Original Research

No Observable Relative Age Effects in Professional Surfers: a Constraints-Based Evaluation

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ABSTRACT

International Journal of Exercise Science 11(6): 355-363, 2018. With the recent inclusion of surfing in the 2020 Olympic Games in Japan, there will be a number of surfing athletes vying for one of the twenty total available spots for their respective gender. The purpose was to evaluate relative age effects (RAEs) in surfing with consideration for specific developmental constraints. Elite competitive male surfers (n = 1590) were examined by birth month and subcategorized by competitive level, age groups, and geographical regions. The observed quarterly distribution was not significantly different (using χ^2; p>0.05) from expected for the overall group or any of the subcategories. However, an odds ratio of 1.85 (90% confidence interval: 1.08-3.14) was calculated for being born in the first semester of the year compared to being born in the second semester between top 34 athletes and the rest of the field. Despite consideration for individual, environmental, and task constraints in this study, the sport of surfing does not appear to have any observable RAEs at the professional level. Thus, surfing appears to be one of the few sporting activities included in the Olympic Programme with limited RAEs.

KEY WORDS: Relative age effect, Olympic sports, developmental constraints

INTRODUCTION

Sport association governing bodies often use annual age grouping strategies, such as the separation of cohorts by chronological age, to separate athletes into different competitive divisions. However, this may lead to a biased distribution of birth dates and potential for physical and/or competitive advantages, referred to as relative age effects (RAEs) (11). Sports, such as amateur surfing, that use January 1- December 31 groupings may result in athletes that have a difference of 12 full months in chronological age (age as measured by years moths or days from birth) and a largely variable difference in biological age (age in relation to maturation or developmental status) and a largely variable difference in biological age (20). A negative consequence of RAEs are the possible early termination of sport involvement due to disadvantages experienced by athletes born later in the selection year (3). In judge derived point based criterion sports, such as figure skating and dance, there are both aesthetic and

technical demands; however no evidence of RAEs has been seen (3). Surfing is similar to gymnastics in regards to scoring based upon judges and specific criteria, however, in competition featuring challenging and constantly fluctuating surfing conditions, more physiologically developed athletes may be at a particular advantage. Previous studies have examined RAEs in team sports, (5) and some individual sports (3, 7, 10), but this phenomenon has yet to be examined in surfing.

Previous studies examining RAEs in sport have focused primarily on the perceived physiological advantages (1, 5, 9). In a meta-analysis by Cobley et al. (5), age, skill level, and sport context were identified as distinguishing factors in the propagation of RAEs. The physiological demands of competitive surfing have been identified (13) and show that strength and power, as well as aerobic and anaerobic work capacity, are critical components of the sport and are necessary components needed to meet the judging criteria established to recognize measurable performance aspects (13, 14, 17). This would suggest that RAEs should exist in surfing at the same level as seen in other sports. Selection of athletes for teams in highly popular sports, which varies greatly between countries, typically propagates RAEs where selection favors the more developed athlete (5). RAEs have also been found in individual sports of snowboarding, ski jumping and alpine skiing, potentially showing that RAEs are not a phenomenon exclusive to team sport settings (3).

RAEs are based on the supposition that there is a relationship between an individual's relative age (birth month or quarter) and his/her physical and cognitive maturation (1, 6, 15). However, this may be overly simplistic for adolescent age groups, as significant variability exists in various factors such as emotional development, motivation to compete, and sports experience between younger athletes born later in the cohort year and older athletes born earlier in the cohort year (11, 15). Wattie and colleagues (21) recently presented a constraints based model for RAEs utilizing developmental systems theory with three interacting constraints responsible for control and coordination of an activity. This model has been modified and used previously to examine factors that affect athlete development by way of the individual, environmental, and task constraints (16, 21). These constraints have been further defined as constraints concerning individual qualities of humans, social constructs that impact development, and constraints related specifically to demands of the specific sport, respectively. Therefore, with consideration for the individual constraint of birth date, the environmental constraint of geographical region, and the task specific constraint of a competitive rankings, the purpose of this study is to evaluate the hypothesis that RAEs exist in professional surfing.

METHODS

Participants
Birthdate information for World Surf League (WSL), *formerly the Association of Surfing Professionals (ASP)*, World Championship Tour (WCT) and World Qualifying Series (WQS) male surfers was requested and received from the WSL. The study protocol was submitted to the university's institutional review board and it was determined that the research activity was

not human research as defined by federal guidelines. The WCT rankings included results from the top 34 surfers. Only results from WCT events counted towards the WCT rankings. The best 9 of 11 results counted towards the men's end of season rankings. The WQS rankings included results from all WSL surfers competing in WQS events. The best 5 results counted towards the rankings. Therefore the WSL top 34 is comprised of: top 22 finishers on the previous year WCT rankings, the top 10 from the previous year WQS rankings (excluding those who have already qualified through the CT Rankings), and two WSL Wildcards. Birthdates of 1590 professional male surfers were examined. End of year rankings for WSL male competitors for seasons ending in 2011-2014 were also examined to establish any potential RAEs in the WCT.

