FITNESS

Importance of Health-Related Fitness Knowledge to Increasing Physical Activity and Physical Fitness

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Abstract

Physical inactivity is expanding across all ages in the United States. Research has documented a deficiency in health-related fitness knowledge (HRFK) among elementary- through college-aged students. The need for a credible and reliable resource that provides research-based information regarding the importance of HRFK is significant. The purpose of this article was to examine the relationship between HRFK, physical activity (PA), and physical fitness (PF). This issue is particularly important for physical educators because of the growing concerns over rising obesity and declining levels of PA across the country. HRFK research to this point has indicated three important findings: (1) HRFK is low among elementary-aged students through college-aged students; (2) HRFK has successfully predicted PA and PF levels, though research is limited; and (3) educational interventions such as conceptual physical education (CPE) center on fitness knowledge, and their

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application has indicated a longitudinal increase in PA and PF levels.. This comprehensive review of literature is designed for the use of physical educators considering the adoption of health-related fitness education initiatives with the intent of improving long-term PA and PF.

Regular participation in physical activity (PA) is important to sustaining good health and has been a topic of investigation since the acknowledgment of the obesity epidemic throughout the last 30 years. The obesity rate in the United States has increased to near epidemic proportions (15% to 30% in adults, 5% to 18% in adolescents aged 12 to 19 years, 6% to 19% in children aged 6 to 11 years; Centers for Disease Control and Prevention [CDC], 2009). With obesity at problematic levels and with current trajectories suggesting the possibility of further increases, related financial outlays for health-related illness are likely to become overwhelming. Obesity and lack of PA have been linked to numerous medical complications including cognitive decline. They are often linked to disease and disability, and the impact of obesity on the development of type 2 diabetes is so profound that the onset of this disease now is befalling childhood. At the other end of the life span, obesity and lack of PA have been linked to numerous medical complications (e.g., hypertension, stroke, certain types of cancer, and coronary heart disease) and impaired brain activity (Mirowsky, 2011). Recent research, however, has demonstrated promising acute and chronic effects of PA on health outcomes including cognitive performance (Best, 2010). The need for enhancing appropriate PA and physical fitness (PF) levels to reverse increasing trends of obesity and the prevalence of other health-related diseases associated to physical inactivity is at an all-time high (CDC, 2010; Kahn et al., 2002; Warburton, Nicol, & Bredin, 2006).

This situation has prompted scholars to undertake comprehensive studies into the correlates of obesity. Addressing the underlying behavioral and psychological mechanisms leading to the rising obesity trajectories is an important step to solving the problem (Judge et al., in press). Promising societal changes triggered by educational efforts that support and sustain healthy individual and family behaviors have been reported. The purpose of this article was to jump-start a crucial conversation among academia regarding the importance of health-related fitness knowledge (HRFK) and the potential impact of health-related interventions on PA and PF. The

main goal was to provide direction to physical educators on what recommendations, strategies, and actions can be implemented to accelerate progress in obesity prevention using the best available scientific evidence. This prevention and intervention refers not only to the brief time physical educators have with their students during the school years but also, more important, to equipping students with the tools to strive for high levels of PA and PF throughout their life span.

Current Recommendations for Physical Activity

One method to decrease obesity is to promote PA behaviors (Wareham, 2007). Communities and organizations must encourage PA by providing and supporting programs intended to increase such activity. As physical educators work in the present with students, it is vital to understand that increasing current students' PA is an aim, but equipping students to continue PA over a lifetime is the greater objective. The transition from childhood PA into adult PA is crucial to truly changing overall health throughout individuals' lives. Physical inactivity tends to increase during the aging process with the most dramatic increase occurring in late adolescence and early adulthood (Keating, Castelli, Castro-Pinero, & Guan, 2011).

