 year olds. Wales were ranked higher than both Scotland and England with 5.6% and 3% of boys and girls respectively being deemed obese (www.hbsc.org).

In reaction to the published HBSC figures, the Welsh Assembly Government has set a target of '90% of secondary school pupils achieving 60 minutes of physical activity five times a week by 2020' (www.sports-

council-wales.org.uk). In order to achieve the target, the Assembly Government in conjunction with the Sports Council for Wales have set up a school sport scheme named 5×60. Its aim is to offer activities before or after school that targets individuals that currently do not participate or are in danger of losing interest. 5×60 officers are being based in secondary schools to consult with pupils and listen to needs and barriers which prevent them from participating in activity. The 5×60 programme should give the pupils an opportunity to try a range of activities that are not currently available to them. 'The Welsh Assembly Government plans to invest some £7.6 million over the next 3 years and aims for every school in Wales to be involved in the programme by 2009' (www.sports-council-wales.org.uk).

A variety of environmental factors influence the physical activity behaviour of youth (Armstrong and Welsman, 1997). The place of residence has a considerable influence upon the opportunities for PA as found by Loucaides *et al*. (2004). Differences found were that parents of children in rural localities reported more space available in the garden and safer neighbourhoods for their children to be physically active in. Children in urban areas had more exercise equipment available at home and were transported by their parents to places where they could be physically active more often than rural counterparts. The conclusion of their study was that 'intervention programmes to promote physical activity need to consider … geographical location differences in physical activity levels' (p. 138). Some studies have been conducted to investigate possible differences in physical fitness and HRF levels of urban and rural youth (Dollman *et al*., 2002; Pena Reyes *et al*., 2003; Tsimeas *et al*., 2005). Results so far seem inconclusive to whether urban and rural differences exist. More research is needed in the field.

CHAPTER II

LITERATURE REVIEW

CHAPTER III

METHODS

3.0 Methods

3.1 Participants

Boys from two Welsh Secondary schools volunteered to participate in this study. One school was within an urban area, defined as having >10,000 inhabitants and was situated within the urbanised Cardiff area and the second school was within a rural area, defined as <10,000 inhabitants in a highly agricultural region in Mid Wales (31 urban and 21 rural). The participants were year 7 pupils at rural and urban schools, aged between 11 and 12 years old. An explanation of the study was given to both headmasters. Consent forms and explanation letters outlining the content of the study were sent to the parents and guardians of all participants. Consent forms were filled in and signed by parents or guardians of all the participants. The whole testing protocol was undertaken at the respective schools. The protocol for the study was approved by the university's ethics committee.

3.2 Procedure

Prior to the anthropometric assessments and field tests, the PA behaviour questionnaire was answered by each participant, as seen in Appendix A. The Modifiable Activity Questionnaire for Adolescents (Appendix B), originally developed by Aaron et al. (1995) was used but adapted with questions from the Sports Council Wales Youth Questionnaire (Appendix B). The Modifiable Activity Youth Questionnaire did not include questions on transportation to school. Therefore questions 1 to 3 were included from the Sports Council Wales Youth Questionnaire. The questionnaire was answered under the supervision of the PE teachers and principal researcher. Pupils were separated when answering the questionnaire to avoid copying the answers of peers.

After answering the questionnaire, pupils in pairs completed the anthropometric assessment, sit and reach, sit up test and vertical jump, which were set up as circuit stations. The sit and reach, sit up test and vertical jump stations had 6th form pupils from the schools to ensure that the correct procedure was used in each test, and that the correct results were recorded by the pupils. Anthropometric assessments were done by the principal researcher. The multistage fitness test (MSF) was conducted after the circuit tests. All tests were completed in the school gyms.

