Exercise and training levels of elite elderly athletes

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Exercise and Training Levels of Elite Elderly Athletes

Submitted by

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Exercise and Training Levels of Elite Elderly Athletes

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Conducted in Cooperation with the Medical University of Ohio Department of Physical Therapy
3000 Arlington Ave.
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To meet the requirements of
Masters of Science in Biomedical Sciences with a concentration in Physical Therapy

Advisor: Dan Cipriani, Ph.D.
Abstract:

**Background:** Despite the well-known benefits of exercise in the elderly only a small percentage of elderly individuals participate regularly in physical activity. Many elderly may be hesitant to resume activities that they have not participated in for decades. Of the small percentage of elderly who are highly active, further research is needed to determine their exact exercise habits and the implications the exercise habits of the aged may have on their risk of injury with activity. Health care providers need to be aware of the potential full extent that active elderly individuals exercise. **Purpose:** to show the elderly population is heterogeneous in nature by documenting the exercise practices of elderly runners, swimmers, cyclists, and triathletes. **Methods:** This observational survey study recruited elderly individuals, identified as potentially active in regular exercise, from local running clubs, triathlon clubs, and race registries from running races, triathlons, bike races, and swimming events in a tri-state. Inclusion criteria were subjects 65 years or older and engaged in a minimum of 2-hours of exercise each week. Respondents reported on their health, their visits to health care providers, and their exercise habits (number of minutes spent exercising each season, by mode of exercise). **Results:** A response rate of 67% yielded 148 useable responses with 123 males and 25 females. 91% participated in at least one race event in the past 12 months. Running was the most popular mode of exercise with 88% of sample participating in running. Males (3.39 ± 2.03) chose running as a mode of exercise more than females (2.25 ± 2.10). Females (3.19 ± 3.32) chose alternative exercise modes (AEM) of exercise more than males (1.59 ± 2.88). (p < .05). Summer (9.21 hrs/week) and spring (7.40 hrs/week) had more recorded hours of exercise than fall (7.00 hours/wk) and winter (7.22 hrs/wk). **Conclusion:** This study shows that health care providers should not generalize and
stereotype an elderly individual’s ability to participate in vigorous exercise. Activity level should be taken into consideration before physical activity recommendations are made. Providers should be able to recognize the normal decline of activity during the fall and winter months and offer alternate modes of exercise to keep this population active year round. Providers should be more aware of the existence of elite elderly athletes and educate this population accordingly to prevent overuse injuries.
**Introduction:**

The elderly population is steadily increasing and this trend will continue throughout the twenty-first century. In the United States by the year 2030, nearly 70 million people will be 65 years of age and older, and the fastest growing segment of the population will be those individuals who are 85 years of age and older (Mazzeo et al., 1998). As an individual ages, it is inevitable that some degree of a loss in strength, power, energy, and fitness will occur. The decrease of muscle strength is one of the most common effects of aging (Lindle et al., 1997). The decrease in strength, postural stability (Gauchard, Jeandel, Perrin, 2001), and cardiovascular function (Heath et al., 1990) in the elderly is associated with an overall decreased functional ability (Skelton et. al, 2002). The decreased functional ability can lead to an increase in the number of falls among the elderly (Wolfson, Judge, Whipple, King, 1997).

Falls are the main cause of accidental death in the elderly (Overstall, Johnson, Exton-Smith, 1978). One-third of the community-dwelling elderly fall each year, and this can cause significant disability, loss of independence, or death to the individual (Herwaldt, Pottinger, 2003). Each year, fall-related injuries in the elderly population cost the United States more than 20.2 billion dollars (CDC). Falls in the elderly are not caused by a single factor but rather by multiple components such as poor postural stability, decreased muscle power, medication use, cognitive status, environmental hazards, decreased strength, decreased proprioception, and reduced vision (Tinetti, 1995). There are many factors that are documented to cause falls; however, there are just as many interventions documented to help prevent them such as tai chi (Wolf, Barnhart, Ellison, Coogler, 1997), strength and endurance training (Buchner, Cress, De Lateur, 1997), and prescribed home exercise programs (Campbell et al., 1997).
Exercise seems to have multiple advantages such as increasing strength and power; reducing fatigue, improving heart and lung function (Hickey, Wolf, Robins, Wagner, and Harik, 1992); preventing or minimizing reductions in bone density; helping to manage stress; increasing self image; improving coordination, gait, balance, and flexibility (Grove, Spier, 1999). Exercise has also been found to postpone the development of disability and decrease current levels of disability in older adults (Wang et al., 2002). Adults who maintain a regular routine of physical activity of a longer extent that is performed at an optimal intensity for their body will likely reap greater benefits from exercise (CDC, 2001).

