

Declines in ten-pin bowling performance with advancing age

SIR—One approach to studying the effects of ageing on functional capacity in humans is to analyse peak physical performance of trained athletes with increasing age [1]. Because top master athletes are highly motivated, train vigorously, and experience minimal body composition changes or diseases, analyses of athletic records provide a possible biomarker of ageing [2]. We have previously characterised the age-related reductions in the physically demanding tasks of running, swimming and weightlifting [3–5]. Unlike these athletic events that are determined by muscular strength, cardiovascular endurance or agility, ten-pin bowling offers an unique opportunity to explore the relation between age and athletic performance because the sport is highly skill and technique dependent, and can be performed successfully by many individuals across a wide age-span for many years. Bowling is also distinctive in that its performance is largely determined by skill and technique rather than muscular strength and endurance [6,7]. The primary aim of the present study was to determine ten-pin bowling performance with increasing age in active professional and master bowlers.

Subjects and methods

Cross-sectional analysis of the average scores of the 2002 Professional Bowlers Association (PBA) World Championship and the 2002 Senior World Championship was performed on 147 male bowlers. Participants whose ages could be found on the PBA.com website or those whose ages were revealed by using an internet search engine were included in the analysis. Average scores were calculated as the total points divided by the number of games. Correlation and regression analyses were performed to determine the relation between age and bowling performance.

Results

As depicted in Figure 1, ten-pin bowling scores declined curvilinearly with advancing age. Performance appeared to be maintained until approximately 45 years of age and started to decrease more rapidly thereafter. Correlation and regression analyses suggested that ageing accounted for approximately 40% ($R^2 = 0.39$) of the decline in bowling performance. The overall magnitude of decline was very small with less than a 10% (approximately 8%) decline in the span of 50 years (from 216 pins at age 20 to 188 pins at age 70).

Discussion

Since the seminal report by Shock [8], a number of physiological functions and tasks have been characterised as to how they decline with advancing age. This is an important topic of investigation from a gerontological point of view. However, the effects of age *per se* are very difficult to address because age-related changes are often confounded

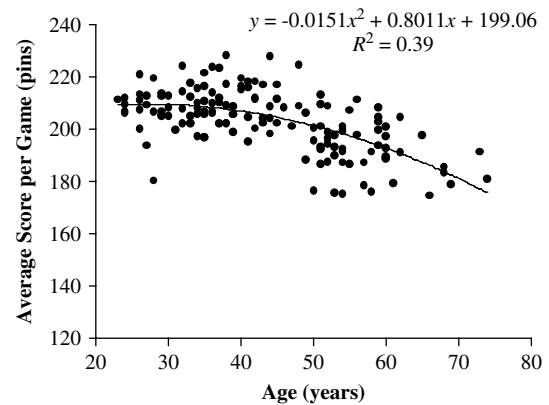


Figure 1. Average ten-pin bowling scores with advancing age.

by simultaneous changes in lifestyle, motivation and co-existing disease processes. To minimise these confounding issues, master athletes have been used to study age-related changes in function and performance as they are active, highly motivated and experience fewer chronic diseases. In contrast to studies dealing with frail elderly (one end of the extreme), master athletes (the other end of the extreme) provide another example of what is possible in human ageing. In the present study, we assessed how ten-pin bowling performance changes with advancing age.

A salient finding of the present study was that the overall decline in ten-pin bowling performance with advancing age was small. From ages 20 to 70, average bowling scores declined less than 10%. This magnitude of decline is considerably smaller than that seen in other athletic events (e.g. running, swimming, etc.), which are known to decrease approximately 10% per decade [2, 4, 9]. Bowling scores do not appear to be dependent upon typical physiological functions like muscular strength and endurance [6, 7], but rather by skill and technique. In this regard, it is interesting to note that the rate of decline in the present study is considerably lower than those observed in other skill-dependent functional tasks in normal older adults [10]. These results suggest that the components of skill and technique that are necessary for some athletic events may be well maintained with advancing age.

Bowling performance declined in a curvilinear fashion. The performance appeared to be maintained until approximately 45 years of age and started to decrease more rapidly thereafter. Interestingly, the curvilinear decline in bowling performance was similar to other athletic events including running and swimming [2, 4, 9]. It seems likely that depending on athletic events, there may be a given threshold age up to which athletic performance can be maintained. In bowling, this occurred at approximately 45 years of age. Possible limitations in this study are the inclusion of only men's scores and also the lack of information regarding the participants' training regimen and bowling experience.

In summary, we have demonstrated that the overall magnitude of decline in ten-pin bowling performance with age was very small with less than a 10% decline in the span of

Research letters

50 years. These results suggest that the skills and techniques required for the maintenance of bowling performance may be well preserved with advancing age.

Conflicts of interest

No conflicts of interest.

Key points

- Based on this cross-sectional data, the overall magnitude of decline in ten-pin bowling performance with age is extremely small with less than a 10% decline in the span of 50 years.

ALLISON ELIZABETH DEVAN*, HIROFUMI TANAKA
Department of Kinesiology and Health Education,
The University of Texas at Austin,
1 University Station, D3700,
Austin, TX 78712, USA
E-mail: adevan@mail.utexas.edu

*To whom correspondence should be addressed

References

1. Bottiger LE. Physical working capacity and age. *Acta Med Scand* 1971; 190: 359–62.
2. Tanaka H, Seals DR. Dynamic exercise performance in Masters athletes: insight into the effects of primary human ageing on physiological functional capacity. *J Appl Physiol* 2003; 95: 2152–62.
3. Anton MM, Spiriduso WW, Tanaka H. Age-related declines in anaerobic muscular performance: weightlifting and powerlifting. *Med Sci Sports Exerc* 2004; 36: 143–7.
4. Tanaka H, Higuchi M. Age, exercise performance, and physiological functional capacities. *Adv Exerc Sports Physiol* 1998; 4: 51–6.
5. Tanaka H, Seals DR. Age and gender interactions in physiological functional capacity: insight from swimming performance. *J Appl Physiol* 1997; 82: 846–51.
6. Tan B, Aziz AR, Chuan TK. Correlations between physiological parameters and performance in elite ten-pin bowlers. *J Sci Med Sport* 2000; 3: 176–85.
7. Tan B, Aziz AR, Teh KC *et al.* Grip strength measurement in competitive ten-pin bowlers. *J Sports Med Phys Fitness* 2001; 41: 68–72.
8. Shock NW. Physical activity and the “rate of ageing”. *Can Med Assoc J* 1967; 96: 836–42.
9. Bortz WM, Bortz WM. How fast do we age? Exercise performance over time as a biomarker. *J Gerontol* 1996; 51A: M223–5.
10. Potvin AR, Syndulko K, Tourtellotte WW *et al.* Human neurologic function and the ageing process. *J Am Geriatr Soc* 1980; 28: 1–9.

doi:10.1093/ageing/afm129

Published electronically 16 October 2007