Protocol
Birthdates of active member male surfers in the WSL were separated by birth month into quarter 1 (Q1; January-March), quarter 2 (Q2; April-June), quarter 3 (Q3; July-September), and quarter 4 (Q4; October-December). The athletes who were active members of the WSL in the competition seasons of 2011-2014 were examined and were separated as follows:
- Elite (Top 34 in the WCT from 2011-2014 and top 200 in the WSL as of February 2012)
- Age (<25 years, 25-35 years, >35 years)
- Geographical region [countries/state with the most athletes in the WSL: Australia (AUS), Brazil (BRA), Hawaii (HAW), United States of America (USA)]

The observed annual age distributions for the overall group, the top 34/200, and the age groupings were compared to an expected values based on equal percentages for each quarter (Q1: 25%, Q2: 25%, Q3: 25%, and Q4: 25%), while the country/state of representation groups were compared to publicly available geographic population data for 2011-2014 .

Statistical Analysis
Chi square goodness of fit tests were conducted to compare the observed and expected frequencies for the overall group and sub-groups of professional surfers. The WSL rankings between the age groups and geographical regions were compared using Kruskal-Wallis one-way analysis of variance with post hoc testing consisting of Mann-Whitney U with Bonferroni corrections. Effect sizes were calculated using χ^2 and interpreted as follows: 0.010 (small), 0.060 (moderate), and 0.140 (large). A type I error rate of less than or equal to 5% (p ≤ 0.05) was considered statistically significant. Annual age distribution values by quarter were calculated as percentages and 95% confidence intervals for graphical comparison.

Due to relatively few surfers being included in the WCT and to further evaluate the effects of competitive level, the odds ratio (with 90% confidence interval) for being born in first half of the year (Q1+Q2=S1) compared to being born in the second half of the year (Q3+Q4=S2) was calculated between WCT athletes and the rest of the field (non WCT) as follows:

$$Odds\ Ratio_{WCT\ vs\ non\ WCT} = \frac{S1\ WCT\ Frequency/S2\ WCT\ Frequency}{S1\ non\ WCT\ Frequency/S2\ non\ WCT\ Frequency}$$

RESULTS

The average age (±SD) of the male professional surfing athletes at the time of the rankings for the overall group, the top 200 surfers, and the WCT surfers was 28.9 (±7.0), 30.0 (±5.5), and 27.8 (±4.8) years, respectively. The comparison of observed and expected frequencies for the overall group and the highly ranked athletes are listed in Table 1 and Figure 1. The observed annual age distribution was not significantly different from expected for the overall group professional male surfing athletes (χ^2=1.804, p=0.614), or for the highly ranked surfers (top 200: χ^2=3.080, p=0.379; top 34: χ^2=6.767, p=0.080). The S1-S2 odds ratio for WCT and non WCT athletes was 1.85 (90% confidence interval: 1.08-3.14 small to moderate effect) indicating that surfers in the WCT have greater odds of being born in the first half of the year as compared to the second half of the year than non WCT athletes.
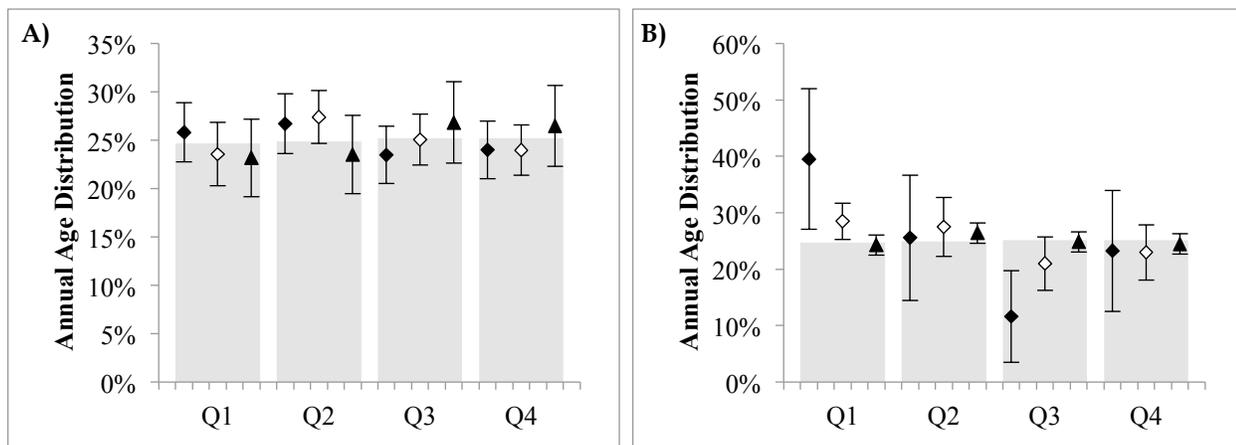

