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Effects of the Youth Fit For Life Protocol on Physiological Factors, Mood, Self-Appraisal, Voluntary Physical Activity, and Fruit and Vegetable Consumption in Children Enrolled in YMCA After-School Care

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Changes associated with the Youth Fit For Life physical activity intervention were assessed with 5- to 12-year-old children in after-school care (N = 477). Body mass index (BMI), strength, and flexibility significantly improved over 12 weeks. Initial BMI was negatively related to observed changes, r = -.29, p < .001. Significant within-group improvements in tension, vigor, and physical self-concept scores, and levels of voluntary moderate-to-vigorous physical activity/week were also found in the 9- to 12-year-olds (n = 91). Multiple regression analysis indicated that changes in physical self-concept, exercise self-efficacy, and general self scores explained a portion of the variance in changes in voluntary physical activity that approached significance, R^2 = .08, F = 2.55, p = .06. Revisions and extensions of the protocol were suggested.

Key Words: health behavior, self-efficacy, after-school care, physical activity

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From 12 to 22% of American children are presently overweight (i.e., body mass index; BMI [kg/m^2] $\geq$ 95th age- and gender-adjusted percentile; U.S. Department of Health and Human Services, 2000). Overall, a three-fold increase in overweight has been observed over the last 25 years (Ogden, Flegal, Carroll, & Johnson, 2002). Recent data suggest this trend is continuing (Ogden et. al., 2006). Compared to their White counterparts, African American and Hispanic children are more overweight, with some effects based on sex also suggested (Ogden et. al., 2006). Along with a diet high in fat and calories, a reduction in physical activity has been implicated (U.S. Department of Heath and Human Services, 1996; 1999). In 2003, only 25% of teenagers engaged in moderate amounts of physical activity for at least 30 min, five or more days per week (Grunbaum et al., 2004). Habits established during earlier years may predict physical activity throughout adolescents and into adulthood (U.S. Department of Heath and Human Services, 1999).

Although schools can help with reaching the nationally established goals for children's physical activity, physical education (PE) has been given a low priority compared to academic subjects and has been reduced in many U.S. communities (National Association for Sport and Physical Education, 2006). Even when PE is regularly administered in elementary schools, research suggests that only 10 to 36% of class time is spent with students participating in moderate-to-vigorous physical activity (McKenzie et al., 1995; Simons-Morton, Parcel, Baranowski, Forthofer, & O'Hara, 1991; Simons-Morton, Taylor, Snider, & Huang, 1993), with the higher proportions of such time associated with classes run by PE specialists (McKenzie, Sallis, Kolody, & Faucette, 1997). Reductions in PE time are generally not made up outside of school, and more research is required regarding factors associated with increases in children's *voluntary* moderate-to-vigorous physical activity (Pate & Sirard, 2000).

In addition to PE, after-school care may be an appropriate setting for administering physical activity interventions to children. Currently about 7 million children attend after-school care in the U.S., with a demand of approximately 22 million (Afterschool Alliance, 2004). Although some attempts have been made to adapt school-time physical activity interventions for after-school applications (see Kelder et al., 2005; Nigg, Battista, Chang, Tamashita, & Chung, 2004), the Youth Fit For Life protocol was specifically designed to be administered to large numbers of children by after-school counselors previously untrained in PE methods. Improvements in measures of body composition, BMI, and fitness, associated with use of this protocol over 12 weeks, were found in 5- to 12-year-old (Annesi, Westcott, Faigenbaum, & Unruh, 2005), and 9- to 12-year old (Annesi, Faigenbaum, Westcott, Smith, & Hamilton, 2007), primarily African-American children in YMCA-based after-school care sites in the Atlanta, Georgia area.

Although most of the concern regarding adequate amounts of physical activity has been focused on physical health concerns, there are also potential benefits to mood and self-concept. Though these areas have not been well studied in children, Annesi (2005) and Tomson, Pangrazi, Friedman, and Hutchison (2003) found positive changes in mood associated with physical activity in participants ages 8 through 12 years. In addition, scores on measures of physical and overall self-concept were significantly increased (Annesi, 2005, 2006). Although improvements in these areas are important in their own right, it is possible that positive changes in self-appraisal factors are associated with increases in freely chosen physical activity. This is consistent with various theories of motivated behavior (see Culos-Reed, Gyurcsik, & Brawley, 2001, for a review). Increased voluntary physical activity is important because it is unlikely that programs that provide physical activity alone will supply children with the recommended amounts of 60 min per day at moderate-to-vigorous levels of exertion (Strong et al., 2005).