PA guidelines have been set for children and adults based on scientific evidence to facilitate good overall health. Current PA guidelines for most adults aged 18 to 64 provided by the U.S. Department of Health and Human Services (2008) consist of a minimum of 150 min of moderate-intensity PA or 75 min of vigorous-intensity PA or a combination of the two per week along with muscle-strengthening activities that work all major muscle groups 2 days a week. The American College of Sports Medicine (ACSM, 2011) agreed with these guidelines but also categorized the basic recommendations into four areas and gave weekly prescriptions. The four areas include cardiorespiratory exercise (30 to 60 min of moderate-intensity exercise 5 days per week or 20 to 60 min of vigorous-intensity exercise 3 days per week), resistance exercise (2 or 3 days per week of resistance training with further breakdown of prescription of training including sets, repetitions, and intensity levels), flexibility exercise (2 or 3 days per week of flexibility exercise focusing on 10- to 30-s stretches accumulating to 60 s per movement), and neuromotor exercise (2 or 3 days per week of motor skills and activities to help everyday physical function). For children and adolescents aged 6 to 17, the current guidelines

consist of 60 min or more of PA every day with the majority of that being moderate or vigorous intensity. Also stated in the guidelines are 3 days per week devoted to vigorous-intensity PA and at least 3 days per week of muscle-strengthening and bone-strengthening PA (CDC, 2011).

These additional recommendations for PA levels are especially important given that PA tends to decrease over time from adolescence to adulthood (Caspersen, Pereira, & Curran, 2000; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Sidney, 2007). Currently, 40% of adults in the United States are completely sedentary, 60% of adults do not reach the minimum PA requirements, and only 27% of adults engage in muscle-strengthening activities (CDC, 2010). These statistics suggest that a large number of adults do not exhibit healthy levels of PA and muscle-strengthening activities. Although the aforementioned recommendations address the symptoms of the obesity epidemic, the underlying causes of decreased PA are less understood. Thus, discovering the underlying mechanisms of why individuals choose or choose not to exercise is imperative.

Underlying Mechanisms Associated With Engagement in Physical Activity

To provide a broader understanding of PA behaviors, we will give first a brief synopsis of positive and negative correlates to PA. Many factors have been found to have a relationship to PA, but as of yet, none have been shown to provide a complete picture as to why some individuals choose to stay physically active and others do not. Trost, Owen, Bauman, Sallis, and Brown (2002) conducted a meta-analysis investigating personal, social, and environmental factors associated with adult PA and concluded that biological factors and demographic factors positively correlate to PA. The most important factors appear to be socioeconomic status, occupational status, and educational attainment. Self-efficacy was found to be the strongest psychological predictor of PA, and lack of time, fatigue, weakness, bad weather, lack of facilities, and lack of exercise partners were found to be negatively associated with levels of PA. Social support has been cited as an important correlate of PA (King, 1994), but the impact of social support on adolescent PA has not been widely assessed. Social support for PA can come from many sources and takes many forms. The factors identified seem to play a role in PA levels, but further research is needed to understand more completely the mechanisms for improving levels of PA.

Many interventions have been designed to promote improvement in PA levels and overall health (Hillsdon, Foster, & Thorogood, 2005). Hillsdon et al.'s (2005) meta-analysis found that PA interventions positively affected self-reported PA ($p < 0.12$ to 0.50) and cardiorespiratory fitness ($p < .09$ to .70), but their results also indicated that the effect PA interventions had on reaching desired PA levels over time was not significant.

Researchers have found that PA and exercise interventions have had only a limited impact outside of the actual intervention time frame (Hillsdon et al., 2005). Thus, one underlying problem with which researchers have struggled is the long-term impact and sustainability of interventions.

One area of research that has been understudied in relation to improving PA and PF is HRFK. Having appropriate HRFK may be critical for adults to understand and apply principles of exercise to their daily lives aimed at exercise adherence and overall health. Currently, little is known about the contribution HRFK may play in individuals' decisions to engage in PA. What is known is that HRFK among elementary students through college-aged students is low (Barnett & Merriman, 1994; Desmond, Price, Lock, Smith, & Stewart, 1990; Keating, Harrison, et al., 2009; Kulinna, 2004; Losch & Strand, 2004; McCormick & Lockwood, 2006; Miller & Berry, 2000; Miller & Housner, 1998; Petersen, Byrne, & Cruz, 2003; Placek et al., 2001) and the few studies that have investigated HRFK have revealed positive correlations among knowledge, PA, and PF (Dilorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998; Ferguson, Yesalis, Pomrehn, & Kirkpatrick, 1989; Liang et al., 1993). Initial levels and/or decreases in PA may result from a lack of HRFK. If an individual does not possess adequate knowledge related to the importance of exercise and how to structure a PA or PF program, he or she may be more likely to discontinue PA as adults. Before this conclusion can be drawn, however, we must first establish the connection among HRFK, PA, and PF.

