Physical Activity and Nutrition Interventions and Physical Self-Image in Youth

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Abstract

The importance of improving physical self-image and its related consequences in youth provided the rationale for this study. Based on the Exercise and Self-Esteem Model, the adapted Health Behavior and Self-Esteem Model provides an explanation of behavior (physical activity and nutrition) leading to self-image. We found that physical activity and nutrition were related with self-image by gender and grades (4-12) during a school year. Cross-sectional pre- (n=263; 52.9% female) and post- (n=287; 51.5% female) intervention data revealed that: males generally belonged to more active groups; males were more satisfied with their physical body attributes than their female peers; and that 82% of the physical activity, nutrition, and self-image study variables remained stable across time. The maintaining of health behaviors mirroring the maintenance of physical self-image lends credence to this aspect of the adapted Health Behavior and Self Esteem Model. More rigorous testing of the full Model is warranted.

Keywords: physical activity, nutrition, health behavior, youth

Physical self-image is defined as subjective perceptions and attitudes that one has about their physical body attributes (i.e. body shape, weight) and physical fitness attributes (i.e. strength, coordination) (Carron, Hausenblas, & Estabrooks, 2003). Physical self-image is an important concern for youth. Approximately two-thirds of adolescent girls at any age are dissatisfied with their weight, the proportion increasing with actual weight, and slightly more than half of all girls are dissatisfied with the shape of their bodies, an attitude which is also positively correlated with body weight (Moore, 1993). Girls are most likely to be distressed about the excess size of their thighs, hips, waist and buttocks, and inadequate size of their breasts (Moore, 1993).

Physical self-image is also a concerning topic for males. Approximately one-third of boys are dissatisfied with their body shape, desiring larger upper arms, chest and shoulders (Moore, 1993). Therefore, it is important to promote a healthy sense of physical self-image as it is a component of self-esteem.

The Exercise and Self-Esteem Model posits that exercise leads to self-competence and acceptance which then leads to self-esteem (Sonstroem & Morgan, 1989; Sonstroem, Harlow, Gemma, & Osborne, 1991). This model can be conceptualized more generally to include health behavior (physical activity and nutrition) affecting the variables of physical self-acceptance and self-efficacy (see Figure 1). Therefore, the proposed Health Behavior and Self-Esteem Model (HBSEM) provides a possible explanatory mechanism between health behaviors, self-image, self-efficacy and self-esteem.

However, prospective studies document marked declines in physical activity among children aged 9 to 14 years (Barnett, O'Loughlin, & Paradis, 2002). Furthermore, studies have shown that girls belong to sedentary and low activity groups, while boys frequently belong to more active groups (Mota & Esculas, 2002; Sunnegardh, Bratteby, & Sjolin, 1985). In a study of 8-13 year old children, it was found that the younger children of each sex tend to be more

physically active than the older ones (Sunnegardh, et al, 1985).

Decreased concerns with eating are seen as age increases in boys, while girls tend to have increased concerns about eating with age (Ohzeki, et al, 1993). Furthermore, eating behaviors in girls tend to be less influenced by changes in body weight than in boys (Ohzeki, et al, 1993).

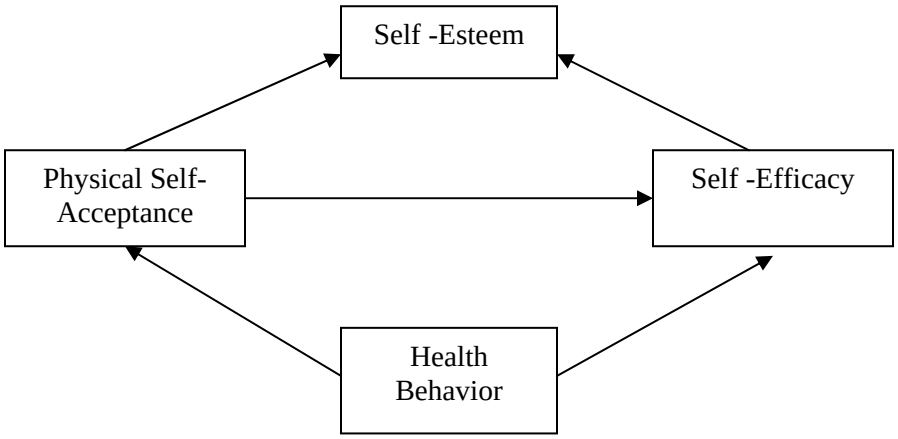

Figure 1
Health Behavior and Self-Esteem Model

That engaging in health behaviors leads to self-efficacy is well accepted in the literature (Bandura, 1997). Although much research has indicated an increase in self-image as a result of physical activity (Fox, 2000), few studies show how nutrition interventions for youth may affect self-image. More studies are required to illustrate if and how the combination of physical activity and nutrition may affect self-image in youth.