The aforementioned Youth Fit For Life protocol was developed using tenets of social cognitive and self-efficacy theory (Bandura, 1986, 1997), and psychological correlates of physical activity in youth (see Barbeau, 2005; Cavill, Biddle, & Sallis, 2001; Sallis, Prochaska, & Taylor, 2000, for reviews). It was thought that exercise program administration, that incorporates training in behavioral skills such as short- and long-term goal setting, self-monitoring of incremental progress, managing self-talk, and recruiting social support in a non-threatening, mastery-focused manner, would improve participants' self-management and self-regulatory abilities concerning physical activity. This was intended to counter barriers to voluntary exercise, and positively affect determinants of physical activity such as self-efficacy (Dishman et al., 2004; Pate et al., 1997; Strauss, Rodzilsky, Burack, & Colin, 2001), body image (Douthitt, 1994), perceived competence (Boyd & Hrycaiko, 1997; Cavill, Biddle, & Sallis, 2001; Sallis, Alcaraz, McKenzie, & Hovell, 1999), and self-esteem (Ferguson, Yesalis, Promrehn, & Kilpatrick, 1989).

More specifically, through application of the Youth Fit For Life protocol it was thought that improvements in participants' self-efficacy to overcome barriers to complete regular physical activity (i.e., self-regulatory efficacy), perceptions of making progress in exercise-related goals (i.e., task self-efficacy), and general perceptions of the self (generalized self-efficacy), would be associated with increased voluntary physical activity. Researchers have indicated a need for further study of theory-based mediators of desirable health behaviors to improve adequacy of interventions (Baranowski, Anderson, & Carmack, 1998; Lewis et al., 2006; Lewis, Marcus, Pate, & Dunn, 2002).

Thus, it was also a goal within this investigation to evaluate physiological and behavioral changes, assess theory-based mediators for their association with changes in voluntarily completed physical activity, and replicate and extend previous findings on the Youth Fit For Life protocol (Annesi, Westcott et al., 2005; Annesi, Faigenbaum et al., 2007) in a "real world" setting – apart from influences from architects of the protocol. In their comprehensive review of physical activity interventions in youth, Stone, McKenzie, Welk, and Booth (1998) cited a need for research on, "…increasing out-of-school [physical] activity levels" (p. 310), and testing interventions with, "…diverse ethnic/racial groups…" (p. 311).

Thus, the purposes of this three-part investigation were (a) to assess physiological changes associated with the Youth Fit For Life protocol in an overall sample of 5- to 12-year-old children, and subsamples of 5- to 8-, and 9- to 12-year-old children who were initially overweight or at-risk for overweight; (b) to assess changes in mood, self-appraisal, voluntary physical activity, and fruit and vegetable intake associated with the Youth Fit For Life protocol in the 9- to 12-year-old participants; (c) to assess whether changes in factors of self-appraisal, derived from self-efficacy theory, predict a significant portion of the variance in changes in voluntary physical activity; and (d) to assess the generalizability of the protocol in a purely practical setting.

The following specific hypotheses were made:

1. The Youth Fit For Life protocol would be associated with statistically significant improvements in BMI and days per week of voluntary physical activity, and measures of strength, flexibility, and endurance.
2. The Youth Fit For Life protocol would be associated with statistically significant improvements in Tension, Vigor, Physical Abilities, Physical Self-Concept, Exercise Barriers Self-Efficacy, and General Self scores, and increases in fruit and vegetable intake.
3. Changes in General Self, Physical Self-Concept, and Exercise Barriers Self-Efficacy scores would, together, account for a statistically significant portion of the variance in changes in days per week of moderate-to-vigorous physical activity.

It was hoped that findings would allow for further development and application of effective physical activity protocols for children.