Research has found that age does not appear to be a factor that affects the benefits of regular physical activity, especially for the elderly (Tideiksaar, 1992). A study was conducted of Harvard Alumni and found that even people who did not begin regular exercise until the age of 75 had moderate increases in life expectancy. This group was compared with individuals who exercised early in life and then stopped exercising later in life. The study found that the aged group had a lower mortality rate overall (Paffenbarger et al., 1986). The geriatric population will see the most beneficial gains from exercise with improvements in their general health and overall functional ability. According to Firschknecht (1998) page 172, “A resistive muscle training greatly increases muscle strength, even in the very old, by improving neural factors and inducing muscle hypertrophy. This increased strength allows for improvement of functional activities of daily living such as walking, rising up from a chair, and climbing stairs.”

Despite the well-known benefits of exercise, only a small percentage of elderly individuals participate regularly in physical activity and others may be hesitant to resume activities that they have not participated in for decades. Women are more likely than men
to report that they do not engage in any leisure-time activity (CDC, 2001). The United States Health and Human Services department reported in 2000, only 13% of individuals, ages 65 to 74, reported participating 20 minutes of vigorous activity 3 or more days per week. For people over the age of 75, the percentage drops to 6% (U.S. Department of Health and Human Services, 2001). A majority of the studies that have been conducted on the elderly population and exercise focus on the effects of exercise in the frail elderly and/or sedentary elderly individuals (Mazzeo et al., 1998; Firschknecht, 1998; Buchner et al., 1997; Campbell et al., 1997; Lindle et al., 1997; Skelton, 1992; Wolf et al., 1997; Wolfson et al., 1996). Of those elderly who are highly active, further research is needed to determine their exact exercise habits and the implications the exercise habits of the aged may have on their risk of injury with activity. Physicians need to be aware of the potential full extent that active elderly individuals exercise. Therefore the main goal of this study is to show the elderly population is heterogeneous in nature by documenting the exercise practices of elderly runners, swimmers, cyclists, and triathletes.

**Methods:**

This study was an observational survey study. Elderly individuals identified as potentially active in regular exercise were recruited from local running clubs, triathlon clubs, race registries from running races, triathlons, bike races, and swimming events. The demographic region of this study included the tri-state area of Ohio, Indiana, and Michigan, as representative of a mid-western population of elderly athletes. Elderly was defined as any individual 65 years or older. In addition, to be included in the study, the individual needed to be engaged in a minimum of 2-hours of exercise each week. Two hundred and thirty-nine individuals met the initial criteria.
An initial cover letter, explaining the nature of the study, was mailed to all potential subjects. The purpose of the letter was to explain the nature of the study and alert the subjects that a questionnaire would soon be mailed to their residence. One week following the initial contact letter, questionnaires were mailed to all potential subjects. One-month later, a reminder/thank you card was mailed to all potential subjects. The purpose of the card was to thank those individuals who had returned the questionnaires, and to remind those who had not replied to consider completing their questionnaires. All questionnaires were completely anonymous.

The questionnaire included a series of questions describing the subject’s demographics including age, gender, height, weight, number of races entered in the past year (e.g., number of road running races, number of triathlons, number of iron man races, number of duathlons, etc.). The questionnaire also included questions about general health and well-being, including questions about number of chronic diseases and number of physicians and physician visits. Included in this section were questions about fall history and stumbles. Finally, the questionnaire asked questions about specific exercise training. Subjects were asked to estimate, in minutes, the amount of time spent exercising each week, with different forms of exercise. Exercise options included time spent running, cycling, swimming, and “alternative exercise modes (AEM).” “AEM” was defined as any vigorous activity performed for health and/or fitness. Examples included golf, tennis, aerobic exercise, water aerobics, etc.