Therefore, the purpose of this study was to explore possible relations of physical activity and nutrition interventions on self-image in youth. Specifically, this study investigated if physical activity and nutrition interventions across gender and grade affect self-image, therefore illuminating what gender and age groups self-image issues are prevalent.

Method

Participants

This was a multiple cross-sectional study design. A total of 263 student questionnaires at time one and 287 questionnaires at time two were collected, roughly half male and half female (for complete participant details collected at each time point, see Table 1).

Procedures

Upon approval of the Institutional Review Board, anonymous questionnaires were administered to one class per grade (4-12; to ensure representation across grades) at each school in a Hawaii complex, which consisted of two elementary schools, one intermediate school, and one high school. Classes were selected to participate in the study based on the teacher's willingness to administer the survey at each time point. Questionnaires were distributed to interested teachers by the school complex health promotion coordinator. The coordinator collected cross-sectional data during the fall semester 2002 (time one) and spring semester 2003 (time two).

Interventions promoting physical activity and healthy nutrition were implemented in each school over the course of two semesters. Refer to Appendix A and Appendix B for intervention details.

Table 1
Study Characteristics

Variable	N Time 1	% Time 1	N Time 2	% Time 2	N T1+T2	% T1+T2
Participants	263	100	287	100	550	100
Gender						
Male	123*	46.8*	139	48.4	262*	47.6*
Female	139*	52.9*	148	51.6	287*	52.2*
Grade						
4	48	18.3	42	14.6	90	16.4
5	48	18.3	49	17.1	97	17.6
6	28	10.6	28	9.8	56	10.2
7	22	8.4	27	9.4	49	8.9
8	21	8.0	36	12.5	57	10.4
9	25	9.5	26	9.1	51	9.3
10	19	7.2	24	8.4	43	7.8
11	11	4.2	27	9.4	38	6.9
12	41	15.6	28	9.8	69	12.5

Note. * Sample sizes smaller for some variables because of missing data.
Data representative of a multiple cross-sectional study design.

Measures

Demographic questions were asked regarding gender, grade level, and school of attendance (elementary, intermediate, or high school).

Physical Activity Assessment. The Godin's Leisure-Time Exercise Questionnaire (GLTEQ), a self-report instrument that assesses the frequency of strenuous, moderate, and mild leisure-time physical activity that is performed during a typical week, was used (Godin, Jobin, Bouillon, 1986). A total exercise index (weekly metabolic equivalents) is calculated by multiplying the frequency of each intensity and summing for a total score using the following formula: 3*(mild) + 5*(moderate) +9*(strenuous). The GLTEQ is a psychometrically sound measure of exercise behavior (Godin et al., 1986; Jacobs, Ainsworth, Hartman, Leon, 1993) and has been related to other indices of physical activity in adolescents (Lee, Nigg, DiClemente, Courneya, 2001).

Additionally, the number of hours watching television/playing video games (sedentary behavior) was obtained. One-week test-retest reliabilities of 0.72 were documented (Wallace, Buckworth, Kirby, Sherman, 2000).

Nutrition (Fruit and Vegetable) Assessment. Single item questions inquired about the average number of fruits and the average number of vegetables eaten each day. Validity with a 3-day food record ($r=.35$, $p<.01$) and reliability ($r=.53$) were good in an adolescent sample using similar measures (Prochaska, Sallis, Rupp,Wade, & Long, 2000).

Physical Self-Image Assessment. Students rated two aspects of their physical self-image: their physical body attributes and physical fitness attributes. These attributes were rated on a scale from one ("I really don't like this and wish I could change it") to five ("I really like this and do not want to change it").

Measures of physical body attributes were adapted from the literature (Moore, 1993). This measure assessed satisfaction with the following components: waist, body build, height, weight, shoulder width, chest, health, and appetite.