Method

Participants

For Part 1 of this investigation, children ranging in age from 5 to 12 years, from 21 after-school care sites of a YMCA association in the Midwest United States, were participants. A complete set of physiological data was required for inclusion in the analyses. Thus, analyses were conducted on 242 boys and 235 girls (M_{age} = 7.86 years, *SD* = 1.59). Racial composition was 61% White, 23% African-American, 13% Hispanic, and 3% of other racial/ethnic groups. BMI scores at baseline are reported in Table 1. Based on normative data (U.S. Department of Health and Human Services, 2000), the overall sample was in the 81st percentile for BMI. Based on records of use of the free and reduced price meal program, participants were generally in the lower- to lower-middle socioeconomic strata. Informed consent for participation was required from a parent or caregiver. Children's participation was voluntary. No fees in addition to the basic income-adjusted fee for after-school care were required.

For Part 2 and Part 3 of this investigation, the 41 boys and 50 girls of ages 9 through 12 years from the total sample were included. A complete set of the mood, self-appraisal, recalled physical activity, and fruit and vegetable intake surveys was required.

Measures

Body mass index (BMI). A recently calibrated scale and tape measure were used to measure BMI. BMI is an estimate of health risks associated with body fat, derived from a ratio of weight and height measurements (weight [in kg]/height [in m^2]). Correlations with the most precise measure of body fat, dual energy x-ray absorptiometry, were .80 to .90; Dietz & Robinson, 1998).

Strength. Number of push-ups completed at a 3-s pace within 1 min was used as the measure of muscular strength. Participants were required to start in an upright position and lower the body using the arms until the elbows were at a 90° angle. The required pace was indicated by a recording heard by both the participant and tester. When either the required form or pace was not kept, the assessment was terminated and the number of properly completed push-ups was recorded. Test-retest reliability of the 90° angle push-up test was reported at .90 to .91 for ages 7 to 11 years (McManis & Wuest, 1994). Validity was demonstrated through correlations of ≥ .70 with combined bench press, latissimus pull-down, and arm curl scores, after controlling for body weight (Rutherford & Corbin, 1993).

Flexibility. Consistent with recent research (Plowman, 2006), the shoulder stretch was used as the measure of flexibility. This was an alternative to the more often used sit-and-reach test that has consistently demonstrated poor validity as a measure of general flexibility in preadolescents (e.g., Jackson & Baker, 1986; Patterson, Wiksten, Ray, Flanders, & Sanphy, 1996). With the right hand, the participant reached over the right shoulder and down the back. The left hand was positioned behind the back reaching up. The distance between the fingers was recorded in cm. If the fingers touched, the score was 0. Test-retest reliability for boys and girls ages 5 through 12 years was ≥ .90 (Annesi et al., 2005).

Endurance. To estimate endurance or cardiovascular fitness, each participant ran/walked as far as possible in a period of 6 min. The distance covered was recorded in m. Test-retest reliability ranged from .60 to .84 for the present sample. Concurrent validity was evaluated by correlating distance covered with $VO_{2\ max}$ treadmill test results. Previous studies of children ages 9 through 11 years found correlations ranging from .71 to .82 (Jackson & Coleman, 1976).

Tension and vigor. The Tension and Vigor scales of the Profile of Mood States – Short Form (McNair, Lorr, & Droppleman, 1992) are self-report surveys of five items each. Responses range from 0 (*not at all*) to 4 (*extremely*). Sample items for the Tension scale are “Nervous,” “Anxious,” and “Tense;” and for the Vigor scale are “Energetic,” “Active,” and “Lively.” Internal consistency averaged .91 and .88, respectively. Test-retest reliability over 3 weeks was .70 and .65, respectively (McNair et al., 1992). Although designed for adults, Profile of Mood States scales have been used with children starting at 9 years of age (Annesi, 2005; Berger, Grove, Prapavessis, & Butki, 1997).