In order to specifically detail the exercise habits of this cohort, the respondents were asked to estimate their exercise habits for each of the four main seasons (i.e., fall, winter, spring, summer). Minutes of exercise were the measure of choice because most runners and cyclists are aware of the time spent exercising. Thus, the questionnaire
generated information regarding the average minutes of exercise for each category of exercise, during each session.

**Results:**

One hundred and sixty-six questionnaires were returned for an initial 69% response rate. Of these 166 responses, 15 were discarded because they did not meet the criteria (i.e., the respondent was under the age of 65 or the respondent was no longer active in exercise). Three of the respondents had since passed-away, and the questionnaire was returned by the surviving spouse. Thus, 148 responses were used for the final analysis, for a 67% response rate of possible respondents.

**Descriptives of Sample**

The gender percentages represented in Figure 1 show that the sample population was largely male, 83%. Table 1 demonstrates that there is no significant difference in the $M$ and $SD$ of the age and BMI of the two genders. No significant difference was found in the number of stumbles and falls among the participating groups ($p > .05$). All subjects in the sample are currently nonsmokers. 41% of the respondents smoked at some point during their lifetime and 59% have no smoking history as illustrated in Figure 2.

**Figure 1.**
Gender Percentages
### Table 1.
Sample Statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Age M</th>
<th>SD</th>
<th>BMI M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>123</td>
<td>70.03</td>
<td>4.11</td>
<td>23.19</td>
<td>2.06</td>
</tr>
<tr>
<td>Female</td>
<td>25</td>
<td>70.59</td>
<td>4.72</td>
<td>22.28</td>
<td>2.30</td>
</tr>
</tbody>
</table>

### Figure 2.
Smoking History of Sample

*All subjects are currently non smokers.

During the previous 12 months, the sample visited various health care professionals for numerous reasons. Figure 3 demonstrates that 97% of the respondents visited some type of a doctor with a family medicine doctor being the most common, 82%. Other common types of doctors that the sample held appointments with are Ophthalmology (36%), Dermatology (30%), Orthopedic (22%), and Cardiology (18%).
Figure 3.
Type of Health Care Providers Sample Visited in Past 12 months

Figure 4 shows that 57% of the time the respondents visited a physician for illness related reasons and 30% of the time for injury related reasons. Figure 5 demonstrates that 55% of the respondents have at least 1 disease condition. Some of the most common disease conditions among the participating group are high cholesterol (21%), hypertension (15%), low back pain (11%), and cancer (11%). Only 1% of the respondents suffer from depression. 3% of the sample has diabetes and 9% of the respondents have heart disease.
**Figure 4.**
Reason Sample Visited Physician in the Past 12 months

**Figure 5.**
Disease Conditions in Sample
Competition Events

The sample that was surveyed was asked to identify and report the type and number of race events that they participated in during the previous 12 months. Figure 6 illustrates that 91% of the sample group participated in at least one race event. The most common types of events that the respondents participated in at least once were a running race, 82%, and a triathlon 36%. Of the respondents, 23% participated in at least one marathon and 4% participated in at least one ironman competition.

Figure 6.
Race Events Sample Participated in during the Past 12 Months

Frequency of Exercise Mode

All individuals in the sample participated in some form of exercise during the past 12 months. Figure 7 illustrates that running was the most popular exercise mode with
88% of the sample participating in running. During the past 12 months, cycling was common with 70% of the sample choosing it as a mode of exercise. 69% of the population exercises by alternative exercise modes such as golf, tennis, or aerobics. Of the respondents, 49% reported using swimming as a mode of exercise during the past 12 months.

