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The Prevalence and Risks of Injury for Masters Athletes: Current Findings

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The Prevalence and Risks of Injury for Masters Athletes: Current Findings

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Abstract

The Prevalence and Risks of Injury for Masters Athletes: Current Findings

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Regular physical activity and exercise are important clinical mediums that can be used to improve our health. This is especially true given the prolonged lifespan of the average adult and the declines in physical function that are attributed to advancing age. Those functional detriments can be controlled or reversed via regular exercise and as a natural outgrowth competitive sports targeted to the elderly are on the rise. These events have created generations of Masters athletes. However, continued growth of and successful participation in these competitions may be limited by an unfounded belief that an increased risk of sports injury occurs as we age. This notion is not supported by the available scientific literature. The preponderance of epidemiological evidence demonstrates no age-associated increase in injury for Masters athletes. This remains true even when the research has focused on specific injury types such as connective tissue. To unequivocally answer the question of whether elderly athletes are at a high risk of injury, future research needs to focus on providing more rigorous controls over activity levels and training status as both of these variables are likely confounding the current

conclusions that can be drawn when comparing young and old athletes. It will also be beneficial to specifically study the association between altered muscle function, age and injury. This association has not been addressed within the Masters athlete population, but could provide potent insight into the aging process of habitual exercisers.

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Introduction

There are many well established benefits that regular physical activity (PA) can provide, including increased functional capacity, improved mood, increased musculoskeletal strength, improved ability to perform activities of daily living, improved metabolic profile and improved body composition (Allen & Morelli, 2011). When these factors are aggregated at a population level, it has become clear that regular PA will decrease population wide morbidity (CDC, 1999) and mortality rates (Gulsvik et al., 2012). Regular aerobic exercise has been shown as a potent intervention to reduce cardiovascular disease (CVD) and hypertension (Karvonen, 1984) as well as type II diabetes risks (Fogelholm, 2010). High impact running activities (Gast et al., 2013) and regular resistance training exercise (Nikander et al., 2010) can both provide improvements in bone mineral density thus decreasing osteoporosis risk.

The profound multifactorial nature and system-wide effects that exercise has on the body and the existence of few medical contraitidications (Best & Hart, 2008) are fostering a growing research, clinical and cultural shift to increase PA levels world-wide. This "Exercise as Medicine" movement aims to not only counteract and control the well-established obesity and inactivity epidemics, but to proactively fight these far from inevitable outcomes via prevention (Russell, 2013). Worldwide there are initiatives to increase PA level for all genders, ethnicities, socioeconomic classes and age groups.

Of particular interest to many are the effects that PA can have towards promoting healthy aging. While the prospect of mortality is unavoidable, large advances in medicine and technology have drastically increased the human lifespan. Unfortunately, this prolonged time does not come without a cost. Aging is associated strongly with increased morbidity risk, decreased functional capacity and an increase in sedentary behavior (Allen & Morelli, 2011). Thus, it is evident that exercise may be an essential tool to combat these trends. Older individuals are now increasingly encouraged to maintain an active lifestyle. Furthermore, the once strongly held belief that frailty and disease are an inevitable outcome of aging is being rejected and replaced with a narrative of successful aging. This narrative holds that physical and mental health can be maintained well into later life and the high quality of that lifespan period is should be an expected outcome.

An ideal example of where exercise is clearly demonstrating this "successful aging" paradigm can be found in the form of the Masters athlete (Tanaka & Seals, 2008). An exact definition of what defines membership in the Masters athlete population remains elusive due mainly to different conventions used by individual Masters sport governing bodies. For example: Masters level swimming begins 18 years old while Masters golf starts its membership at 50 years of age (Concannon et al., 2012). For the purpose of this paper, and in keeping with general research trends, a Masters athlete is an individual over the age of 35 who regularly trains for and participates in a competitive sport. The sporting events involved often mirror the wide variety of youth sporting options that exist (i.e. ultra-endurance running, powerlifting, track and field events and team sports such as soccer and rugby) and competition is usually bracketed by age into quintets (i.e. 35-39, 40-44, 45-49….) or decades (i.e. 40-49, 50-59….).

Unfortunately, the growing participation in these competitions is being limited by the aforementioned misconception about the inevitable decline in physical function that comes with age. Within this incorrect framework, many people will cite injury risk as a barrier to participation or a special issue that must be addressed while training and competing (Strathokostas, 2013). However, to date there is no firm evidence-based platform on which we can ground those assertions.

The aim of this paper is to provide an overview of what current research has found regarding injury prevalence in the Masters athlete population.

Injury Rate Epidemiology

In order to answer whether Masters level athletes are truly at a greater risk for injury, large epidemiologic studies are the primary assessment tool. An early application of this methodology came when Hogan and Cape (1984) retrospectively surveyed a group of 32 marathon runners over the age of 60. The injury prevalence rate was 46.9%, which was comparable to the expected injury rate of a theoretical younger population. They also noted that the knee and foot were the most common sites for injury.

