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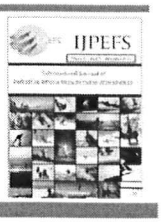

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Disc Golf and Walking Benefits: A Pedometer-Based Physical Activity Assessment

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Abstract: Background: The purpose of this study was to assess the contributions of walking when participating in disc golf and achieving the recommended 10,000 steps per day. Data from men (n = 226) and women (n= 109) participants who played on 15 disc golf courses were analyzed to determine if gender, age, score or playing format had an effect on the average number of steps walked per hole. Each participant wore a pedometer while playing. Participants averaged 311 steps per hole, which equates to 5613 steps for an 18-hole round of disc golf. Women took 69.3 fewer steps per hole than men and each additional throw resulted in 3.2 additional steps per hole. Playing an 18-hole round of disc golf provided for over half of the recommended 10,000 steps per day for healthy living, but these steps were not evenly distributed across all types of players.

Keywords: Pedometry, Physical Activity Assessment, Lifetime Fitness.

Introduction

In the current climate of escalating obesity rates and increasingly sedentary lifestyles of Americans, the promotion of health and wellness activities has taken on new importance. About one third of the U.S. population is overweight and the cost for medical care of obesity is estimated to be as high as 147 billion (CDC, 2011). Attempts to educate the public through school and community-based programs have broadened to include a variety of educational initiatives. Most of these incorporate activity-based and nutritional programs. School (k-12) programs typically include both health and physical education initiatives. Unfortunately, these programs are often limited in scope, poorly designed, and do not provide enough time for in-depth study or moderate-to-vigorous physical activity (Reading & Reading, 2009). While critical to changing the behavior of the public, targeting school-aged children means reaching only part of the population. Efforts to educate those no longer in schools can prove to be a difficult task. Community-based programs suchas public recreation departments or community health centers may help alleviate this growing concern.

Many health and physical education programs, particularly community-based ones tout the benefits of walking for physical health and well-being. Community-based programs tend to impact older adults, but can have great potential for serving families of all ages. Promoting physical activity such as walking can encourage many to "get up and get out," rather than scaring potential participants away by offering more traditional skill-related fitness or competitive recreational activities such as team sport leagues. Sesso (2000) points out in his editorial in the American Journal of Medicine, that walking provides appropriate quantity and intensity of physical activity for the prevention of various obesity-related diseases. Walking 10,000 steps a day appears to be a reasonable estimate of daily activity for healthy adults (Morgan, Tobar, & Snyder, 2010; Cocate et.al., 2014) but does not guarantee meeting the American College of Sports Medicine (ACSM) and Centers for Disease Control and Prevention (CDC) guidelines documented to elicit the health benefits of

physical activity (Le Masurier, Sidman and Corbin, 2003). Of course, people walk in many sports and walking may be responsible for the health benefits of lifetime sports, or sports that a person participates in, such as golf. To date, several studies have shown substantive health benefits of playing traditional golf and a few have even examined its effects on factors such as cholesterol levels and exercise intensity (Plank & Hargreaves, 1990).

Playing a round of traditional golf elicits physiological responses typically associated with aerobic exercise. Playing golf two or three times a week during a 20-week study showed a significant improvement in aerobic performance and trunk muscle endurance. In the same study it was found that golfers had significantly greater increase in serum high-density lipoprotein (HDL) cholesterol levels (Parkkari, Natri, Kannus, Ma ntta ri, Laukkanen, Haapasalo, Nenonen, Pasanen, Oja, & Vuori, 2000). Also, after male and female participants played a round of golf, golfers carried a GPS (global position system) receiver to measure heart rate, playing time, and walked distance. Male golfers on average walked 11,256 ± 830 while female players walked on average 10,000 ± 595 m. The average heart rate was 104.1 ± 14.5 bpm for male players and 110.8 ± 16.9 bpm for female players. Based on the energy expenditure in kcal used 2,467 kcal on average while female players used 1,587 kcal on average during a round of golf (Tangen, Sunde, Sageie, Hagen, Krisoffersen, Istad, Tor Lonnestad, & Eriksrud Bergan, 2013). The health benefits of playing traditional golf are largely a result of the benefits of walking the course (Tangen, Sunde, Hagen, et al. (2013).