Perceived physical abilities and general self. The Self-Description Questionnaire-I (Marsh, 1990) is a self-report survey intended for children ages 8 through 12 years. The General Self and Physical Abilities scales were used in this research. Responses range from 1 (*false*) to 5 (*true*). The factor structure was supported across eight studies (see Marsh, 1990, pp. 29-39, for a review), and independence between scales was demonstrated. Each scale has eight items. Sample items for the General Self scale are, “Overall I have a lot to be proud of,” “I can do things as well as most other people,” and “I’m as good as most other people.” Sample items for the Physical Abilities scale are, “I like to run and play hard,” “I have good muscles,” and “I am a good athlete.” Internal consistencies of the scales ranged from .81 to .90 (Marsh, 1990). Although usual test-retest methods were considered inappropriate due to expected changes in the measured constructs over time, findings suggested *systematic* changes over 6 months (Marsh, 1990). General Self was related to a generalized sense of self-efficacy in self-efficacy theory.

Physical self-concept. The Physical Self-Concept scale of the Tennessee Self-Concept Scale: 2 Child Form (Fitts & Warren, 1996) is a self-report survey intended for use with children ages 7 through 14 years. A single score is recorded from possible responses of 1 (*always false*) to 5 (*always true*) on 12 items, although item clusters include identity (e.g., “My body is healthy”), satisfaction (e.g., “I don’t feel as well as I should”), and behavior (e.g., “I’m not good at sports and games”). Factor analysis supported the Physical Self-Concept scale items relative to the other five scales of the

Tennessee Self-Concept Scale: 2. Internal consistency for the 9- to 12-year-old age group averaged .70, and test-retest reliability over 1 week was .71 (Fitts & Warren, 1996). Physical Self-Concept was related to the construct of task self-efficacy in self-efficacy theory.

Exercise barriers self-efficacy. The Exercise Barriers Self-Efficacy scale for Children (Annesi et al., 2005) is a self-report survey intended to assess exercise barriers self-efficacy, or perceptions of the ability to overcome social, personal, and environmental barriers to participating in physical activities. Based on previous research (Marcus, Selby, Niaura, & Rossi, 1992; McAuley, 1991; McAuley & Mihalko, 1998), each of the 10 items begins with the stem, "I am sure I can exercise three or more days per week even if…." Responses range from 1 (*not at all confident*) to 5 (*definitely confident*). Sample items are, "I was nervous being around other people" (social barrier), "My body felt uncomfortable while exercising" (personal barrier), and "The weather was bad (very hot, rainy, very cold)" (environmental barrier). Internal consistency for the 9- to 12-year-old age group averaged .79, and test-retest reliability over 1 week was .77 (Annesi et al., 2005). Exercise Barriers Self-Efficacy was related to the construct of self-regulatory efficacy in self-efficacy theory.

Voluntary physical activity. Consistent with recent research (Annesi, 2006; Annesi et al., 2007; Tremblay, Inman, & Willms, 2000), a single item was used to assess the number of days a participant voluntarily completed a bout of moderate-to-vigorous ("made you breathe harder than usual") physical activity or exercise over the previous week, excluding physical activities completed during school (e.g., during PE classes) or after-school care programs (e.g., during Youth Fit For Life sessions). The item was based on review of the extant physical activity recall research (see Piera et al., 1997), and adapted from recent research with 12-year-olds from Canada (Tremblay et al., 2000). Test-retest reliability over 1 week was .79. The correlation between days of voluntary, moderate-to-vigorous physical activity and time to complete a 1-mile (1.61 km) run/walk was significant, $r = -.39$, $p < .01$. Responses range from 0 to 7 days.

Fruit and vegetable consumption. Two items from the Food Frequency Questionnaire for Youth (Speck, Bradley, Harrell, & Belyea, 2001) were used to recall the number of fruits and vegetables consumed over the past week. Internal consistency for the Fruits and Vegetables scales was .72 and .83, respectively. Test-retest at 48 hours was .77 and .67, respectively (Speck et al., 2001).

Changes on each measure were derived by subtracting scores at baseline from scores at Week 12.

Procedure

Participants were enrolled in a 12-week segment of after-school care that administered the Youth Fit For Life protocol. Although informed consent was required prior to program start, participants and their caregivers were unaware of inclusion of the protocol at time of enrollment. Thus, it was unlikely that findings were biased by self-selection for participation. Instructors completed a 5-hour training on the protocol supported by manuals and a video that was retained for ongoing reference. The participant-to-instructor ratio was approximately 15:1. Youth Fit For Life curriculum components are described more fully elsewhere (see Annesi et al., 2005, National Cancer Institute, in press), and will be provided by the first author upon request. A brief overview will be given here.