Kannus and colleagues (1989) extended our understanding of Masters athlete injury risk by tracking the treatment of 57 elderly (>60 years of age) individuals at an outpatient sports clinic over 3 years. Knee (21%) and calf (21%) were the sites most injury prone, thus corroborating earlier findings that the legs are the most susceptible. They also provided indirect support to the notion that older athletes were not at a higher age-driven injury risk. A similarly competitive youth control group was used for comparison and the prevalence of knee injuries was 15% greater for the young.

A Finnish study used questionnaires and in-person examinations to track the injury status of 97 elderly (age range 71-80 years) strength and endurance athletes for a 10 year period (Kallinen & Allen, 1994). A total of 81% of athletes sustained at least one sports injury with 62% of being them being acute and 38% being overuse. Among them, 75% of injuries were localized to the lower-body. While the extremely high injury prevalence shown here may seem alarming when compared with Hogan and Cape's findings, this discrepancy is likely due to the variety of sports involved. The cohort was composed of competitors classified as either "endurance athletes" or "strength/power athletes". The endurance group included a large number of cross-country skiers and "orienteers" which may have increased the injury risk due to environmental factors. It is also plausible that the higher loading factors and joint stress that are inherent to strength and power training and competition could have also increased injury incidence.

Mckean et al. (2006) conducted a cross-sectional study of injury prevalence of 2886 participants (34% Masters) during A 100 mile relay running race. The prevalence of injury for Masters runners within the previous year was 49%. This value was directly compared with a younger cohort within the same race and showed 4% increased injury prevalence for the older athletes. It was also clear that the Masters athletes were also more prone to reporting multiple injuries over the course of their training (30% versus 24%) and that these injuries were most likely to occur at the knee, foot and back. Unfortunately, a population sourced from distance running events may not be the best choice for evaluating age-related injury risks. While the distance runner may be a useful archetype to study aging and physical function, many distance-running events do not provide a well-controlled cohort. Due to their wide popularity, the requirements for participation in most events are open ended and thus participants of varying fitness, training and activity levels are grouped together by their age. The high prevalence demonstrated above could therefore be the result of injury caused by training factors and not age, per se.

This is supported by the observation that the older group had significantly more runners with 7 or more years of experience and who ran more that 30 miles a week or ran 6 times per week or more.

More recently Walsh et al. (2013) and Haezlewood et al. (2014) have used a more focused population of World Masters Games participants to address the issue of training status. This population provides better control for the confounding variable of fitness as competition at an international level necessitates a more dedicated and organized training regime. Focusing on 931 football coded (i.e. soccer, rugby and touch football) athletes, Walsh et al. found a 23% injury rate with no significant age-related difference. This held true when the cohort was divided into young (<50 yrs) and old (>50 yrs) groups and when it was stratified by decade. The primary injury sites were again the leg, knee and then ankle. These results are especially interesting because they negate an easy assumption that sports allowing player-on-player contact/collision would create a more hazardous environment for older athletes while also confirming previous indications that the lower extremities are most vulnerable to injury. The reality may be that performance factors such as lowered running speed and decreased strength dramatically change the dynamic of play in these team sports and result in fewer collisions and lower impact forces when collisions do occur.

A year later, Heazlewood et al. found an injury prevalence of 13% for a larger sample of 1,590 athletes, across all sports, at the Pan Pacific Masters games. This injury prevalence was 41% lower than a comparable youth injury report. However, the retrospective survey time period for this study was only 3 months and this could explain why the prevalence was dramatically lower that anything found previously (Hogan and Cape, 1984) (Kallinen & Allen, 1994) (Mckean et al., 2006).

Adding even further support to the low Masters athlete injury prevalence is the work by Ganse et al. (2014) who used the 2012 European Veteran Athletics Championships to track injuries. Of 3154 participants aged 53.2 years in average, only 2.4% (76 individuals) registered injuries. This incidence was substantially lower than high-level youth cohorts in previous years (13.5%).

Collectively, the result of this review clearly show that there is not enough evidence to support a notion that overall injury risk increases with advancing age. Future research should utilize longitudinal surveys or observational studies to permit meta-analytic examination, from which more conclusive associations can be gleaned. In the interim however, it appears that age alone is not a clear injury risk factor for the Masters athlete.

Connective Tissue Injury

It is also important not to overlook whether specific injury types/locations are more affected by the aging process. Chief among the tissue types that lay people may associate with injury susceptibility due to age is connective tissue (CT). Healthy CT structures are essential for maintaining joint stability (primarily via ligaments) and allowing joint movement (primarily via tendons). If either of these CT structures become weakened then the risk of stress induced joint injury and functional impairments will increase.