Measures of physical fitness attributes were derived from the physical self-concept literature (Marsh, et al, 1994). This measure assessed satisfaction with the following components: strength, endurance, coordination, appearance, and flexibility. These physical activity attributes have been validated with Australian adolescents (Marsh et al., 1994), American college students (Nigg, Norman, Rossi, Benisovich, 2001), and are significantly related to components of physical fitness (Marsh & Redmayne, 1994) and other self-concepts (Marsh et al., 1994).

Analysis

Statistical analysis was performed using SPSS 11.0 (SPSS Inc.) statistical software. Descriptives of the demographics by time and each physical self-image variable by time and grade were determined. Bivariate correlations determined the degree of association between each study variable for each time period.

The differences between time one and time two for each gender were calculated using time as the independent variable and the study variables as the dependent variables. The difference between genders within each time point was calculated using gender as the independent variables and the study variables as the dependent variables. As this was an exploratory analysis, significance levels were set a priori at 0.05.

Results

Correlations

Appendix C shows correlations between study variables for time one for males and females. Physical body and physical fitness variables correlated with each other, but few were related to physical activity, inactivity, and nutrition behaviors.

Appendix D shows correlations between study variables for time two for each gender. Similar to time one, time two correlations showed that the physical body and physical fitness variables were correlated with each other. Few of these variables, however, were correlated with physical activity, inactivity, and nutrition behaviors.

There was no significant difference in correlations between time periods. In both time periods, physical body and physical fitness variables were mostly related to the variables of fruit consumption per day and vegetable consumption per day.

Variable Differences Across Time Per Grade

Appendix E describes the significant differences in the study variables across time for each grade. Of those grades that had a significant score difference for the study variables from time one to time two, all but two had lower scores at time two. Further, there is an obvious pattern of significantly lower scores at time two in satisfaction with shoulder width for males in grades ten, eleven, and twelve.

Gender Differences by Time and Grade

Appendix F describes the significant differences in the study variables across for each gender by time and grade. More males than females had a significantly higher score for the study variables by grade. This was especially noticeable in the following study variables: height, weight, shoulder width, health, appetite, strength, endurance, coordination, appearance, and flexibility. No significant patterns were found for differences across time.

Self-Image Attribute Changes

Overall means showed that males' satisfaction with their self-image was lower at time two compared to time one, except for grades five and nine that were higher. Female overall means showed higher self-image satisfaction in grades four, seven, eight, ten, and twelve at time two versus time one.

At time one, males of all grades except grade nine had higher self-image satisfaction than females. During time two, females had higher self-image than males in grades four, six, eight, ten, and twelve. For details on mean self-image attribute changes across gender and grade, see Figure 2.

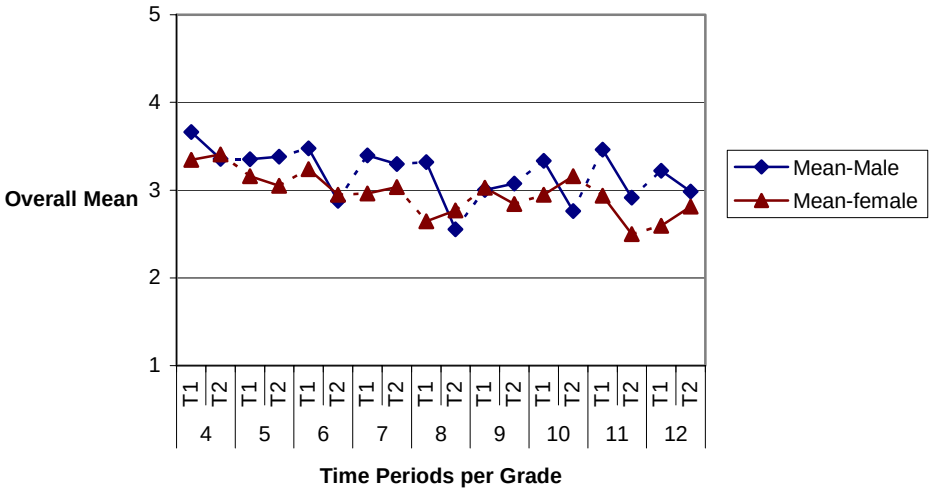

Figure 2
Overall Mean Changes in Self-Image Attributes

Discussion

This study explored the possible relationships of physical activity and nutrition interventions on self-image in youth. Results showed that physical activity and nutrition was maintained over time, contrary to research that indicates that physical activity and nutrition decrease over time. This is possibly due to our intervention efforts. Furthermore, this study showed that physical self-image was also maintained over time, possibly due to the maintenance of physical activity and nutrition levels.