3.3 Anthropometric Assessment

Height was measured to the nearest millimetre using a portable stadiometer (Seca Ltd, Birmingham, United Kingdom). Weight measurements were taken to the nearest 0.1 kg using Seca digital scales. Body composition measurements were taken through bio-electrical impedance (BIA) (Bodystat 1500, Isle of Man, British Isles). The anthropometric variables were inputted into the BIA device for calculation. Participants were asked to remove their right shoe and sock and lie in a supine position on the floor with no parts of their body touching one another. Electrodes and leads were attached to the appropriate sites as outlined in the Bodystat 1500 users' guide. Measurements recorded from the device included fat mass percentage, lean mass percentage and the body mass index (BMI) calculation. A previous study using bio-electrical impedance has reported a reliability coefficient of .96 in males aged 14.9 ± 1.7 years (Unick et al. 2006).

3.4 Field Tests

3.4.1 Sit & Reach (Flexibility)

The sit and reach test was used to measure lower back and hamstring flexibility (Docherty, 1996). Pupils sat on the floor with bare feet placed vertically against the end of a bench measuring 30 cm in height with knees and legs straight. Pupils stretched forward along the top of the bench four times, hands on top of each other with straight arms and palms facing downwards. On the fourth stretch, the pupils reached as far as possible and held it for a second, for a measurement to be taken with a tape measure. Recorded measurements were in centimetres. The distance between tips of fingers and toes were taken. If pupil was able to stretch past their toes, then a positive measurement was taken. If the pupil was unable to reach their toes, a negative measurement was taken and if they were able to touch their toes a zero value was given. The reliability of the test has been documented as being up to .94, dependent on following a consistent procedure in each test (Tritschler, 2000). Therefore the same testing procedure was followed with each subject.

3.4.2 Sit Up Test (Muscular Endurance)

The aim of the sit up test was to measure the strength and endurance of abdominal muscles (Safrit, 1995). On an exercise mat, pupils performed as many sit ups as possible in 60 seconds measured with a stopwatch. Pupils were paired up in order to have someone to hold ankles or feet on the floor. The participants being tested started from a lying position on their back with knees bent. Sit ups were performed with arms crossed on the chest and were counted if the forearms touched the thighs. Scoring was the number of correctly performed sit ups within the time limit. The

reliability of the test has been reported as being between .68 and .94 dependent on consistency of administration (Safrit, 1995).

3.4.3 Vertical Jump (Muscular Strength/Power)

The vertical jump was used to assess the explosive strength of the extensor muscles of the thigh, leg and foot (Docherty, 1996). The test was conducted through the use of jump mats (Takei Scientific Instruments, Japan). Prior to each jump, the line between the mat and the belt around the waist was winded tight to ensure tension. A short familiarisation period was allowed before testing. Pupils performed the jumps with hands held behind their backs. The participants performed three vertical jumps, with the highest jump being recorded. Jump height was displayed on the digital display and was recorded in centimetres. This test has been found to be highly valid and reliable in men, but unknown in children. The test has a concurrent validity of .989 with the vertical jump (horse power) for college men and a test-retest reliability of .977 (Tritschler, 2000).

3.4.4 MSF Test (Cardiorespiratory Fitness)

The MSF Test was used as a measure of cardiorespiratory fitness (Safrit, 1995). Pupils performed the test over a length measuring 20 m, which was marked out with cones. The participants performed shuttles of the 20 m length, back and forth, in synchrony with the timed and recorded beeps (CD used). Pupils were required to touch the line created with the cones with their foot, and wait for the timed beep before performing the next shuttle if they were early arriving at the line. They were encouraged to pace themselves in relation to the beeps. The speed began at 8.5 km/hr and increased 0.5 km/hr at each successive level. They continued running back and forth until they could no longer maintain the pace. When the pupils were unable to reach the lines in time for three successive beeps in a level,

they were withdrawn from the testing. The test is reasonably high in validity with .52 to .93, compared with a VO_2 max stress test on a treadmill. The reliability coefficient for the test range from .89 to .98 (Safrit, 1995).

3.5 Statistical Analysis

Mean and standard deviation calculations were made on all anthropometric and field test results. The independent t test was used to assess urban and rural differences anthropometrically and in the field tests. Nonparametric testing through the likelihood ratio was used to identify differences in the answers reported by urban and rural boys in the PA behaviour questionnaire. The significance level was set at $p < 0.05$ for both tests. Independent t tests and likelihood ratios were calculated using the SPSS 12.0 software package.