Health-Related Fitness Knowledge

Research Investigations Focused on Health-Related Fitness Knowledge

Although HRFK has commonly been a part of most rhetoric and reforms aimed at physical and health-related fitness initiatives (e.g., American Association for Health, Physical Education, and

Recreation, 1969), it has largely been overlooked when considering important elements of curricula and accountability for education reform (Stewart & Mitchell, 2003). This oversight is unfortunate given the likelihood that possession of HRFK may be important for adults as they become more independent and transition into self-directed PA. If individuals do not understand the importance of maintaining a healthy weight balance or being physically fit and/or do not have adequate knowledge on how to apply this knowledge to their daily lives, it may affect their motivation to be physically active and their PA choices. In essence, inadequate HRFK may influence individuals' capability to sustain a physically active lifestyle (Zhu, Safrit, & Cohen, 1999).

Researchers have focused on two main study designs when examining HRFK. The first type of study tends to examine levels of knowledge about PA and PF. The second type of study tends to examine how HRFK is associated with other important health and fitness behaviors. Both types of studies are important given the high stakes associated with the looming obesity epidemic.

Differences in Extent of Health-Related Fitness Knowledge Among Subpopulations

Several researchers have compared HRFK across subgroups of students and young adults based on age or race and ethnicity and across groups of students with different health-related occupational aspirations. The majority of these studies have found differences in HRFK levels, but overall the levels of HRFK were low (McCormick & Lockwood, 2006; Placek et al., 2001), even among students studying in health-related fields (Miller & Housner, 1998).

For example, a study by Desmond et al. (1990) investigated urban black (n =154, M = 16 years) and white (n = 93, M = 15.8 years) high school students' PF status and perceptions of exercise. Students answered a 70-item questionnaire on the health belief model that contained a fitness knowledge construct. White students had higher fitness knowledge than black students, but both groups scored poorly overall. Keating, Chen, Guan, Harrison, and Dauenhauer (2009) likewise tested HRFK of urban ninth grade Hispanic (n = 169) students. Students failed all construct areas except for "effects of exercise on chronic disease risk factors." Female students scored significantly higher than male students.

Miller and Berry (2000) conducted a study looking at changes over time in allied health students' (e.g., physical therapist, athletic

trainers, nurses) HRFK. They found that, from pretest to posttest, only athletic trainers scored significantly higher on the posttest. In addition, athletic trainers and physical therapists scored significantly higher than nurses. They concluded, however, that students in all groups scored much lower on both administrations than expected.

Several other studies have examined differences in HRFK among pre-service physical education teacher education (PETE) candidates. For example, Barnett and Merriman (1994) compared levels of HRFK between PETE and non-PETE pre-service teachers. They found that PETE students scored significantly higher on the HRFK measure than non-PETE students and that, over time, PETE students' levels of HRFK continued to increase and non-PETE students' knowledge remained low. However, the PETE candidates' HRFK were still considered low. Similarly, Losch and Strand (2004) and Petersen et al. (2003) reported that senior-level undergraduate PETE students' knowledge of HRFK was lower than expected when preparing to be a physical education teacher.

Studies Relating Health-Related Fitness Knowledge to Fitness and Physical Activity

Few researchers have examined links between HRFK and a number of important health-related variables. Studies of this type are of particular interest in the present context. For example, Liang et al. (1993) investigated first-year medical students' attitudes and knowledge about health and exercise and their PF levels. Participants (n = 131) completed a questionnaire concerned with knowledge and attitudes about health promotion, disease prevention, and exercise and performed a PF test on a VO_2 max treadmill. Liang et al. found that students' knowledge and attitudes about health promotion and disease prevention and exercise to be predictive of PF levels.

Similarly, Dilorenzo et al. (1998) tested HRFK of fifth and sixth graders and then tested the same students 3 years later as eighth and ninth graders (n = 54 girls, 57 boys). Along with HRFK, they tested many social (i.e., mother involvement, father involvement) and psychological aspects (i.e., self-efficacy, enjoyment). They measured PA by interviews and a self-report questionnaire. They found that exercise behavior was positively related to HRFK in the eighth and ninth grades but not in the fifth and sixth grades. Dilorenzo et al. indicated that enjoyment of activity was the strongest indicator at the earlier ages.