Our results are consistent with other studies that showed that males generally belong to more active groups than females (Mota & Esculas 2002; Sunnegardh, et al., 1985). Furthermore, our results show that males are more satisfied with their physical body attributes than their female peers. Our findings are also consistent with the idea that females are more dissatisfied with their body shape than are males (Moore, 1993).

Eighty-two percent of the physical activity, nutrition, and self-image study variables remained stable across time. Of those that did change significantly, a majority decreased from pre-intervention to post-intervention for both males and females.

Correlation of study variables did not change significantly across time. As expected, the physical body and physical fitness variables were correlated with each other. Interestingly, fruit and vegetable consumption per day were the variables that were most associated with physical body and physical fitness attributes. The maintaining of health behaviors mirroring the maintenance of physical self-image lends credence to this aspect of the HBSEM. Further research is required to fully investigate the entire model.

Limitations in this study were the use of a multiple cross-sectional study design that did not allow us to measure change. In addition, there was no control group. Dependence on self-reported measures could have introduced positive response bias. Sample selection procedures may have also introduced selection bias into the study. Furthermore, there were inconsistent interventions over all grade levels. However, the maintenance of physical activity

levels and nutrition consumption, as well as physical self-image levels, is encouraging.

Conclusions

This study explored the possible relations of physical activity and nutrition interventions on physical self-image in youth. Physical activity and nutrition levels remained constant across time; contrary to research that indicates that these levels decrease over time. Guided by the Health Behavior and Self-Esteem Model, interventions that promote physical activity and nutrition possibly maintain physical self-image in youth.

Future directions need to examine whether the data holds over time, such as over a summer break and, ideally, over years; use a longitudinal cohort of large representative samples and various locations; and evaluate standardized health behavior interventions to produce a positive impact on self-image in youth.

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Bioography

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Appendix A
School Intervention Programs

Intervention	Grades Invited to Participate
Physical Activity (PA)	
Yoga class	Grades 4-8 parents/children/school staff
Low impact aerobics	School staff in complex
Dance classes.	Grades 4-8 students
After school activities to promote PA.	Grades 4-8 students
Community fun walks.	Grades 4-8 parents/children/school staff
Walking map and stretching tips.	Grades 6-8 students/school staff
Use of pedometers for PA motivation.	Staff at intermediate and high schools
Nutrition	
Demonstrations to bake healthy baked goods.	Grades 4-8 parents/children/school staff
Healthy gardening-learn to plant and grow salad vegetables and herbs.	Grades 4-8 parents/children/school staff
Make quick and healthy breakfasts.	Grades 4-8 parents/children/school staff
Healthy eats: prepare fruit and vegetable dishes.	Grades 4-8 parents/children/school staff
Healthy choices for snacks and food as rewards.	Grades 4-8 parents/children/school staff
Healthier alternatives to soda (e.g. milk and juice).	Grade 9-12 students/staff; policy Grades K-5 parents/students, Grade 6-8 students/staff
5-A-Day to better health posters, bulletins, newsletters.	Grades 4-8 parents/children/school staff
"Krazy Kowz" campaign: selling strawberry, chocolate, and plain 2% milk.	Grades 9-12 students/school staff
Elementary and intermediate schools do not allow candy and soda to be brought to school.	Grades K-5 parents/children/school staff Grades 6-8 parents/children/school staff
Salads at lunch twice a week.	Grades 9-12 students/school staff
Other	
Body fat/weight measures for five months.	Intermediate school staff
Health school newsletter	Grades 4-12 parents/children/school staff
Drama to teach about nutrition and PA	Grade 7-8 students
Healthy fair	Grade 7 Health class project; fair open to grades 6-8 students/school staff
Promote activities sponsored by community organizations (e.g., American Heart Association, March of Dimes)	Grades 4-8 parents/children/school staff

Appendix B

Intervention Purchases (time 1-time 2)