CHAPTER IV

RESULTS

4.0 Results

4.1 Anthropometric Assessments

Mean anthropometric values are all higher for boys living in rural localities compared to those in urban areas, as demonstrated in Table 2. Although the mean values are greater, no significant differences were found in height, body mass, BMI and fat mass ($p > 0.05$).

Table 2. Anthropometric measurements of urban and rural Welsh boys

	Urban	Rural
Height (cm)	147.8 ±8.5	148.7 ±7.5
Body mass (kg)	42.2 ±10.1	44.9 ±12.4
BMI (kg/m²)	19.3 ±3.4	20.1 ±4.0
Fat Mass (%)	23.8 ±11.9	24.7 ±7.5

The BMI and fat mass values of both groups of boys are towards the upper end of the criterion referenced health standard range (15–22 kg/m² and 10-25 % respectively) (Physical Best Health Fitness Standards, 1989; Prudential FITNESSGRAM, 1992).

4.2 Field Tests

Results from the field tests are given in Table 3. Both urban and rural boys were unable to attain the norms in the sit and reach, and sit up tests. In the sit and reach, urban and rural boys were also unable to reach distances set by boys of the same age in a previous study (Tsimeas et al., 2005). In the MSF test, the criterion reference health standard (FITNESSGRAM, 1999), was achieved. In the vertical jump test, both populations were unable to reach the heights achieved by boys of the same age in a previous study (Tsimeas et al., 2005).

Table 3. Anthropometric and fitness test results for urban and rural boys with norm values, criterion reference health standards and previous study results where applicable

	Urban	Rural	Norm Values	Criterion Reference Value	Previous Studies
BMI (kg/m^2)	19.3 ±3.4	20.1 ±4.0	15-22	16-22	Urban Boys: 21.0 ±3.4 Rural Boys: 20.5 ±3.4 (Tsimeas et al., 2005)
Fat Mass (%)	23.8 ±11.9	24.7 ±7.5	n/a	10-25	Urban Boys: 21.0 ±7.8 Rural Boys: 19.4 ±7.9 (Tsimeas et al., 2005)
MSF (level+shuttle)	7.0 ±1.6	7.4 ±1.9	n/a	32-72 (~level 5-9)	n/a
Sit and Reach (cm)	-0.9 ±6.2	-1.8 ±4.9	+2.5	n/a	Urban Boys: 14.3 ±6.1 Rural Boys: 14.5 ±6.0 (Tsimeas et al., 2005)
Sit ups (in 60 s)	31.0 ±7.7	33.0 ±6.1	38	n/a	n/a
Vertical Jump (cm)	38.5 ±5.7*	33.4 ±5.5	n/a	n/a	Urban Boys: 48.6 ±7.7 Rural Boys: 46.9 ±7.5 (Tsimeas et al., 2005)

* $p < 0.005$

The MSF test, sit and reach and sit up tests were not significantly different between urban and rural boys ($p > 0.05$). A significant difference was however seen is in the vertical jump, $t(50) = 3.341$, $p<0.05$ ($p= 0.002$).

4.3 PA Behaviour Questionnaire Results

Questions 1-3 dealt with transport to school, of the rural boys, 47% reported walking to school compared with 13% of urban boys (question 1). Within this active transport group, 43% of the rural boys reported that their journey to school included more than 10 minutes of walking, versus 12% of the urban boys (question 3). No obvious percentage differences could be seen in the total reported time that urban and rural boys took to travel to school (question 2). Likelihood ratio analysis revealed that there were significant differences between the populations in terms of walking to school and the duration of this walk ($p < 0.05$).