In addition to typical after-school care processes (e.g., completing homework, consuming a snack), the Youth Fit For Life protocol was administered by after-school counselors who were formerly untrained in exercise or health promotion methods. Participants were grouped by age (i.e., 5 – 8-year-olds and 9 – 12-year-olds). Counselors were supported one session per week by a PE or exercise science specialist who possessed a corresponding academic degree and training in Youth Fit For Life administration. These individuals performed structured quality-control assessments and reported findings to a central administrator who intervened as required. The treatment was three sessions per week for 45 min per session. It included moderate- to high-intensity cardiovascular activities in the form of non-competitive, mastery-focused games and tasks each day for 20 min. On two non-consecutive days per week, resistance training was completed utilizing age-appropriate resistance bands for 20 min. Every attempt was made to keep participants active throughout these exercise components, and to be reflective of personal progress made. Review of various self-management and self-regulatory skills (e.g., goal setting, self-monitoring, self-talk/cognitive restructuring, recruiting social support) was provided one session per week for 20 min. A workbook tailored for the present ages was used to enhance learning and application of the self-management and self-regulatory skills. General health and nutrition information topics were also addressed with participants (one theme per week; e.g., “Fruits and Vegetables,” “Heart Health,” “Fast Foods”) for 5 to 7 min each session. These were supported by displays of corresponding posters. All Youth Fit For Life components were completed in the multi-purpose room or gymnasium of the corresponding after-school care site (i.e., elementary school).

Before the start and at the end of the 12-week Youth Fit For Life treatment, children completed the aforementioned physiological assessments and surveys in a private area.

Data Analysis

For Part 1, because of the possibility of race/ethnicity and sex being associated with significantly different BMI scores at baseline (Ogden et al., 2002), preliminary analyses were conducted to determine whether subsequent tests should account for any such difference. Correlational analyses were thus conducted, controlling for age, where associations between White participants, and African-American and Hispanic participants, were estimated. Similar analyses were then conducted to assess associations of BMI at baseline, and BMI change, with participants’ sex. Subsamples of participants who were overweight and at-risk for overweight (≥ 85th age- and gender-adjusted percentile; U.S. Department of Health and Human Services, 2000) were derived from the larger sample and grouped by age (5 – 8-year-olds, n = 88; 9 – 12-year-olds, n = 49) for further analyses. Dependent t-tests were used to determine if significant within-group changes in physiological measures occurred over 12 weeks. Consistent with previous research (Annesi, Westcott et al., 2005; Annesi, Faigenbaum et al., 2007), where a significant change in score was found, it was contrasted with expected changes derived from age-adjusted normative data using appropriate t-tests. This enabled changes associated with participants’ maturation to be adequately accounted for.

For Part 2, only participants of ages 9- through 12-years were included because of the age requirements associated with the behavioral surveys used. Independent t-tests were calculated to determine if behavioral test scores differed by sex either at baseline, or difference between baseline and Week 12. Dependent *t*-tests were then utilized to determine within-group changes over 12 weeks.

For Part 3, based on self-efficacy theory (Bandura, 1997; McAuley & Mihalko, 1998), and previous research (Annesi, 2006; Lewis et al., 2006) utilizing a mediating variable framework (see Baranowski et al., 1998; Lewis et al., 2002), changes in scores on the General Self, Physical Self-Concept, and Exercise Barriers Self-Efficacy scales were simultaneously entered into a linear multiple regression equation as predictor variables to estimate the variance explained in changes in voluntary moderate-to-vigorous physical activity. Consistent with earlier research (Annesi, 2006; Annesi et al., 2007), actual changes in scores were used in the multiple regression analysis, rather than controlling for baseline values. As previously suggested (Fitzmaurice, Laird, Ware, 2004; Williams & Zimmerman, 1996), this enabled analyses of changes while retaining the naturally occurring array of actual (rather than statistically adjusted) baseline scores, and their changes. Distributions of change scores did not present a problem for the analytic methods planned.

