Is implementing age and positional specific training drills necessary in elite youth rugby league?

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Headline

Professional sporting clubs invest in pathway programs, attempting to develop physical, technical abilities and psychological skills within a long-term framework (1,2), aiming to retain these athletes for selection in their senior teams. Often, youth teams will train separately within specified age groups, however, from a physical preparation perspective, there may be benefit in training cohesively if there is not a large difference in the physical demands of competition between age and perhaps positional groups.

Aims

The aim of this research is to differentiate the speed and acceleration demands of competition by age and positional group within youth rugby league using power law (3), with a subsequent purpose of assisting practitioners to create accurate training prescription for running demands.

Methods

Athletes. Elite youth rugby league athletes (n = 46) from the same club during the 2018 season participated (n = 332 observations). These athletes completed at the highest level within the New South Wales Rugby League competition for their age groups. Training typically involved three field sessions and three gym sessions per week between matches. Athletes were classified by age group (U16 or U18), and further grouped according to playing position; fullbacks (n = 3), outside backs (n = 13), halves (n = 6), edge forwards (n = 10), middle forwards (n =18), hookers (n = 5). Match duration for U16 was 60 minutes, and U18 was 70 minutes, both including a ten-minute half time. The study conformed to the recommendations of the Declaration of Helsinki and institutional ethics clearance was obtained.

Design. An observational research design was employed, where data were collected across a youth competitive season. Ten matches were played for both U16 and U18 teams, with both teams recording seven wins and three losses. No interventions were necessary.

Protocol. During matches, GPS units recording at 5 Hz were worn in a pouch in the athlete's playing jersey (SPI HPU, Gasport, Canberra, Australia). Following matches, data were downloaded using the proprietary software (Team AMS, Canberra, Australia) and trimmed to only include playing time. Using customized software (R Studio; V 1.0.136), speed ($m{\cdot}min^{-1}$) was determined and acceleration ($m{\cdot}s^{-2}$) was calculated as the rate of change in speed, regardless of the direction of change, reflecting all acceleration requirements (4).

Data Analysis. Moving averages for mean speed and acceleration over 1 to 10 minutes were calculated,5 and the maximum of each duration (for the season) was recorded for each athlete. The maximal mean intensity data was used to calculate intercept and slope values for speed and acceleration, as this information is useful in the prescription of training (6). These intercept and slopes were calculated using power law (3), which quantified the decrement in speed and acceleration as duration increased (3). Detail of this method is described in other research (1,6), however in summary, the intercept represents the highest theoretical intensity as time approaches 0, whilst the slope reflects of the rate of decline in intensity over such time.

Statistical analysis. Data were log transformed prior to any statistical analysis. Linear mixed models (R Studio; V 1.0.136) were used to compare speed and acceleration intercept and slopes between age groups (regardless of position) and between position (within age). Athlete identification was treated as a random effect. The least squares mean test was used for pairwise comparisons, which were further assessed using magnitude-based decisions. Standardized effect sizes (ES) and 90% confidence limits (CL) were calculated, categorized using the thresholds of; 0.2 trivial, 0.21–0.60 small, 0.61–1.20 moderate, 1.21–2.0 large, and 2.0 very large (7). Differences were considered substantial when there was a >75% likelihood of the observed effect exceeding the smallest worthwhile difference (0.20) and are described as: 75–95%, likely; 95–99.5%, very likely; and 99.5%, most likely (7).

Results

Regardless of position, speed for a 1-minute window for U16 and U18s was 169 ± 5.02 $m{\cdot}min^{-1}$ and 166 ± 4.49 $m{\cdot}min^{-1}$ and acceleration was 1.17 ± 0.08 $m{\cdot}s^{-2}$ and 1.18 ± 0.06 $m{\cdot}s^{-2}$, respectively. Table 1 depicts the intercepts and slopes for each age group and position for both speed and acceleration, where only between age group differences are shown. Between age groups, U16 hookers demonstrated a likely higher acceleration intercept (ES; ±00% CL = 0.74; ±0.78) than U18 hookers, and U16 halves had a likely lower acceleration than U18 halves (0.74; ±0.78). When comparing positions within age group, U16 hookers had a likely higher speed intercept than middle forwards (1.03; ±0.86). For acceleration, the intercept value was likely higher for U16 hooker compared to edge forwards (1.08; ±1.19), and very likely higher than fullbacks (1.89; ±1.56).

Table 1. Intercept and slope of global positioning system derived running intensity measures across playing age and position in elite youth rugby league players. Differences between age groups (within position) that are greater than 75% of the smallest worthwhile difference (0.2) are depicted.