Likewise, Ferguson et al. (1989) tested middle school students' ($n = 603$) knowledge of the benefits of exercise, attitudes toward PE, and beliefs about their abilities to determine whether a relationship existed between intent and current exercise behavior. They found that results from multiple-regression analyses indicated that the perceived (knowledge of) benefits of exercise, along with attitudes and beliefs about one's own ability, shared 37% of the variance when predicting intention to exercise and 27% of the variance when predicting current exercise behavior.

To date, only one study has examined the relationship between HRFK and PA using an instrument that thoroughly investigated HRFK (Thompson & Hannon, 2010). In this study, Thompson and Hannon (2010) investigated the HRFK and PA of high school students (88 males, 77 females, $M = 16$ years) from the southwestern United States. PA was measured using the self-report Physical Activity Questionnaire for Adolescents (PAQ-A; Kowalski, Crocker, & Kowalski, 1997), and HRFK was measured by a 100-point test based on students' knowledge of the five components of health-related fitness (cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition) derived from the Fitness for Life teacher resource (McConnell, Corbin, & Dale, 2004). Results showed a moderate positive correlation between HRFK and PA, $r = .438$, $p < .001$, indicating that students with more HRFK reported higher levels of PA. Post hoc comparisons of HRFK were conducted across categorical levels of PA (high, medium, low). Results from this analysis revealed that students in the low group reported significantly less PA than students grouped into the medium or high groups. Thompson and Hannon concluded that students with higher HRFK exhibited higher PA levels.

Given the focus of the present research, it is important to note that although each of these studies contributes to an understanding of the relationship among HRFK, PA, and PF, a majority of the studies used instruments that lacked adequate information about psychometric properties of the measures and scores and did not clearly define HRFK (Keating, Harrison, et al., 2009). With limited studies investigating HRFK, PA, and PF and the lack of valid HRFK instruments used, the ability to generalize these findings remains limited and must be further investigated.

Effects of Health-Related Fitness Knowledge Interventions

A number of researchers have reported that comprehensive educational programs or interventions that have included a cognitive element applied with PF activities have produced longitudinal gains in PA and PF. For example, Dunn et al. (1999) conducted a study that implemented two interventions: a lifestyle intervention group and a traditional structured exercise group. The lifestyle intervention group learned cognitive and behavioral strategies that would enable them to engage in 30 min of moderate PA daily. They were taught different PA that would fit into their daily lifestyle. The traditional structured exercise group was brought into a state-of-the-art training facility and was trained with traditional exercise prescription but not educated on the training. Both groups were trained extensively for 6 months. They then went through a maintenance program for 18 months. During the maintenance program, subjects were responsible for their own programs and implementation of PA in their daily lives.

Dunn et al. (1999) reported that at the end of the 6-month training period both groups significantly improved in PA and cardiorespiratory fitness. The participants in the traditional structured exercise group had significantly higher gains in cardiorespiratory fitness (tested by a VO_2 max treadmill test) than participants in the lifestyle intervention group, with no difference in PA levels measured by a self-report 7-day PA recall questionnaire. At the end of 24 months, however, both groups continued to exhibit significantly higher PA and cardiorespiratory fitness compared to baseline, but the participants in the lifestyle intervention group exhibited cardiorespiratory fitness levels that were significantly higher than the traditional structured exercise participants. These results delineated the longer term advantages of including a knowledge component in the PA intervention.

What these results suggest is that the knowledge the participants gained in the lifestyle intervention group enabled them to maintain their training more effectively over time. If the traditional structured exercise group would have been trained but given more instruction (knowledge) on how to maintain this type of training, they may have been able to also maintain their training levels without such a dramatic decrease. This study suggests that HRFK may contribute to improving individuals' ability to maintain or minimize a decrease in PA and PF levels over time.

Conceptual Physical Education Courses

Another area of research that investigated the importance of the application of HRFK in improving PA and PF is the study of conceptual physical education (CPE) or personal fitness classes (Dale & Corbin, 2000). The goal of CPE is to develop a "competence and a positive attitude toward activity and exercise" (Dale & Corbin, 2000, p. 61) that students can implement throughout their lifetimes. CPE classes consist of instruction in a classroom setting where health and fitness concepts are taught along with an activity session where students can apply their newly acquired HRFK. This is a PE activity course comprising a 1-hr lecture class and a 1-hr activity class. The activity sessions in CPE allow students to learn how to develop their own fitness programs and provide them with the tools to monitor and understand the functions and responses of the body in PA.