The next section of the questionnaire (questions 4 and 5) dealt with participation in vigorous and moderate activities. Although more urban boys reported that they engaged in 6 or more days of vigorous activity (by approximately 17%), this was not significantly higher than the amounts reported by the rural population. No significant differences were found in terms of reported amount of moderate exercise performed over the last 14 days. It must be noted however that 6% of urban boys reported that they did no moderate exercise, whilst all rural boys reported that they had engaged in moderate exercise on at least 1 day in the past two weeks.

Question 6 investigated the hours of sedentary activity in terms of hours watching television and playing video games. Again no significant differences were found between the groups. The hours that urban and rural boys reported spending on ‘screen’ time is shown in Figure 1.

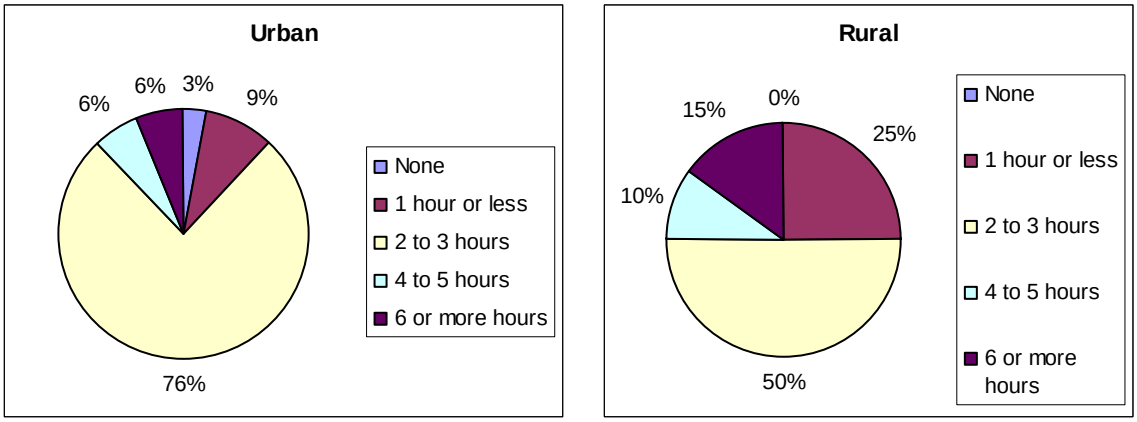

Figure 1. Reported amount of hours a day spent watching television and playing video games.

Table 4. Participation levels in various sports/activities as percentages.

Sport/Activity	Urban (%)	Rural (%)
Athletics	3	1
Badminton	1	2
Baseball	3	1
Basketball	1	1
Circuit Training	2	1
Cricket	3	5
Cross Country Running	5	1
Cycling/Mountain Biking	7	6
Dance	0	2
Fitness Classes	3	4
Football	11	15
Golf	6	4
Gymnastics	3	1
Hockey	0	0
Outdoor Pursuits	3	1
Martial Arts	4	0
Rugby	11	14
Swimming	11	10
Street Sports	3	1
Squash	1	7
Table Tennis	5	7
Tennis	7	7
Trampolining	5	6
Volleyball	0	0
Other	1	1

Question 7 investigated the participation of the boys in different types of sports. Table 4 shows participation levels for each sport.

The last section of the questionnaire dealt with participation in competitive sports and activities. Twice as many rural boys reported not to have competed in a sport or activity over the past year (urban= 12%; rural= 24%). More boys from the urban area reported to have competed in 2 or more competitive sports or activities (by approximately 17%).

CHAPTER V

DISCUSSION

CHAPTER VI

CONCLUSION

6.0 Conclusion

The results of the study demonstrate that no significant differences exist between urban and rural Welsh boys in all but one of the HRF components. The vertical jump results identified that urban boys were significantly stronger and more powerful than rural counterparts. Although no significant differences were observed in the other measures of HRF, some noteworthy mean differences were seen. The main one being that rural boys were anthropometrically bigger than those from urban localities. Height, body mass, BMI and fat mass measures were all higher for rural boys. It emerged that the BMI measurements for rural boys were deemed as overweight according to the UK BMI cut off points. The urban group were also not far from being classed as overweight. The BMI measures have therefore raised concerns about the body composition and the possible associated health risks posed to boys involved in the study. Another cause for concern was the results obtained for flexibility and muscular endurance. Neither group was able to reach normative values set at the 50^{th} percentile for the sit and reach (flexibility) and sit up test (muscular endurance). Although the results were not comparable to set HRF measures, it does add to the speculation that the level of HRF in youth is generally low.