Contrary to popular belief, tendons do not degenerate with age in the same way that muscle mass decreases with age. In vivo MRI has shown that patellar tendon length and cross-sectional area were not significantly different between an elderly (~70 years) and a young (~30 years) cohort (Couppé et al., 2009). However, it is clear that the mechanical properties of these tissues are susceptible to age-related changes as decreases in metabolic rate, elasticity, stiffness and tensile strength have been observed (Narici & Magnaris, 2006; McCarthey & Hannafin 2013). Chronic physical activity, on the other hand, is a potent promoter of CT health. Using in vivo ultrasonography techniques, Reeves, Maganaris and Narici (2003) demonstrated that 14 weeks of resistance training was able to increase patellar tendon stiffness (65%), Young's modulus (69%; the ratio of stiffness multiplied by the ratio of tendon length divided by tendon CSA) and torque development (27%).

While a large body of research addressing age-related CT injury risk in Masters athletes does not exist, the current evidence appears to mimic the larger injury prevalence trend. Longo et al. (2009 & 2011) studied a group of Masters track and field athletes participating in the European Veterans Championships and found no association between age and either patellar tendinopathy or Achilles tendinopathy. This result is especially interesting considering the concurrent finding that CT injury rates did not differ between high-impact and low-impact events and is bolstered by the strength of clinician diagnosed injury. The use of clinical injury assessment here is a clear methodological strength because it eliminates the effect of recall bias that can occur with retrospective survey study designs.

Contrary to previous research, Kettunen et al. (2006) found a large discrepancy between Achilles tendinopathy risk in a similar cohort of Masters track and field athletes. Using a 16-year follow-up study design they show that the prevalence of Achilles tendinopathy increased by 16.9% after the age of 45. These results should, however, be viewed with a critical eye because the investigation failed to adequately control for the activity level of the runners during the study period. Training distance and years of running had are significant correlates with injuries in Masters runners (Knobloch et al., 2008). This study corroborates that trend of injury to the lower extremities with overuse injuries being more prevalent than acute and Achilles tendinopathy having the highest prevalence. Further corroboration is added by Stenroth et al. (2012) who demonstrated, in vivo, that the tendon stiffness of young and old subjects was similar when muscular strength was equivalent.

Conclusions

The successful aging paradigm embodied by the Masters athlete is one of great cultural and intellectual value. Due to the ability of these competitors to maintain good health, high function and an independent lifestyle well into senescence, this population should be held as a model for lifelong health promotion. This assertion is strengthened by findings that the aging process, per se, does not increase the chance of injury due to training or competition. While the risk of participation related injury will always exist, clinicians, therapists, event organizers, coaches and athletes and should feel confident that these high-level physical pursuits are not an danger above-and-beyond the norm and that drastic training program and/or competition modifications are not required.

While clear protective mechanisms have not been established to explain the low injury prevalence's shown above, a number of plausible explanations can provide useful insight for future studies. Firstly, advancing age may provide its own form of injury protection in the guise of decreased muscle function. On its face, it would be easy to assume that decreased function would elicit an increase in injury. However, if an athlete loses strength or endurance they may be lowering the overall magnitude of stresses that the joints and exercising limbs will encounter. This is indirectly corroborated by the large prevalence of overuse injuries. If the magnitude of performance decrement (i.e. lower force production, decreased power development, reduced neuromuscular control, etc.) is greater than any age-related changes to the mechanical function of CT then injury to that tissue will be less likely.

Age associated increases in Type I fiber type (Trappe et al., 1995) and decreases in muscle cross-sectional area (Frontera et al., 2000) are well-established mechanisms that could contribute to this line of thinking. Muscular strength is directly related to cross-sectional area thus muscle mass losses will lower the magnitude of force that can be produced. Strength is also reduced due to due the lower force and power production that results from the slower shortening velocity of Type 1 fibers (Aagaard & Bangsbo, 2006). Furthermore, aging rat model work examining injury recovery adds support to this concept through the finding of a decreased “overt injury” response to stretch-shortening contractions in favor of an altered adaptive inflammatory and myofiber degeneration response (Baker & Cutlip, 2009).

Secondly, the origin of the aging increases athletes injury risk may stem from a “weekend warrior” subset of the Master’s population who are, in fact, at a high risk of injury, but have inappropriately blamed their aliments on an easy scapegoat. The weekend warrior is an amateur athlete that devotes a limited proportion of their time to exercise training, but who expect to perform at higher levels than are likely capable. Due to multiple competing responsibilities (family life, work, household upkeep, pets, multiple hobbies, etc….) these individuals are not able to devote enough time to training. When high performance exercise stresses are imposed during, for example: an irregularly heavy training day or competition day, injuries are sustained. The underlying deficits in strength, flexibility and/or aerobic fitness that are the actually the root cause of sustained sports injuries, not the Masters athlete’s age.

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