		Intercept		Slope	
Age	**Position**	**Speed ($m \cdot s^{-1}$)**	**Acceleration ($m \cdot s^{-2}$)**	**Speed ($m \cdot s^{-1}$)**	**Acceleration ($m \cdot s^{-2}$)**
U16	Edge Forward	159 ± 10	1.13 ± 0.14	-0.24 ± 0.05	-0.21 ± 0.03
	Fullback	170 ± 11	1.04 ± 0.06	-0.21 ± 0.03	-0.16 ± 0.02
	Half	165 ± 11	1.14 ± 0.06*	-0.22 ± 0.03	-0.18 ± 0.03
	Hooker	174 ± 15	1.31 ± 0.17*	-0.25 ± 0.08	-0.2 ± 0.05
	Middle Forward	158 ± 15	1.16 ± 0.12	-0.23 ± 0.04	-0.21 ± 0.03
	Outside Back	167 ± 15	1.19 ± 0.08	-0.25 ± 0.04	-0.19 ± 0.03
U18	Edge Forward	159 ± 13	1.18 ± 0.16	-0.23 ± 0.03	-0.21 ± 0.04
	Fullback	163 +± 18	1.04 ± 0.07	-0.23 ± 0.04	-0.16 ± 0.03
	Half	162 ± 18	1.21 ± 0.13	-0.21 ± 0.03	-0.17 ± 0.02
	Hooker	166 ± 15	1.19 ± 0.13	-0.23 ± 0.07	-0.19 ± 0.04
	Middle Forward	158 ± 12	1.17 ± 0.11	-0.24 ± 0.05	-0.21 ± 0.04
	Outside Back	167 ± 17	1.20 ± 0.18	-0.23 ± 0.03	-0.19 ± 0.03

Compared to the same position within the U18 age group, * Difference between age groups (within positional group) that is >75% of the smallest worthwhile difference.

Discussion

The purpose of this research was to differentiate the speed and acceleration demands of youth rugby league competition by age and positional groups using power law (3), with the overall aim of assisting practitioners to create accurate training prescription for running demands. Interestingly, there were no substantial differences between age groups for speed intercept and slopes, together demonstrating that manipulating simply the running intensity (i.e. speed) according to age group or positional groups may not be necessary. It must be noted that this recommendation is purely from a physical perspective (i.e. speed), and as such manipulating drills, particularly positionally still may have benefits from a tactical and tactical point of view. Regarding acceleration, acceleration intercepts varied between age groups for halves and hookers, although the respective slopes were not substantially different. As such, peak acceleration intensity may alter between age and positions, although the manipulation of this in terms of training prescription is however questionable. The findings of this study provide useful data (intercept and slopes) that can directly assist in the accurate prescription of sport-specific training drills aimed at proving the correct stimulus they face during competition.

Maximal mean speeds (one minute) for U16 and U18 were 169 ± 5.02 $m \cdot min^{-1}$ and 166 ± 4.49 $m \cdot min^{-1}$ respectively, which are similar to that reported in senior professional rugby league (8). This demonstrates that the running intensity (i.e. speed) does not largely alter between age groups, potentially reflecting a more 'open' style of play within youth rugby league when compared to seniors. Further, as depicted in Table 1, the intercept and slope values are presented, demonstrating no substantial difference in the speed intercept and slopes between age groups, which is a comparable finding to that within elite youth soccer (1). This is an important practical application, as this suggests that age specific training drills that target speed may not be necessary, but also positional specific training drills (with the purpose of manipulating speed) are may also not be necessary, given the lack of differences between speed slopes.

When comparing the one minute maximal mean acceleration to that of senior rugby league athletes,9 the data presented for both U16 (1.17 ± 0.08 $m \cdot s^{-2}$) and U18 (1.18 ± 0.06 $m \cdot s^{-2}$) are markedly lower (1.25 ± 0.14 $m \cdot s^{-2}$), suggesting that as age increases, acceleration intensity increases. When considering the acceleration intercept value, this research demonstrated some age group differences, where U16 hookers had a higher acceleration intercept than U18 hookers, and U18 halves had a higher acceleration intercept than U16 halves. These data suggest that peak acceleration intensity may vary, thus highlighting the importance to accurately quantify acceleration in team-sports such as rugby league (4). This finding potentially reflects a change in the style of play (i.e. less 'open', increased line speed) to that of senior competition. Despite these differences in acceleration intercepts, when using power-law to prescribe drills using the values presented, it may not be practically feasible to separately prescribe according to age or positional group, further reflected by the lack of substantial differences between acceleration slope values. For example, regarding acceleration, when using the intercept and slope values provided, a 12- minute drill for U18 halves is 0.79 $m \cdot s^{-2}$, whereas for U16 halves is 0.73 $m \cdot s^{-2}$, demonstrating that when prescribed as a function of time, there is limited difference in planned intensity of the drill. Given there were no within-age positional differences, this further reiterates that positional-specific prescription may not be necessary within elite youth rugby league athletes purely from a physical perspective. However, practitioners may wish to manipulate drills between age and positional groups as to appropriately train technical and tactical abilities, however this is beyond the scope of this report.

Practical Applications

- These data can be used directly to calculate the equivalent speed and acceleration for training prescription, ensuring athletes are prepared to compete at match intensity.
- When using power law to prescribe intensities, it may not be necessary to separately prescribe according to age or positional group from a physical perspective.

Limitations

- Only athletes from one club was included in the analysis, potentially reflecting the clubs' style of play, and further limiting the size of the dataset.

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