Figure 1. Percentage of athletes by quarter (Q1, Q2, Q3, Q4) with 95% confidence intervals (error bars) for A) the competitive ranking comparison [Top 34 ◆; Top 200 ◊; Overall ▲] and B) the age comparison [<25 years of age ◆; 25-35 years of age ◊; >35 years of age ▲]. The gray vertical bars represent the expected distributions for each quarter.

The average age (±SD) of the male professional surfing athletes at the time of the rankings for the <25 years, 25-35 years, >35 years age groups was 22.2 (±1.7), 29.3 (±2.9), and 40.2 (±4.3) years, respectively. No differences in observed and expected annual age distributions were noted in any of the age categories (<25 years: χ^2=1.527, p=0.676; 25-35 years: χ^2=2.592, p=0.459; >35 years: χ^2=1.338, p=0.720). Significant differences in rankings were found between age groups (H=16.533; p<0.01; η^2=0.018: small effect) with the >35 years [median (interquartile range): 497 (343.5 to 634)] group being lower ranked than the <25 years [383 (191 to 629)] (U=15092.5; p<0.001; η^2=0.020: small effect) and 25-35 years [370 (173.75 to 570)] (U=24224; p<0.001; η^2=0.029: small effect) groups (see Table 1).

The average age (±SD) of the male professional surfing athletes at the time of the rankings from AUS, BRA, HAW, and USA was 28.2 (±6.1), 29.3 (±6.4), 30.8 (±8.1), and 28.4 (±7.6) years, respectively. The observed annual age distribution was not significantly different from expected for AUS (χ^2=3.205, p=0.361), BRA (χ^2=1.167, p=0.761), HAW (χ^2=3.014, p=0.390), or USA (χ^2=1.160, p=0.763). Significant differences in rankings were found between geographical

regions (H=18.298; *p*<0.01; η²=0.035: small effect) with USA [median (interquartile range): 446.50 (219.5 to 687)] being lower ranked than AUS [328.5 (122.5 to 569.50)] (U=6497.5; *p*=0.008; η²=0.027: small effect), BRA, [187 (110.25 to 516)] (U=4035.5; *p*<0.001; η²=0.071: moderate effect), and HAW [274 (153.25 to 484.75)] (U=4980; *p*=0.007; η²=0.032: small effect).

Table 1. Frequency For each comparison by quarter (Q1, Q2, Q3, Q4) for the rankings and age comparisons.

		Q1	Q2	Q3	Q4	Total	χ^2	p
Overall		386	420	395	389	1590	1.804	0.614
	Δ	-12	23	-3	-9			
Top 200		57	55	42	46	200	3.080	0.379
	Δ	7	5	-8	-4			
Top 34		17	11	5	10	43	6.767	0.08
	Δ	6	0	-6	-1			
<25 years of age		144	149	131	134	558	1.527	0.676
	Δ	5	10	-9	-6			
25 - 35 years of age		172	200	183	175	730	2.592	0.459
	Δ	-11	18	1	-8			
>35 years of age		70	71	81	80	302	1.338	0.720
	Δ	-6	-5	6	5			

Note. SD: standard deviation; Δ: difference between observed and expected values

DISCUSSION

Contrary to the original hypothesis, no RAEs were found in the overall group of professional surfers or in the elite, age group, or geographical region comparisons. The current findings appear to be in contrast to other individual judge-derived point-based criterion sports that integrate aesthetics and a high degree of technical skill into performance, such as alpine skiing, snowboarding and figure skating, which have reported RAEs (3). Despite specific consideration given for individual (age), environmental (geographical region), and task (top 34/200) constraints in this study, the sport of surfing does not appear to have any observable RAEs at the professional level.

Within the context of surfing, individual constraints such as birth date, chronological age, sex, physical maturation and size, as well as emotional and cognitive development should be considered (21). The importance of physical characteristics, related size and physical maturation, have shown to be important indicators in the selection process with significant differences in strength and speed reported between athletes selected and not selected for the Australian national surfing team (18). Previous studies have identified that RAEs do provide certain developmental advantages to those athletes born earlier in the selection year, particularly in traditional strength and power sports (4, 5, 9, 13, 14). In surfing, strength is beneficial for sport specific skills such as: paddling, popping up to the feet from the prone position, and wave riding (8). The influence of relationship between advanced emotional development and RAEs must also be considered, as relatively older athletes are likely to have comparatively more developed cognitive skills which manifest as increased self-confidence (12) and the ability to grasp technical and tactical skills more quickly than relatively younger

athletes of the same competitive level (4). Taken together, the individual constraints of surfing athletes indicate that the sport has the potential for RAEs, however, this conclusion is not supported by the current data.