Dale and Corbin (2000) conducted a study on PA participation of high school graduates following exposure to either a yearlong conceptual physical education (CPE) or a traditional PE program taken while in high school. The participants were given a PA questionnaire during their junior year and senior year and 18 months after graduation. Dale and Corbin reported that 18 months after graduation, 65% of the CPE men in the 1996 cohort reported being vigorously active compared to 29% of traditional PE men in the 1996 cohort. These results indicate a CPE program may contribute to keeping men more vigorously active than a traditional PE program. The largest difference in the men of the 1995 cohort was strength activity after graduation (CPE = 55% active vs. traditional PE = 33% active). In addition, CPE participants were found to be less sedentary than traditional PE students 1 to 3 years after ninth grade PE. Dale and Corbin found that CPE female participants were significantly less sedentary than the national average, which is particularly important (CPE average = 10% vs. national average = 22%). This study indicates that focusing on HRFK can have a long lasting effect on PA and PF. Dale and Corbin recommended that PE needs to change from games and sports to a more applicable CPE approach stressing a lifetime fitness curriculum.

Adams and Brynteson (1992) conducted a similar study at the college level involving a CPE curriculum. This study investigated how college PE activity courses affect the attitudes and exercise behaviors of college graduates. There were 3,169 surveys sent out

to college graduates of four private colleges that differed based upon whether PE classes were a general education requirement. The surveys asked questions about the students' attitudes toward PA and about their current PA levels. The results indicate the more CPE activity courses students complete, the more active they are following graduation. The colleges that required the most credit hours in their PE activity programs resulted in the most positive and active graduates in PA as they aged, as well as in an improved perception of the importance of exercise and overall health. Adams and Brynteson concluded that the more students are taught HRFK through CPE and participate in different PA, the more likely they are to engage in those activities as they grow older.

Jenkins, Jenkins, Collums, and Werhonig (2006) investigated college students' perceptions of a required CPE activity course. The activity class consisted of two cardiovascular conditioning classes, two walking/stretching classes, two circuit training classes, two volleyball classes, and two badminton classes. The lecture class covered topics in health and wellness, PA, nutrition, destructive behaviors, diseases, and sexually transmitted diseases. At the end of the semester, each student was given a qualitative questionnaire concerned with his or her perceptions of the class and what he or she learned. Overall, Jenkins et al. concluded that the students' responses indicate that learning and then applying HRFK is important in how they comprehend the material and what they take away from the lessons. The newly acquired knowledge of PF and the strategies, techniques, and ideas on how to improve PF levels seemed to give students a more positive outlook and motivation to improve PA.

Taken together, the main findings from these studies suggest that acquiring HRFK through CPE positively impacts PA and PF levels. However, because these studies did not include direct measures of HRFK, the exact relationship among these variables remains unclear. HRFK may be a key component for understanding current fitness levels and how to structure future programs such as CPE to reach fitness goals (Geary, 2009). To date, only limited research on HRFK and even less research on the relationship among HRFK, PA, and PF has been conducted. Researchers need to conduct additional investigations to determine whether a link exists between HRFK and PA and the possible affect knowledge might have on long-term improvements of PA and PF.

Conclusions

Lack of PA continues to contribute to the high prevalence of overweight and obese individuals within the United States. An ongoing need exists to foster PA opportunities across all disciplines of PE, recreation, dance, and sport. Not only must recreation and sport administrators be aware of national trends (e.g., 67% of noninstitutionalized adults aged 20 years and 18% to 19% of 6- to 19-year-olds are overweight or obese in the United States (CDC, 2008), but they also should diligently examine their educational efforts, their facility needs and accompanying programming, and their ability to impact these trends (Judge et al., in press). CPE classes where health and fitness concepts are taught along with an activity session where students can apply their newly acquired HRFK may be the answer. The activity sessions in CPE allow students to learn how to develop their own personal fitness prescription along with giving them the tools to monitor and understand the functions and responses of the body in PA. These courses could be offered for a variety of exercise modes that are sustainable over a lifetime, such as fitness walking, jogging, and swimming. PE programs are crucial to building an understanding of the importance of PA and PF and must be adapted to promote HRFK and incorporate PA and PF over the life span. CPE classes offer opportunities for students to learn about PA choices and encourage adoption of those activities. PE programs not only must encourage students to be more active and healthy for the short time that they are in the program, but also, more important, must equip individuals with the tools needed to continue in PA throughout life.

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