PA behaviour differences were not statistically significant in response to six of the eight questions. Two questions which displayed significant differences between the two groups were associated with transport to school. It was found that rural boys were more physically active when travelling to and from school. This goes against what was hypothesised, as it was believed that more rural boys would require transport through cars and busses. But it emerged that the majority of the boys involved in the study lived in the town where the school was situated, and as a result were able to walk to school.

It was also hypothesised that there would be no significant difference in the sedentary measure of hours watching television and playing video games. Although no statistically significant difference was observed, the measures seemed to suggest that rural boys spent more hours on ‘screen’, and were therefore more sedentary than urban counterparts. This goes against the pre conceived notion that rural children should generally be more physically active. But it was found that the sedentary measure may have been linked with the availability of sports clubs and the time of year. The data was collected during the winter, which has previously been proven to reduce the level of PA that rural children complete. This was linked to the belief that the parents of urban children more frequently transport their children to places where they can be physically active. Urban boys reported to compete in more sports in this study which supports the belief.

The urban boys reported to engage in more vigorous PA than those from the rural area. This may again link to the fact that the urban boys are able, and do participate in more sports at a competitive level. Due to the time of year and lack of sports clubs available locally, it may explain why rural youth do not engage in more vigorous PA. No definitive differences were however seen in the amount of moderate PA that both groups engaged in. The results of the study therefore suggest that urban and rural boys differ in ways which impacts health related fitness and physical activity patterns.

6.1 Limitations

As previously mentioned, the fat mass measures obtained cannot be interpreted as reliable results. The data is displayed in Appendix**?** Although previous studies have proven that the use of BIA is valid and reliable in youths (Unick et al. 2006), unless pre testing procedures are controlled future field testing should avoid its use. Recognised testing batteries with criterion reference health standards should have been used to enable a

clearer discussion about the HRF levels of the pupils. Studies using standardised testing batteries would enable easy comparisons to be made between youths in various areas and countries.

A delimitation of the study was the assessment of boys alone. Future research would need to investigate the effect that the area of residence has upon both sexes to be in accordance with previously published papers (Dollman *et al*., 2002; Pena Reyes *et al*., 2003; Tsimeas *et al*., 2005). Another delimitation was that the maturation level of the participants was not assessed. Growth and maturation has a significant influence on the HRF of children (Katzmarzyk *et al*., 1998). Results may have been influenced by the effects of growth and puberty.

The lack of urban and rural participants may mean that the results obtained are not a true reflection of the population as a whole. Samples of youth from different geographical regions of the country would have enabled stronger conclusions to be drawn.

The questionnaire should not originally have been set using categorical options. It was developed using questions from two proven valid and reliable questionnaires which had used categorical answers. Nonetheless the lack of answered questionnaires meant that the frequency of 5 in the likelihood ratio analysis was not met for some categories. The assumption of a significant difference may therefore have been met in some instances. More answered questionnaires would have enabled the frequency to be met in more of the categorical answers.

6.2 Recommendations for Future Research

Published papers in the related field (Dollman *et al*., 2002; Pena Reyes *et al*., 2003; Tsimeas *et al*., 2005) have also not assessed the maturational status of their participants. Future studies in the specific field should assess the maturation level of participants to ensure that participants are grouped as pre pubescent and post pubescent. This would ensure that a fluctuation in the data retrieved on a cohort is due to HRF levels and not the effects of puberty.

Research on urban and rural differences should gather data in numerous areas of the country to have a true representation of the general population and not specific to those areas alone. A follow up study could identify the effectiveness of the 5×60 scheme in adapting PA behaviour and HRF levels in Welsh youth.

