EFFECT OF BIRTH DATE ON PLAYING TIME DURING INTERNATIONAL HANDBALL COMPETITIONS WITH RESPECT TO PLAYING POSITIONS

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Abstract:

While a relative age effect (RAE) has been reported in handball, such analyses do not consider actual playing time during competitions, which may actually have more impact on performance in matches. The objective of the present study was to examine the RAE on playing time during international competitions with respect to playing positions. Team compositions (477 players) of the quarter finalists of the 2012 Olympic Games, 2013 World Championships, and 2014 European Championships were analyzed. Month and year of birth where collected in the starting list of each team for center, left and right backs, left and right wings, goalkeepers and pivots. Players were categorized into birth quartile (Q1 Jan–Mar; Q2 Apr–Jun; Q3 Jul–Sep; and Q4 Oct–Dec) and as odd/even year. Playing times were retrieved from official statistics. Data were analyzed for practical significance using magnitude-based inferences. We observed a strong selection bias towards players born earlier within a two-year selection period for all playing positions (Chi-square, $p<.001$). There was, however, an inconsistent effect of age (i.e. expected, reversed or a lack of it) on actual playing time during competitions. In conclusion, the present study showed for the first time that, despite its large effect on players' selection, players' relative age had a limited and position-dependent effect on their actual playing time during top-level competitions. Present findings suggest that the reasons supporting the relative age effect with respect to team selection are at odds with the current utilization of players by coaches in the field.

Key words: *relative age effect, team selection, main competitions*

Introduction

Handball is an Olympic sport played across the world. There are more than 52 millions of players, many professional leagues in Europe (e.g. Germany, Spain, France) and international events with a very large audience (e.g. in 2012, the Men's EHF EURO held in Serbia reached a cumulative television audience of 1.47 billion spectators; Infront-Sport, 2012). National federations and professional teams are constantly striving to improve players' development and selection process. While playing handball at the elite level requires multiple attributes such as strength, speed and aerobic capacities to respond to game demands (Karcher & Buchheit, 2014), minimal body dimensions and technical and tactical qualities are also required for successful handball participation (Karcher, Ahmaidi, & Buchheit, 2014).

During childhood and adolescence, it is common to observe large differences between players with respect to their body dimensions, strength and speed qualities. These differences are mainly due to variations in players' maturation timing, and could therefore bias talent identification programs (taller/stronger players might be selected in priority, irrespective of their actual 'talent') (Vaeyens, Lenoir, Williams, & Philippaerts, 2008). In order to reduce this selection bias, national organizations have divided young players into age groups. However, despite this organization, some athletes are still disadvantaged within single age groups (Cobley, Baker, Wattie, & McKenna, 2009) for maturational (Carling, Le Gall, Reilly, & Williams, 2009), psychological or social reasons (Hancock, Adler, & Cote, 2013). The well-known relative age effect (RAE) refers to an asymmetry in the birth date distribution favoring players born earlier in the age-group (Cobley, et al., 2009). Importantly in handball, since team selections for international youth competitions can include players born over a 2-year period, the older players born during even years always remain the older players within the selection panel. In agreement with this, birth dates have been shown to play an important role for team selection

in handball, both within (month of birth; Schorer, Cobley, Busch, Brautigam, & Baker, 2009) and between (odd vs. even year of birth; Schorer, Wattie, & Baker, 2013) competitive seasons in young players. However, since technical, tactical, physiological demands (Karcher & Buchheit, 2014), as well as laterality (Schorer, et al., 2009) and anthropometric (Karcher, et al., 2014) requirements are largely playing-position-dependent, playing positions should be taken into account when examining the RAE in handball. In fact, the RAE is likely more pronounced for some positions with high physical and anthropometric requirements such as pivots or back positions, than for others with fewer requirements, e.g. wings. It has been reported recently that the distribution of birth quartile was different between positions (i.e. an overrepresentation of the two first quartiles for backs, but a reversed effect for pivots and goalkeepers, and no effect for wings) (Schorer, et al., 2009). The only study on the impact of the year of birth on national team selection (Karcher, Ahmaidi, & Buchheit, 2013) showed an uneven distribution for all positions (except for right backs) in favor of players born during even years.

A limitation of the classical RAE studies, however (i.e. players' distribution within a team roster) (Schorer, et al., 2009, 2013; Karcher, et al., 2013), is that the actual playing time during competitions was not considered. Team composition and effective playing time are two different variables. In contrast to soccer, for example, players' rotations are unlimited in handball and can occur at any time during matches. For instance, more than 26 rotations can occur during a match (Karcher & Buchheit, 2014), which shows that coaches often modulate their team composition on the court based on matches' technical/tactical demands and score line. Considering that players' total time on the court during elite competitions may better reflect players' efficiency than actual teams' composition, examining the RAE effect on playing time may open the door to a more practical understanding of selection biases in handball. The objective of the present study was therefore to examine the effects of month and year of birth on playing time during international competitions with respect to playing positions.

Methods

Experimental approach

The team composition and the individual dates of birth and playing times (to the nearest minute) of the quarter finalists at the 2013 World Championships, the 2012 Olympic Games and participants of the main round from the 2014 European Championships were retrieved from official statistics and analyzed (IHF, 2012, 2013; EHF, 2014). Analyses were restricted to these teams to ensure a very high level of expertise: handball is mainly a European sport (e.g. only 15 non-European teams have qualified to the second round of the World Championships since 2001, while they had 96 opportunities to do so), and RAE have been shown to be stronger in highly competitive sports (Cobley, et al., 2009).