Elementary Schools	Intermediate School	High School
• Elementary Teachers' Handbook of Indoor and Outdoor Activities Book • Videos-*SuperDuper Sports Bloopers, Fantastic Food Pyramid, Happy Healthy Eating, Systems of the Human Body* • Standard sit and reach tester • Shuttle safe • Can-do low powder exercise bands • Object retrieval team building • Scooter tow rope • Tug-of-war rope • Duel game • Team Bocce • Pedometers-distance and step • Playground rubber balls • Volleyballs • Nerf footballs • Colored cones • Plastic hoops • Rubber basketballs • Volleyball net • Soft volleyballs • Spin jammer school pack • Cushioned volleyballs • Court boundary with winder • Rubber soccer balls • Whiffle balls	• Texts-Teen Health Course I • Back to back system • Back to back goals • Balls eye • Inflator/deflator • Pedometers • Rhino skin foam balls • Front mounted fixed goals (basketball rims) • Basketball net • Dyna bands • Flag belts • Scooter boards	• Texts- Glencoe Health, A Guide To Wellnesss., 2001 • Airman Inflator • Shape up mats • Weighted base cones • Dyna bands

Appendix C
Time One Correlations

	Gender	stren act	mod activ	mil activ	tv/vgam	frt/dy	veg/dy	waist	bd bld	height	weight	shld wdth	chest	health	appet	strength	enduran	coord	appear	flexab
stren act	M	1	.547(**)	.275(**)	0.067	.183(*)	0.156	-0.018	0.114	.216(*)	-0.049	0.141	0.027	0.178	.195(*)	-0.009	.235(**)	0.027	0.119	0.052
	F	1	.487(**)	.309(**)	-0.04	0.146	.224(**)	0.096	0.144	0.11	.175(*)	.201(*)	0.065	.176(*)	0.156	0.134	.246(**)	0.168	0.102	0.153
mod activ	M		1	.481(**)	-0.062	0.063	0.148	-.254(**)	-0.122	-0.054	-0.16	-0.062	-.231(*)	-0.162	-0.018	-.186(*)	-0.001	-0.008	-0.08	-0.131
	F		1	.465(**)	0.028	.237(**)	.287(**)	0.082	0.043	-0.006	0.08	0.107	0.077	0.02	0.049	0.065	0.118	0.16	0.085	0.089
mil activ	M			1	0.078	-0.009	0.112	-0.084	-0.162	-0.065	-0.04	-0.09	-0.115	-0.116	0.16	-0.134	0.055	0.005	-0.021	-0.077
	F			1	0.16	0.079	.187(*)	-0.027	-0.018	-0.095	0.075	-0.023	-0.005	-0.076	0.037	-0.118	-0.056	0.038	-0.111	0.105
tv/vgame	M				1	-0.174	-0.04	-0.015	-0.049	0.019	0.03	-0.01	0.036	-0.027	0.069	-0.092	0.066	-0.092	0.066	0.001
	F				1	-0.116	-.185(*)	-0.141	-.179(*)	-0.118	-0.02	-0.107	-0.054	-0.166	-.173(*)	-.201(*)	-0.141	-0.109	-.210(*)	-0.086
frt/dy	M					1	.529(**)	0.008	.268(**)	-0.051	0.064	0.116	.191(*)	.258(**)	0.106	0.176	0.175	0.086	0.149	-0.009
	F					1	.471(**)	.291(**)	.188(*)	0.113	0.131	.216(*)	.190(*)	0.133	.190(*)	0.061	0.07	0.033	0.111	0.128
veg/dy	M						1	-0.085	0.113	-0.041	0.056	0.029	0.06	0.021	0.077	0.035	0.043	0.14	-0.044	-0.031
	F						1	.217(*)	0.153	0.084	0.15	0.094	0.054	0.012	0.125	0.004	0.026	0.043	0.164	.176(*)
waist	M							1	.322(**)	.236(**)	.548(**)	.330(**)	.430(**)	.247(**)	0.169	.310(**)	.264(**)	.366(**)	.455(**)	.255(**)
	F							1	.448(**)	.307(**)	.575(**)	.417(**)	.390(**)	.261(**)	.581(**)	.351(**)	.289(**)	.206(*)	.401(**)	.447(**)
bd bld	M								1	.226(*)	.364(**)	.361(**)	.581(**)	.322(**)	-0.023	.510(**)	.347(**)	.205(*)	.401(**)	.313(**)
	F								1	.415(**)	.524(**)	.559(**)	.400(**)	.544(**)	.482(**)	.467(**)	.528(**)	.326(**)	.384(**)	.391(**)
height	M									1	.195(*)	0.174	.234(**)	.221(*)	0.078	.353(**)	.280(**)	0.171	0.033	.288(**)
	F									1	.320(**)	.348(**)	.391(**)	.362(**)	.414(**)	.410(**)	.364(**)	.272(**)	0.166	.330(**)
weight	M										1	0.16	.443(**)	.264(**)	.188(*)	.216(*)	.361(**)	.330(**)	.317(**)	.261(**)
	F										1	.348(**)	.369(**)	.410(**)	.508(**)	.433(**)	.405(**)	.217(*)	.342(**)	.391(**)
shld wdth	M											1	.423(**)	0.171	-0.01	.239(**)	.230(*)	.268(**)	.244(**)	.293(**)
	F											1	.501(**)	.401(**)	.315(**)	.449(**)	.413(**)	0.162	.290(**)	.191(*)
chest	M												1	.299(**)	.220(*)	.305(**)	.211(*)	.295(**)	.527(**)	.361(**)
	F												1	.394(**)	.475(**)	.352(**)	.279(**)	0.159	.350(**)	.287(**)
health	M													1	.354(**)	.255(**)	.419(**)	.225(*)	.344(**)	.333(**)
	F													1	.490(**)	.535(**)	.525(**)	.424(**)	.418(**)	.386(**)
appet	M														1	0.023	.190(*)	0.173	.302(**)	0.089
	F														1	.350(**)	.250(**)	.297(**)	.434(**)	.345(**)
strength	M															1	.419(**)	.292(**)	.229(*)	.271(**)