Several studies have examined the number of steps taken while playing golf. Kobriger, Smith, Hollman & Smith (2006) used step count data to determine if playing a round of golf met daily physical activity goals. The average number of steps walked per 18-hole round of golf averages 11,948 (+/- 1781)--exceeding the 10,000 steps that are recommended to maintain cardiovascular health (Kobriger et al., 2006). Sanders, Broker, Berning & Subudhi (2007) reported that golfers walked an average of 13,145 (+/- 1,736) during an 18-hole round, but only 6,280 (+/-1,428) when using a golf cart. Similarly, Leiker & Kandt (2001) noted significantly fewer steps walked when using a cart during a 9-hole round (3,939 +/- 387) versus playing without one (6562 +/- 908). Playing traditional golf with or without a cart can contribute to achieving 10,000 daily steps and with its notably high rate of compliance and participation (National Golf Foundation, 2011) golf can be a beneficial form of exercise.

The comparatively newer sport of disc golf parallels traditional "ball" golf in many ways. Both typically involve playing a structured course with tee boxes, targets and water hazards. Instead of a 4.25 inch diameter hole and a flag, a disc golf target is typically a 52 inch metal pole surrounded by metal chains to "catch" the disc and a metal basket in which the disc may come to rest. Both disc golf and traditional golf entail playing against par; a pre-determined number of strokes or throws that a scratch golfer should require to complete a hole. Unlike traditional golf, disc golf is typically free to play. This could be a very valuable factor to help reduce health disparities across income levels. Most often, disc golf participants do not have access to carts, suggesting that the average health benefits for disc golf might even exceed that of ball golf.

The Professional Disc Golf Association (PDGA) estimates that approximately 1,000,000 people in the world play disc golf and that the annual growth rate is around 11 to 15 percent (PDGA, 2011). With the growing popularity of Disc Golf, there are over 5000 disc golf courses throughout the United States (DG Course Review, 2014). Thus with the health benefits of walking well-established, and the number of steps taken in traditional ball golf adequately researched, a logical question emerges: How much does a person walk while playing disc golf? The purpose of this exploratory study was to examine the potential walking benefits of disc golf through the use of a pedometer-based exercise assessment.

Methods

Participants and Data Collection

The participants in this study were 335 (226 men and 109 women) aged 18 to 60 years (M age = 36.49 years, SD = 11.30). Participants ranged from self-described intermediate skill level players to professionals. Recruitment occurred through verbal presentations from the researchers of this study during weekly, non-sanctioned events and Professional Disc Golf Association sanctioned tournaments. Exclusion criteria included any medical conditions, which precluded normal disc golf participation. All participants signed an informed consent prior to data collection and a University institutional human subjects review board approved research methodology.

Each subject completed a round of disc golf ranging from nine to twenty-four holes on one of 37 courses in Georgia, North Carolina, Oklahoma, Oregon, South Carolina, Texas, and Wisconsin. During each round, participants wore a Walk4Life model LS 2525 (Walk4Life Inc., Plainfield, Illinois) pedometer on the left side of the body. The LS 2525 pedometer provides an indication of the number of

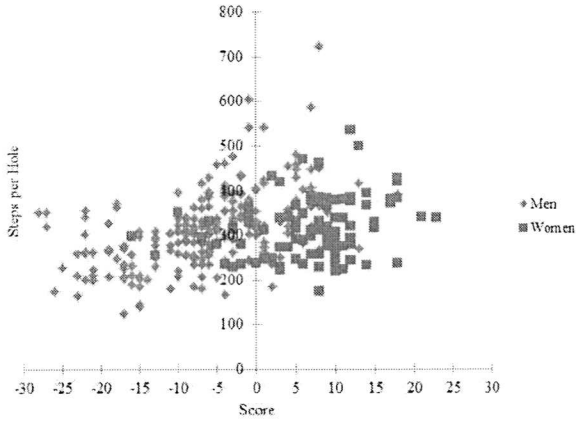
steps taken during a given period of physical activity and has been shown to be a valid and reliable tool for assessing walking steps (Crouter, Schneider, Karabulut, & Bassett, 2003). In accordance with manufacturer's recommendations, the pedometer was aligned with the midline of the thigh on the participant's belt or waistband. The pedometer was set on zero at the first tee and the number of steps taken during the round was recorded after the golfer finished the final hole. In addition to the number of steps, the subject's age, gender, and score (relative to par) was recorded. Playing format referred to whether a person played singles or captain's choice doubles (a common playing format during weekly disc golf events). Both men and women played from the same tees.