Statistical significance was set at $\alpha = .05$, one-tailed, for Part 1, and $\alpha = .05$, two tailed, for Part 2 and Part 3. Based on suggestions from Perneger (1998), no adjustments were made for multiple tests.

Results

The sample size of 477 enabled statistical analyses at a confidence level of 95%, with a confidence interval of 4.5%. After controlling for age, race/ethnicity was not significantly related to baseline BMI scores for the present sample (White – African American $r_{12.3} = .03$, $p = .51$; White – Hispanic $r_{12.3} = -.01$, $p = .78$). Thus, data were aggregated by race/ethnicity for further analyses. After controlling for age, there was not a significant relationship found between participants' sex and BMI at baseline, $r_{12.3} = -.03$, $p = .51$, or change in BMI over the 12-week program, $r_{12.3} = .05$, $p = .25$. Thus, data were aggregated by sex for further analyses. Because a significant difference was not found on any of the participants' behavioral measures at baseline or change from baseline to Week 12 based on sex (*p*s > .20), data were accordingly pooled for analyses in Part 2.

Part 1

Changes in Physiological Factors

Significant within-group improvements were found over 12 weeks in BMI, strength, flexibility, and endurance, for the overall sample (see Table 1). Effect sizes were moderate for strength and flexibility changes, and small for BMI and endurance changes. Based on age- and sex-adjusted normative data (Hoffman, 2006 [endurance]; Plowman, 2006 [strength]; U.S. Department of Health and Human Services, 2000 [BMI], improvements in BMI ($M = -0.15$, $SD = 1.26$) were significantly greater than the age-adjusted expected changes associated with maturation ($M = 0.12$), $t(476) = -4.67$, $p < .001$. Improvements in strength ($M = 3.03$, $SD = 5.33$) were also significantly greater than expected changes ($M = 0.36$), $t(476) = 10.94$, $p < .001$. The significant within-group improvements in endurance ($M = 30.36$, $SD = 331.39$) were not significantly greater than expected changes ($M = 12.97$), $t(476) = 1.15$, $p = .13$. Appropriate normative data were unavailable for contrasts on the flexibility measure used.

For the subsamples of overweight and at-risk for overweight 5- to 8-year-olds, and 9- to 12-year-olds, significant improvements were found on BMI and strength, but not on endurance (see Table 1).

Table 1
Changes in Physiological Factors from Baseline to Program End

Physiological factor	Baseline		Week 12		$t(476)$	p	d
	M	*SD*	*M*	*SD*			
Full sample (N = 477)							
Body Mass Index	17.39	4.12	17.25	3.64	-2.56	.01	.03
Strength	7.38	6.72	10.40	7.19	12.40	<.001	.45
Flexibility	2.67	4.52	1.32	3.16	-8.95	<.001	.30
Endurance	997.61	568.76	1028.70	598.02	2.00	.05	.05
Age 5 to 8 years – overweight and at-risk for overweight (n = 88)							
Body Mass Index	20.07	2.94	19.55	3.13	-3.52	<.001	.18
Strength	6.67	6.16	9.49	7.05	6.15	<.001	.46
Flexibility	4.09	5.62	1.79	3.38	-4.77	<.001	.41
Endurance	928.62	553.04	914.58	480.06	-0.48	.32	-.03
Age 9 to 12 years – overweight and at-risk for overweight (n = 49)							
Body Mass Index	25.70	5.04	24.66	5.47	-3.99	<.001	.21
Strength	6.84	6.59	8.22	7.04	1.76	.04	.21
Flexibility	2.54	5.16	1.66	4.00	-1.59	.06	.17
Endurance	692.20	152.70	719.63	235.00	0.87	.19	.18

Note. Body mass index is expressed as wt(in kg)/ht(in m^2). Strength is expressed as number of push-ups completed in 1 min on a 3-s cadence. Flexibility is expressed as distance (cm) from fingers touching behind the back. Endurance is expressed as distance (m) covered during a 6-min run/walk. *t*-tests were one-tailed. *d* = Cohen's measure of effect size.

Flexibility changes were significant for only the 5- through 8-year-old group. Effect sizes for BMI changes for the overweight and at-risk for overweight subsamples were considerably larger than the overall sample. In contrasting the two overweight/at-risk for overweight subsamples, effect sizes were larger for the 5- to 8-year-old participants on strength and flexibility changes, and similar for BMI changes.