	Gender	stren act	mod activ	mil activ	tv/vgam	frt/dy	veg/dy	waist	bd bld	height	weight	shld wdth	chest	health	appet	strength	enduran	coord	appear	flexab
	F															1	.576(**)	.364(**)	.291(**)	.390(**)
enduran	M																1	.257(**)	.342(**)	.328(**)
	F																1	.436(**)	.365(**)	.350(**)
coord	M																	1	.272(**)	0.146
	F																	1	.413(**)	.448(**)
appear	M																		1	.302(**)
	F																		1	.339(**)
flexab	M																			1
	F																			1

Note: * correlation is significant at the 0.05 level
** correlation is significant at the 0.01 level

Appendix D
Time Two Correlations

	Gender	Stren act	Mod activ	Mil activ	tv/ vgam	frt/dy	veg/dy	waist	bd bld	height	weight	Shld wdth	chest	health	appet	strength	enduran	coord	appear	flexab
stren act	M	1	.451(**)	.197(*)	-.077	.127	.104	-.053	.080	.076	.086	.076	-.025	.010	.018	.111	.039	-.089	-.073	-.019
	F	1	.547(**)	.091	-.008	.295(**)	.131	.079	.066	-.089	.006	-.029	.088	.135	.057	-.017	.076	.039	.069	.195(*)
mod activ	M		1	.430(**)	.089	.074	.086	-.070	-.101	-.111	-.039	.014	-.025	.101	.028	-.074	-.012	-.029	-.085	-.081
	F		1	.307(**)	-.086	.214(**)	.199(*)	.019	.113	.012	.103	-.035	-.035	.065	.039	.108	.061	-.042	.056	.064
mil activ	M			1	.074	-.014	-.035	-.005	.042	-.037	.038	-.004	.004	.002	.053	-.047	-.095	-.053	.014	-.115
	F			1	-.092	.002	.162	-.014	.017	.137	.103	.119	.035	.056	.162	.127	.021	.026	.086	.099
tv/vgame	M				1	.040	.022	-.102	.009	.020	-.145	.107	.034	.066	.057	-.044	.087	.082	-.104	.045
	F				1	.009	.065	-.061	-.033	-.070(*)	-.041	-.001	.010	.092	.021	.058	.046	.099	.004	-.054
frt/dy	M					1	.605(**)	.107	.150	-.057	.068	.079	.015	.108	.156	.163	.236(**)	.242(**)	.113	.139
	F					1	.530(**)	.061	.023	-.056	.016	.019	-.005	.252(*)	.183(*)	.063	.240(**)	.103	.132	.082
veg/dy	M						1	-.207	.008	-.164	.048	-.068	-.038	.094	.113	.074	.084	.214(*)	.072	.136
	F						1	.061	-.066	-.071	.033	-.080	.026	.197(*)	.198(*)	.009	.100	.002	.040	.039
waist	M							1	.565(**)	.271(**)	.603(**)	.331(**)	.335(**)	.377(**)	.510(**)	.407(**)	.433(**)	.263(**)	.522(**)	.374(**)
	F							1	.436(**)	.111	.527(**)	.326(*)	.346(**)	.312(*)	.350(**)	.211(*)	.348(**)	.165(*)	.432(**)	.348(**)
bd bld	M								1	.299(**)	.566(**)	.489(**)	.548(**)	.235(**)	.303(**)	.397(**)	.516(**)	.306(**)	.582(**)	.280(**)
	F								1	.193(*)	.450(**)	.400(*)	.378(**)	.277(**)	.345(**)	.349(**)	.369(**)	.232(*)	.361(**)	.147
height	M									1	.256(**)	.386(**)	.166	.204(*)	.178(*)	.316(**)	.277(**)	.007	.124	212(*)
	F									1	.268(**)	.231(*)	.209(*)	.053	.213(*)	.261(**)	.145	.093	.091	.086
weight	M										1	.331(**)	.401(**)	.409(**)	.394(**)	.301(**)	.409(**)	.324(**)	.480(**)	.399(**)
	F										1	.360(*)	.274(**)	.359(*)	.492(**)	.218(**)	.311(**)	.147	.404(**)	.187(*)
shld wdth	M											1	.550(**)	.218(*)	.290(**)	.309(**)	.377(**)	.150	.321(**)	.265(**)
	F											1	.512(**)	.308(*)	.410(**)	.393(**)	.297(**)	.285(*)	.325(**)	.133
chest	M										.		1	.183(*)	.387(**)	.450(**)	.438(**)	.320(**)	.525(**)	.393(**)
	F												1	.266(*)	.393(**)	.355(**)	.327(**)	.228(*)	.221(**)	.182(*)
health	M													1	.463(**)	.269(**)	.369(**)	.288(**)	.233(**)	.185(*)
	F													1	.458(**)	.290(**)	.433(**)	.269(*)	.358(**)	.339(**)
appet	M														1	.337(**)	.364(**)	.379(**)	.383(**)	.216(*)
	F														1	.298(**)	.410(*)	.216(*)	.375(**)	.243(**)
strength	M															1	.429(**)	.345(**)	.463(**)	.446(**)
	F															1	.395(**)	.226(*)	.214(*)	.209(*)