STATISTICAL ANALYSES

In order to control for confounding factors, an ordinary least squares multivariate regression was used to determine whether step counts might vary significantly by age, gender, score or playing format. Courses vary in many ways—both observed and unobserved—so we clustered the standard errors on the course. Because the number of holes played during an outing (round) varied from 9 to 24 (M= 19.65, SD= 3.69), the number of steps per hole was calculated and used as the dependent variable. Statistical significance was established a prior at $p< .05$.

RESULTS

A multiple linear regression with robust clustering on course yielded a significant effect for gender and score, but not for age or format. Step count varied by gender (p= .004, Coef.= -69.30) and score (p< .001, Coef.= 3.20) but not by age (p= .655, Coef.= -.093) or format (p= .232, Coef.= -27.01). Controlling for all other independent variables, women took 69.3 fewer steps per hole than men and each additional throw resulted in 3.28 additional steps per hole. Figure 1 contains a scatter Sgram of score by the number of steps per hole for men and women.



The mean number of steps per hole was 311.86 (sd= 21.67), which equates to 5613 steps per 18-hole round. Table 1 outlines the descriptive statistics by course. Estimates of course length based on the cumulative distance of each hole were available but were not used in analyses.

Table 1 Average Number of Steps per Hole Played by Course

Course	State	N	M	SD
Black Mountain	NC	52	243.50	61.58
Boomer Lake	OK	31	279.87	107.90
Catamount Links	NC	42	323.38	68.42
Fontana Village Resort	NC	12	315.33	45.40
Foothills	NC	28	325.50	61.15
Haywood Community College	NC	13	291.08	39.91
Milo McIver	OR	16	246.63	36.85
Northeast Creek Park	NC	30	325.70	52.49
Richmond Hill	NC	12	277.33	49.49
South Rock	TX	11	273.18	40.69
Steed Park	NC	24	296.88	54.19
Stephens County	GA	11	362.45	85.25
Timmons Park	SC	31	344.19	90.64
Tourney	TX	12	412.67	69.12
Wakanda	WI	10	360.20	31.30

Note. Mean number of steps per hole was 311.86 (sd= 21.67).

DISCUSSION AND CONCLUSIONS

The purpose of this study was to explore the potential walking benefits of disc golf through the use of a pedometer-based exercise assessment. The efficacy of traditional ball golf has been well established, but heretofore, there has been no extant evidence on the health benefits of the rapidly growing sports of disc golf. The results from this study found that the participant's mean number of steps could provide over half of a person's recommended 10,000 steps in a day (Hatano, 1993). Given that disc golf is typically free, public officials who wish to reduce health disparities across economic strata may wish to invest in public access disc golf course. Traditional municipal ball golf courses, on average cost five to nine million to construct, compared to $20,000 to construct a disc golf course. J. Lyksett (personal communication, November 12, 2014).

Considerable benefits of disc golf were noted with the number of steps differing across types of players. Specifically, women took almost 70 fewer steps per hole than men and players with higher scores take more steps per hole. The latter of these two findings may also be a positive outcome for those concerned with public health, as newer players may be the ones in most need of exercise. As players play more (and thus exercise more), it is less problematic that they take fewer steps per round.

In addition to public officials who design exercise programs and public parks, Physical Education Teacher Education (PETE) faculty members and secondary school physical educators may also benefit from this study. PETE faculties have the opportunity to expose their pre-service teachers to this lifetime activity that can then eventually be taught to their secondary physical education students. By exposing disc golf to pre-service teachers, they are communicating that this activity provides opportunities to be active throughout their lives (Barney, Pleban, Wilkinson, & Prusak, (2015). For secondary school physical educators, disc golf provides another lifetime sport they can expose their students to—a sport that could have considerable long-term health benefits. Disc golf has other benefits, as it will engage the students in activity time for more then 50 percent of the class period (Malina, 1996).

In addition, physical educators that teach disc golf are participating in an activity that meets the national standards in physical education. The Society of Health and Physical Educators (SHAPE America, 2014) has created five nationals standards in physical education for the purpose of developing physically literate individuals to have the knowledge, skills and confidence to enjoy a lifetime of healthy physical activity (SHAPE America, 2014). Disc golf meets the third of these standards, which states, "The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness."

In sum, this study suggests that disc golf provides a high number of steps taken during the activity, given the low cost of disc golf, these benefits are available to people in a variety of socio-economic strata. The results from this study can be added to the body of knowledge regarding physical activity for a person to use throughout their lives. We recommend that both physical educators and park and recreation administrators consider integrating disc golf into their repertoire of recommended life-time sports.

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