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APPENDICIES

APPENDIX A

PA Behaviour Questionnaire

Name ……. Date of birth …….
School ……..

Instructions: Tick the box which applies to you and where appropriate give further details in the space provided.

1) **On a normal day how do you get to school?**

Walk	
By Car	
By Bus	
Cycle	

Other		Specify:

On average how long does it take to travel from your home to school? (Please tick one box only)

Less than 5 minutes		6 to 9 minutes		10 to 15 minutes	
16 to 19 minutes		20 to 24 minutes		25 to 29 minutes	
30 minutes or more					

2) **Does the journey to school usually include more than 10 minutes of walking?**

Yes		No	

3) **How many times in the past 14 days have you done at least 20 minutes of exercise hard enough to make you breathe heavily and make your heart beat fast outside PE lessons? (Hard exercise includes, for example, playing football or jogging)**

None	
1 to 2 days	
3 to 5 days	
6 to 8 days	
9 or more days	

4) **How many times in the past 14 days have you done at least 20 minutes of light exercise that was not hard enough to make you breathe heavily and make your heart beat fast? (Light exercise includes walking)**

None	
1 to 2 days	
3 to 5 days	
6 to 8 days	
9 or more days	

5) **During a normal week how many hours a day do you watch television and DVD's, or play computer or video games before or after school?**

None	
1 hour or less	
2 to 3 hours	
4 to 5 hours	
6 or more hours	

6) **Which, if any, of the activities listed have you done on ten or more separate days with a club or a group that is not run by your school over the last year?**

Athletics		Badminton		Baseball/Rounders/softball	
Basketball		Circuit training		Cricket	
Cross country running		Cycling/Mountain biking		Dance	
Fitness classes (e.g aerobics)		Football		Golf	
Gymnastics		Hockey		Outdoor pursuits	
Martial arts (e.g karate)		Rugby		Swimming	
Street sports (e.g skateboarding		Squash		Table tennis	
Tennis		Trampolining		Volleyball	

Other		Specify:

7) **During the past year, how many team or individual sports or activities did you participate in on a competitive level, such as local club game or competition?**

None	
1 activity	
2 activities	
3 activities	
4 or more activities	

What activities did you compete in?

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

_____ ___

APPENDIX B

APPENDIX C

Rural HRF Testing Results

Subject	BMI (kg/m^2)	Fat Mass (%)	VJ (cm)	Sit and Reach (cm)	Sit up (no. in 60s)	MSF (Level & Shuttle)
1	16.3	25.1	28	-6	37	8.6
2	19.8	23.1	30	2.5	38	8.6
3	16.1	47.1	39	2	28	10.7
4	25.8	21.9	25	-5	21	5.3
5	20.9	20.4	30	9	33	7.4
6	18.6	25.8	29	-7	36	8.4
7	22.4	19.8	32	-5	34	7.3
8	19.7	19.9	30	1	33	8.6
9	20.8	22	37	2	33	9.8
10	17	29.5	34	-4	28	8.6
11	21.3	18.4	40	-8	40	5.1
12	17	21.3	33	0	31	6.8
13	22.2	14.6	31	1	38	6.4
14	16.1	36.3	40	0	37	10.5
15	18.6	31	29	-4	36	6
16	17.1	29.7	37	1	27	8
17	32.5	25.7	42	-4	28	4.2
18	16.4	23.2	46	3	44	8
19	23.2	18.3	30	-12	27	4.3
20	16.4	29.1	33	2	41	8
21	23.5	15.5	27	-7	22	5

Rural Anthropometric Testing Results

Subject	Height (cm)	Weight (kg)	Fat Mass (%)	BMI (kg/m^2)
1	154	38.6	25.1	16.3
2	151	45.1	23.1	19.8
3	134	28.9	47.1	16.1
4	155	62	21.9	25.8
5	155	50.1	20.4	20.9
6	145.6	39.1	25.8	18.6
7	144.5	46.5	19.8	22.4
8	149.8	43.7	19.9	19.7
9	142.2	41.9	22	20.8
10	144.5	35.2	29.5	17
11	153	51.2	18.4	21.3
12	144	35.2	21.3	17
13	156	54	14.6	22.2
14	138	30.6	36.3	16.1
15	135	33.9	31	18.6
16	145	36	29.7	17.1
17	157	80	25.7	32.5
18	153	38.3	23.2	16.4
19	151	52.9	18.3	23.2
20	152	37.8	29.1	16.4
21	163	62.5	15.5	23.5