Age grouping policies, family support, coach influence, and popularity of sport are potential environmental constraints that may influence RAEs (21). Age grouping for surfing uses a January 1-December 31 calendar for establishing competitive divisions. Access to appropriate geographical locations and instruction in order to begin surfing may require familial support, such as travel, time, knowledge of the sport, and money. The role of coaching in athlete development varies depending on both access to qualified individuals and the age that the athlete is identified with potential for elite talent. The training programs and sport specific contextual knowledge of coaches are highly relevant to the progression and development of young athletes (2). In surfing, working with a coach that has knowledge of specific locations and tactical strategy would be a valuable asset to distance one's self from other less prepared competition. The popularity of surfing in a geographical location likely affects RAEs through increased potential for selection bias based on greater numbers of competitors. For example if a competitive team is holding tryouts for 10 open positions and due to lack of popularity in a region only 10 athletes tryout, RAE may play less of a role than availability of potential athletes (15). Regions that have a greater involvement in surfing may hold a greater potential for RAEs than those where competitive surfing is less popular. However, the current data examining the most represented geographic locations in terms of ranked surfers, there were no significant findings to support any evidence of RAEs. However, with the increasing popularity and competitive level of the sport on a worldwide basis and the possibility of Olympic inclusion in 2020, the existence of RAEs should be reassessed periodically.

While both individual and environmental constraints in surfing indicate the potential for RAEs in surfing; task constraints, including the artistic nature of the sport, physicality and competitive level, which are highly variable and multifactorial in nature are less clear with regard to this phenomenon (21). While the annual age distribution comparisons for the top ranked athletes were nonsignificant, the elite surfers have greater odds of being born in the first six months of the year compared to lower ranked surfers. When compared to other sports, surfing is unique due to the objective evaluation of established performance criteria such as time, distance, or volume, and places great emphasis on the subjective determination of performance evaluated by a panel of judges following pre-established criteria that varies based on wave conditions and contest location (17). Physicality has a broad range of definition when you consider strength and power sports such as football, soccer and rugby as comparted to artistic or aesthetic sports such as gymnastics, ice skating and surfing (3, 8, 9). While there are physiological demands between these sports that may place similar emphasis on strength and power aspects, the latter utilize judge based criteria (3, 9, 17).

Surfing is unique within judge-derived point-based criterion sports due to the use of open skills, defined as externally paced movements and techniques that must be continually adapted to an ever changing environment and, as opposed to closed skills, which occur in relatively unchanging environments that allow routines to be developed and repeated with

little variability during competition (4). In support of the current lack of RAEs in surfing, Vaeyens et al. (19) suggest that prediction accuracy for talent identification in open skill sports are much lower than in closed skill sports. Further, these authors noted that an increasing number of essential components required for success, which are likely present in artistic/criterion sports, exacerbate this issue. Thus, task constraints may be the primary set of characteristics contributing to the currently reported lack of RAEs.

Previous research has shown effective training strategies for surfers focusing on physiological methodologies such as standard strength and conditioning types of training (9). Upon examining that there are no evident RAEs in professional surfing, coaches should consider developing training that addresses constraints associated with the individual sport specific tasks and variables. External factors such as opponents, judging, and contest conditions are elements that cannot be controlled by the athlete, or coach. Sport specific skill development such as wave selection, contest mental preparation, ability to assess wave conditions and access to appropriate equipment may play an equal or greater role than individual physical qualities with regard to success.

Some limitations with the current study include the sample population consisting of only professional surfing. Including a larger sample, encompassing more competitive divisions, may reveal if competitive level is a limiting factor for RAEs. Future studies examining amateur organizations and junior professional level surfers may be required to confirm the absence of RAEs. Confirmation at lower levels of competition could provide coaches and trainers crucial information regarding athlete development early in a surfer's career. Another limitation is that we only collected data on male athletes for this study. This was largely in part to the smaller number of female surfers competing at the professional level.

According to the results of this investigation, RAEs do not appear to exist in surfing when examining the top ranks of professional surfing. Furthermore, when surfers are grouped into age divisions or geographical regions, there is still no evidence of potential RAEs. It appears that sport specific external factors and task constraints could negate any potential physiological advantages created by RAEs. While RAEs have been examined in a number of studies involving team and individual sports, surfing may more greatly affected by specific task constraints, such as open skill requirements, than other judge-derived point-based criterion sports.

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