Part 2

Changes in Mood and Self-Appraisal Factors

The mood factors of Tension and Vigor, and the self-appraisal factor of Physical Self-Concept, demonstrated statistically significant improvements over the length of the investigation (see Table 2).

Table 2
Changes in Mood and Self-Appraisal Factors, Voluntary Physical Activity, and Fruit and Vegetable Intake from Baseline to Program End for Ages 9-12 Years (*n* = 91)

	Baseline		Week 12		*t*(90)	*p*	*d*
	M	*SD*	*M*	*SD*			
Mood factor							
Tension	5.69	4.91	4.61	4.23	-2.62	.01	.22
Vigor	13.21	5.27	14.54	4.97	2.70	.01	.25
Self-appraisal factor							
Physical Abilities	34.24	5.68	34.66	4.93	1.04	.30	.07
Physical Self-Concept	44.70	6.97	46.57	7.27	3.39	.001	.27
Exercise Barriers SE	27.45	9.60	27.60	9.79	0.22	.82	.02
General Self	29.11	4.95	29.45	4.42	0.68	.50	.07
Voluntary physical activity							
(days/week)	3.10	2.44	3.87	2.46	2.60	.01	.32
Vegetables (per week)	9.13	7.05	9.82	8.16	0.69	.49	.10
Fruit (per week)	11.66	7.01	12.58	8.03	0.91	.36	.13

Note. Tension and Vigor were subscales of the Profile of Mood States - Short Form (McNair et al., 1992). Physical Abilities and General Self were subscales of the Self-Description Questionnaire–I (Marsh, 1990). Physical Self-Concept was a subscale of the Tennessee Self-Concept Scale: 2 Child Form (Fitts & Warren, 1996). Exercise Barriers SE = Self-Efficacy = Exercise Barriers Self-Efficacy Scale for Children (Annesi et al., 2005). *t*-tests were two-tailed. *d* = Cohen's measure of effect size.

Changes in Voluntary Physical Activity

Increases in days of voluntary, moderate-to-vigorous physical activity per week were significant (see Table 2). The mean increase was .77 days/week (*SD* = 2.82).

Changes in Fruit and Vegetable Consumption

Increases in fruit and vegetable consumption per week did not reach statistical significance (see Table 2).

Part 3

Relations of Self-Appraisal Factors with Voluntary Physical Activity

Results of the multiple regression analysis, simultaneously entering changes in scores on Physical Self-Concept, Exercise Barriers Self-Efficacy, and General Self as predictor variables for changes in days per week of voluntary physical activity, approached statistical significance, $R = .28$, $R^2 = .08$, $F(3, 87) = 2.55$, $p = .06$. Corresponding standardized beta weights are reported in Table 3. Only changes in General Self scale scores made a significant unique contribution to the variance in change in voluntary physical activity.

Post hoc analyses indicated that change in BMI was significantly related to BMI at baseline ($r = -.29$, $p < .001$). Change in physical activity days per week was significantly related to physical activity days per week at baseline ($r = -.51$, $p < .001$).

Table 3
Summary of Predictor Variables for Changes in Voluntary Days of Physical Activity per Week

	β	*t*	*p*
Δ General Self	.27	2.51	.01
Δ Physical Self-Concept	-.16	-1.50	.14
Δ Exercise Barriers Self-Efficacy	.06	0.58	.57

Note. Physical Self-Concept was a subscale of the Tennessee Self-Concept Scale: 2 Child Form (Fitts & Warren, 1996). Exercise Barriers Self-Efficacy = Exercise Barriers Self-Efficacy Scale for Children (Annesi et al., 2005). The delta symbol (Δ) denotes change in score from baseline to Week 12. β denotes standardized beta.