Urban HRF Testing Results

Subject	BMI (kg/m^2)	Fat Mass (%)	VJ (cm)	Sit and Reach (cm)	Sit up (no. in 60s)	MSF (Level & Shuttle)
1	15	46	41	-2	41	9.5
2	15.2	42.2	41	1	39	8.7
3	24.7	15.2	39	5	21	4.4
4	18.5	15.3	39	9	38	7.6
5	20.9	20.4	44	-5	36	8
6	16.5	38.1	37	-3	21	6.7
7	17.7	25.3	49	3	41	-
8	21.7	19.9	31	-10	42	6.2
9	21.4	10.7	33	2	42	4.9
10	21.8	2.9	31	-7	34	7.7
11	27.2	19.3	42	6	34	6.3
12	15.3	59.6	25	-13	42	5.2
13	23.8	19.9	38	0	37	5.4
14	15.7	28.8	39	5	23	6.9
15	16.1	34.6	38	-5	34	6.6
16	20.6	27.3	43	3	34	6.4
17	14.5	37	46	-10	26	8.11
18	18.5	23.1	39	4	27	8
19	21	21.6	41	-16	22	6.3
20	18.3	18.7	44	7	38	8.4
21	17.1	9.2	50	-5	33	6.7
22	17.4	16.7	39	2	32	6.9
23	26.6	22.9	27	4	20	4.8
24	18.2	23.8	33	7	34	6.1
25	21.4	20.8	34	-1	22	4.2
26	19.5	14.3	44	-1	26	8.9
27	20.4	26	41	-5	30	8.9
28	16.4	31.2	41	-5	28	10.5
29	17.3	18.2	43	1	30	8.11
30	16.1	12.9	42	3	33	8.8
31	21.9	18.8	31	1	12	6.2

Urban Anthropometric Testing Results

Subject	Height (cm)	Weight (kg)	Fat Mass (%)	Lean Mass (%)	BMI (kg/m²)
1	138.1	28.5	46	54	15
2	145.8	32.2	42.2	57.8	15.2
3	148	54.1	15.2	84.8	24.7
4	153.8	43.2	15.3	84.7	18.5
5	163	55.5	20.4	79.6	20.9
6	138	31.5	38.1	61.9	16.5
7	141.5	35.2	25.3	74.7	17.7
8	152.2	50.2	19.9	80.1	21.7
9	162.6	56.1	10.7	89.3	21.4
10	144.5	45.3	2.9	97.1	21.8
11	157.5	67	19.3	80.7	27.2
12	132.5	26.7	59.6	40.4	15.3
13	140.2	46.7	19.9	80.1	23.8
14	147.7	34	28.8	71.2	15.7
15	145.4	33.8	34.6	65.4	16.1
16	138	39.2	27.3	72.7	20.6
17	150.4	32.7	37	63	14.5
18	140.4	36.3	23.1	76.9	18.5
19	144.2	43.6	21.6	78.4	21
20	146.6	39	18.7	81.3	18.3
21	155	41.2	9.2	90.8	17.1
22	154.5	41.2	16.7	83.3	17.4
23	157	65.5	22.9	77.1	26.6
24	144.2	37.8	23.8	76.2	18.2
25	143.7	43.8	20.8	79.2	21.4
26	163.6	51.8	14.3	85.7	19.5
27	133.7	36.1	26	74	20.4
28	141.7	32.7	31.2	68.8	16.4
29	146.6	36.9	18.2	81.8	17.3
30	158.4	40.2	12.9	87.1	16.1
31	152.6	50.5	18.8	81.2	21.9