	Gender	Stren act	Mod activ	Mil activ	tv/ vgam	frt/dy	veg/dy	waist	bd bld	height	weight	Shld wdth	chest	health	appet	strength	enduran	coord	appear	flexab
enduran	M																1	.496(**)	.426(**)	.481(**)
	F																1	.419(*)	.511(**)	.428(**)
coord	M																	1	.462(**)	.442(**)
	F																	1	.271(**)	.222(**)
appear	M																		1	.451(**)
	F																		1	.315(**)
flexab	M																			1
	F																			1

Note: * correlation is significant at the 0.05 level
** correlation is significant at the 0.01 level

Appendix E
Significant variable differences across time by grade

		Variables																	
Grade		stren act	mod activ	mil activ	tv/vgam	frt/dy	veg/dy	waist	bd bld	height	weight	shld wdth	chest	health	appet	strength	enduran	coord	appear	flexab
4	M							↓						↓				↓		
	F					↓														
5	M		↓																	
	F													↓						
6	M	↓							↓								↓			
	F									↓										
7	M																			
	F	↓																		
8	M							↓	↓				↓			↓	↓		↓	
	F																			
9	M														↓					
	F			↑																
10	M			↓					↓	↓		↓								
	F					↑														
11	M							↓				↓							↓	
	F											↓								
12	M											↓						↓		
	F																			
	↓	significantly lower score in time two compared to time one																		
	↑	significantly higher score in time two compared to time one																		

Appendix F
Significant gender differences by time and grade

		Variables																		
Grade	**Time**	stren act	mod activ	mil activ	tv/vgam	frt/dy	veg/dy	waist	bd bld	height	weight	shld wdth	chest	health	appet	strength	enduran	coord	appear	flexab
4	1																	M		
	2									M										
5	1									M	M									
	2		F											M		M				
6	1															M				
	2																			
7	1																			
	2	M							M											
8	1										M		M				M		M	
	2																			
9	1																			
	2			F		F														
10	1	M																M		
	2			F					F	F										
11	1					F						M								
	2		M	M																
12	1	M	M	M							M	M		M				M		
	2													M						
	M	Males had a significantly higher score compared to females																		
	F	Females had a significantly higher score compared to males																		