**Figure 7.**
Frequency of Exercise Mode among Sample

Figure 8 shows a large increase in maximum amount of exercise participation during the summer season with all exercise modes. There was an increase in the maximum hours spent exercising with swimming and AEM during the spring and summer. The maximum hours spent exercising remained most consistent with running throughout all seasons.
Figure 8.
Maximum and Minimum Hours Sample Spent Exercising by Season

Table 2 shows there was no significant difference found between the number of hours that males and females spent exercising each week (p > .05). In the weekly exercise hours, there was no significant difference found between the total number of hours spent biking or swimming among the respondents (p > .05). Significant statistical differences were seen across the genders in the total mean run hours each week and the total mean other hours recorded each week (p < .05). The male run mean (3.39 ± 2.03) is significantly higher than the female run mean (2.25 ± 2.10). The female AEM mean (3.19 ± 3.32) is significantly higher than the male AEM mean (1.59 ± 2.88).
Table 2.
Gender Differences in Weekly Hours of Exercise

<table>
<thead>
<tr>
<th>Weekly Exercise</th>
<th>Male</th>
<th>Female</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Weekly Exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bike Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Run Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Swim Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>AEM Totals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at p-value < .05

Table 3 shows the average recorded hours of exercise each season. The sample reports about the same amount of hours of biking in the summer (2.27 hours) and spring (2.26 hours). During the winter and fall seasons, there was a large decline in the amount of time spent biking and swimming. Running has the most recorded hours of exercise of any group with means of over three hours each season. Swimming has the least amount of average hours of recorded exercise with three out of the four seasons not averaging one hour of recorded exercise. The average recorded swim time in the summer was one hour per week. Summer is the season with the highest recorded mean hours of exercise,
9.21 hours. Alternate exercise mode means stayed relatively consistent throughout the year with means between 2.08 hours in the fall and 2.38 hours in the summer.

Table 3.
Average Recorded Weekly Hours of Exercise Each Season

<table>
<thead>
<tr>
<th></th>
<th>Bike</th>
<th>Run</th>
<th>Swim</th>
<th>AEM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>2.26</td>
<td>3.29</td>
<td>0.51</td>
<td>2.37</td>
<td>7.40</td>
</tr>
<tr>
<td>Summer</td>
<td>2.27</td>
<td>3.57</td>
<td>1.00</td>
<td>2.38</td>
<td>9.21</td>
</tr>
<tr>
<td>Fall</td>
<td>1.22</td>
<td>3.15</td>
<td>0.34</td>
<td>2.06</td>
<td>7.00</td>
</tr>
<tr>
<td>Winter</td>
<td>1.58</td>
<td>3.17</td>
<td>0.38</td>
<td>2.23</td>
<td>7.22</td>
</tr>
</tbody>
</table>

**Discussion:**

The elderly population in the United States is steadily increasing and will continue to do so throughout the twenty-first century. The fastest growing segment of the elderly population are those individuals who are 85 years of age and older. By the year 2020, the oldest old will double in population and total an estimated 7 million people in the United States, and by the year 2050, this population could number as high as 31 million people (U.S. Census Bureau, 2000). As the population ages, this group will experience numerous normal physiological declines that occur with aging such as a decrease in muscular strength, power, and mass; decrease in bone density; and decrease in cardiac function. A compilation of the aging changes can lead to a decreased functional mobility and an increased dependence on other individuals for the performance activities of daily living. Preventative measures can be taken to slow these effects of aging on the body.
Exercise has been proven to reduce many health related risks of aging by reducing fatigue, improving heart and lung function, preventing or minimizing bone loss, improving coordination and balance, increasing flexibility, and improving gait.

Regardless of fitness level or age, no one is ever too old or frail to take advantage of the benefits of exercise (US HHS, 2001). It is recommended by the National Council on Nutrition and Physical Activity that exercise be done most days of the week for 30 minute bouts at a time. A study done on exercise, health, and aging found that only 6% of the respondents participated in exercise activities at the recommended level (Loland, Waaler, 2004). Typical exercise activities completed by aging population are gardening, golfing, walking, leisure sports, and home maintenance (Laukkanen P, Kauppinen M, Heikkenen E, 1998). In the literature, gender differences were found in the type of exercise activities elderly men and women choose to participate in. Women were more likely to participate in gardening, walking, cycling, and domestic work while men preferred leisure sports, jogging, and home maintenance (Laukkanen P, Kauppinen M, Heikkenen E, 1998).