Discussion

This field investigation assessed changes over 12 weeks in measures of physiological, mood, and self-appraisal factors, physical activity, and fruit and vegetable intake associated with the Youth Fit For Life protocol administered at YMCA after-school care sites. BMI, an important marker of health risks, improved significantly, along with muscular strength and flexibility. Contrasts with changes associated with maturation further suggested positive effects associated with the treatment. Changes in BMI were greatest for those with the highest scores initially. For the overall sample, cardiorespiratory endurance significantly improved, but not more than expected changes associated with maturation. Cardiorespiratory endurance did not significantly improve for subsamples that were overweight and at-risk for overweight. The present findings were favorable compared to interventions with similar age participants that typically found significant changes in physical activity, but not in body composition or BMI (Cabellero et al., 2003; Donnelly et al., 1996; Luepker et al., 1996; Trevino et al., 2004). In the most recent meta-analysis of 64 reports on child obesity treatments reaching acceptable standards for study inclusion (Stice, Shaw, Marti, 2006), only 21% (13) were associated with statistically significant improvements in BMI. Most required considerably more hours of intervention - much of which interfered with classroom time. The present findings of physiological changes generally replicated previous assessments of the Youth Fit For Life protocol that were conducted in more controlled settings (Annesi et al., 2005; Annesi et al., 2007).

Significant changes in Tension, Vigor, and Physical Self-Concept were found. This replicated recent findings of the association of moderate-to-vigorous physical activity and mood improvements in preadolescents (Annesi, 2005; Tomson et al., 2003). Physical activities delivered in a mastery-focused manner, with inclusion of an array of self-management and self-regulatory skills, may have contributed to this finding. Direct assessment of self-management skills usage, and their association with changes in self-efficacy and other behavioral factors, is planned. A significant increase in days per week of voluntary moderate-to-vigorous physical activity was found. This is important because programs that mandate physical activity (e.g., PE, and inclusion of brief amounts of physical activity during academic classes) are not likely to alone supply recommended amounts, and will require self-selection of physical activity behaviors by children often unaccustomed to physical exertion during their free time. Perceptions of competence in the physical activity domain, as addressed within the present curriculum, may be an important consideration. No significant changes were found in fruit and vegetable consumption. Nutrition information supplied to children alone may not be sufficient to induce behavioral change. Although unsuccessful in most interventions to-date (see Stice et al., 2006), parental recruitment may be an essential component. Fresh ideas for effective parental involvement are required.

Theoretical models that predict behavior through changes in perceptions of the self, such as social cognitive and self-efficacy theory (Bandura, 1986, 1997), and related theories concerned with physical activity and management of body weight (e.g., Baker & Brownell, 2000), were partially supported. Results suggested that changes in constructs related to self-efficacy were associated with changes in voluntary physical activity in the participants. Findings replicated the support of self-efficacy theory previously found (Annesi, 2006; Annesi et al., 2007), however, the unique contribution made to the explained variance in changes in voluntary physical activity, by changes in perceptions of the general self, was greater here. Based on suggestions emanating from the mediating variable framework (Baranowski et al., 1998), results suggest that future physical activity interventions should also incorporate a mastery-focused environment with minimal social threat to the participant. Based on the present treatment effect sizes in BMI being greater for the overweight and at-risk for overweight children than the overall sample, this may be especially relevant for heavier children. In addition, specific attention to the development of applicable behavioral skills is suggested.

Future research should test extensions of the present protocol for comparative effects on related behavioral variables that may have a stronger association with increased, freely chosen physical activity time. Certainly, further investigation of the association of self-efficacy-related constructs and voluntary physical activity is warranted. Assessments of the generalizability of findings across socioeconomic strata and ethnic and racial groups should be made, as well as evaluations of effects over longer periods.

Although limitations of this research were some self-selection for participation, possible expectation effects, and lack of a no-treatment control group, this field investigation had high external validity due to its use of an applied setting that is common to many children. In addition to suggesting within-group improvements, efficacy of the intervention was supported by both contrasts with data on normative changes, and consistency with previous findings associated with use of the same treatment protocol. To further extend this line of inquiry, the effects of additional formats for the Youth Fit For Life protocol currently are being evaluated in settings such as school-time PE, camps, and with home-schooled children. Additional testing will also incorporate components for involvement of participants' caregivers. It is hoped that adequate administration of conveniently delivered, effective physical activity and health-promotion protocols will be possible in enough settings, using enough types of program administrators, that reductions in PE may be effectively countered, and that community health and childhood obesity may be substantially impacted.

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