In contrast to previous studies conducted about elderly and exercise, this study shows that there is a group of elite elderly athletes, with an average age of 70, who participate in exercise an average of 7 hours per week as compared to the recommended 2 per week by the NCNPA. All respondents in this study participated in at least 2 different exercises per week. Athletes in this study followed the normal cyclical seasonal pattern of exercise where exercise time increases with spring and summer and decreases during the fall and winter. There was no significant difference found between the number of hours that males and females spent exercising each week. In this elderly cohort it was also found that the maximum total number of hours respondents spent exercising in the past 12 months was 21.8. The maximum amount that the sample reported participating in
AEM during the spring and summer was 33 hours per season. However, this study did find significant differences in the modes of exercise chosen by males and females. It shows that males (3.39 ± 2.03) chose running as a mode of exercise more than females (2.25 ± 2.10). While females (3.19 ± 3.32) preferred AEM such as tennis or aerobics as mode of exercise when compared to males (1.59 ± 2.88). The summer had the greatest hours of recorded exercise each week with 9.21 hours. Running was found to be the mode of exercise with the greatest number of recorded hours through all seasons with an average of over three hours per week. This study found that of this elite athletic elderly population 91% of the respondents participated in at least one race event and 23% participated in a marathon. 4% of this elderly population competed in at least one ironman competition.

This sample was found to be relatively healthy and health conscious. 97% of respondents visited a health care provider at least once in the past 12 months, and 82% of the sample visited a family medicine health care professional. Of the respondents, just 55% have at least one disease condition. Only 57% of this elderly population visited a health care professional in the past 12 months due to illness. The leading cause of disease and disability in the United States is heart disease which can be caused by sedentary lifestyle, smoking, hypertension, and high cholesterol. This sample reported a much lower percentage of all of these risk factors as well as heart disease when compared to the 65 and older population. The respondents were all currently non-smokers. The health status of the sample was not known prior to beginning exercise and therefore the health benefits cannot be correlated with the exercise. However, numerous studies have shown that exercise and healthy diet can lower blood pressure and cholesterol which will decrease the incidence of heart disease.
Implications

As the population ages, health care professionals will begin to see a greater elderly patient population. Many stereotypes surround the elderly as being feeble, sedentary, incontinent, and senile. This study shows that the elderly population that is 65 and older is not a homogeneous population. The elderly population is as multidimensional as younger populations. Many of these older individuals are able to do just as much if not more than their younger counter parts. Health care professionals should be aware of the diversity in this population and relate it to their health care interventions. Health care providers should be careful not to make assumptions of the activity level of their elderly patients. Currently in physician and physical therapy offices, many elderly patients are sent home with such exercise ideas as starting a walking program, lifting soup cans, or stretching gently in order to build cardiovascular and muscular strength as well as increase flexibility. As shown by this study, exercise generalizations do not fit the elderly population and health care providers should be aware of this before making assumptions based merely on the age of the patient. A true physical and functional assessment should be done before prescribing a home exercise program to a patient, and this will help to provide the best program for the patient based on their needs.

The elderly athlete sample from this study exercises about twice as much as any other studies presented in the literature. Even though the respondents of this study were relatively healthy, due to the large amount of exercise that they participate in, this group could be at an increased risk for overuse injuries. Over the course of a year, 30% of the respondents in this study visited a physician for an injury. 97% of the sample visited a health care provider. Over use injuries are something that health care providers should
educate elderly athletes on and make their elderly patients aware of. As the body ages, cartilage looses a portion of its elasticity which causes it to crack and abrade more easily making the body more susceptible to injury. When injury does occur, the body heals slower with age which can put this population at an even greater risk for cumulative overuse injuries. Being a knowledgeable health care provider for senior athletes can help this population enjoy activity well into their 80s, 90s, and beyond.

**Limitations:**

This study was not able conclude that the health status of the individuals involved in the study was a result of the exercise. The health status of the individuals was not known prior to participating in regular exercise and therefore a cause and effect cannot be established from this study.

**Conclusion:**

This study shows that health care providers should not generalize and stereotype an elderly individual’s ability to participate in vigorous exercise. Activity level should be taken into consideration before physical activity recommendations are made. Providers should be able to recognize the normal decline of activity during the fall and winter months and offer alternate modes of exercise to keep this population active year round. Providers should be more aware of the existence of elite elderly athletes and educate this population accordingly to prevent overuse injuries.
References