Subjects

All the data collected (477 total entries) were grouped by position, i.e. center (n=66), left (n=91) and right (n=62) backs, left (n=55) and right (n=54) wings, goalkeepers (n=63) and pivots (n=85). Data resulted from the 331 different players – center (n=46), left (n=61) and right (n=44) backs, left (n=37) and right (n=37) wings, goalkeepers (n=45) and pivots (n=61), aged 28.8±4.3 (20-41) years.

Procedures

Since handball competitions are usually organized over 2-year age groups, players were categorized into eight birth quartiles (Q1 for January to March, Q2 for April to June, Q3 for July to September, and Q4 for October to December for the even year and as Q5 for January to March, Q6 for April to June, Q7 for July to September, Q8 for October to December for the odd year). To increase sample size for between-position comparisons, we merged players into semesters within two years (S1 for Jan-Jun, S2 for Jul-Dec of the even years and as S3 for Jan-Jun, S4 for Jul-Dec for odd years).

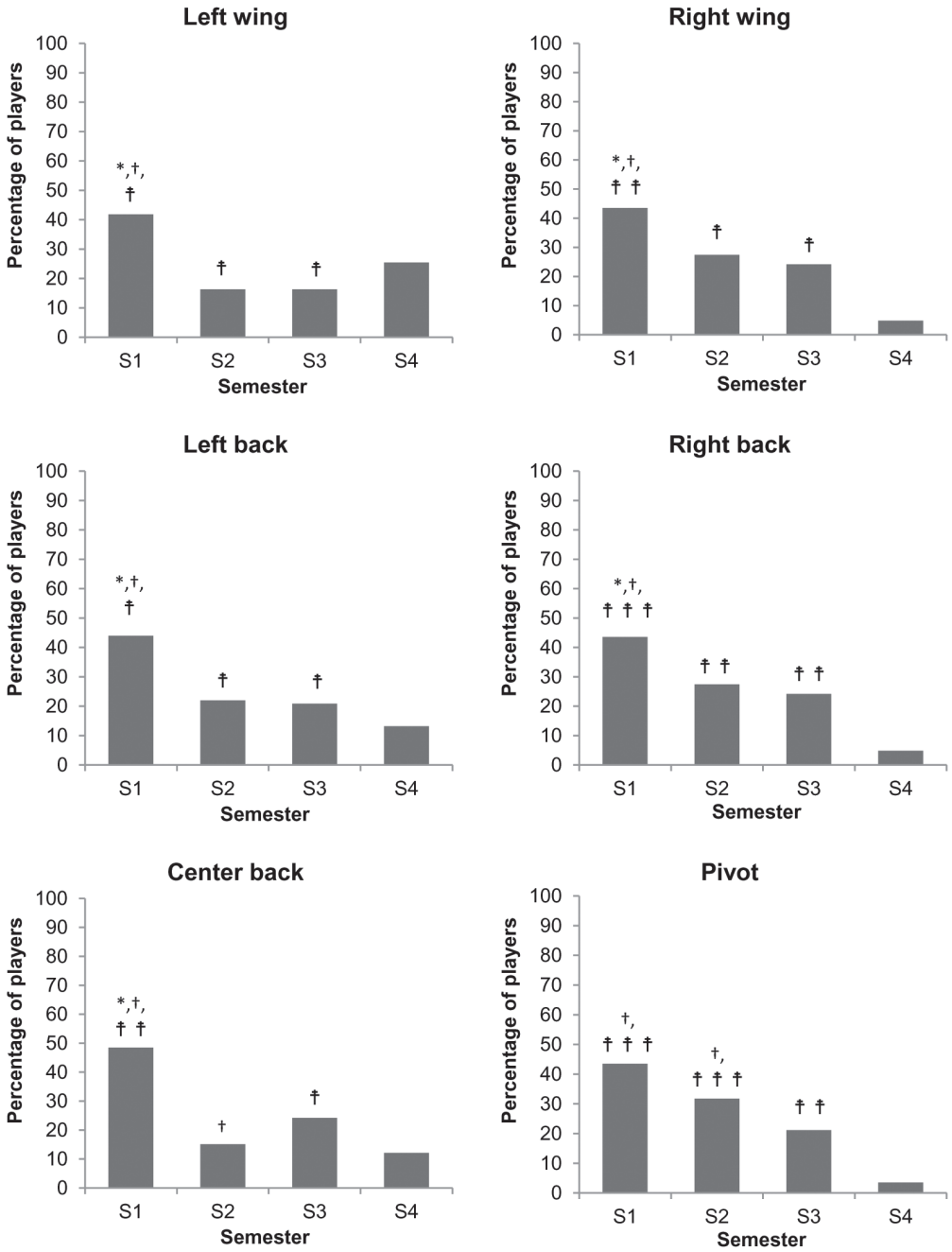
Statistical analyses

Chi-square (χ^2) analyses were used to test the birth distribution for players related to team selection and overall match playing time, without or with respect to playing positions. Chi-square statistics, however, do not reveal the magnitude and direction of an existing relationship. Significant chi-square values were therefore followed with the calculation of odds ratios and 90% confidence limits (CL) for the quartile/semester distributions in order to examine subgroup differences with respect to the bias of the birth-date distribution. Differences in playing time as a function of quartile/semester of birth were analyzed for practical significance using magnitude-based inferences. Confidence intervals (90%) for the standardized (Cohen's effect size) between-group differences were estimated (Hopkins, Marshall, Batterham, & Hanin, 2009). Probabilities were used to make a qualitative probabilistic mechanistic inference about the true differences: if the probabilities of the differences being substantially greater and smaller than the smallest worthwhile difference (0.2 of the between-player SD) were both >5%, the effect was reported as unclear; the effect was otherwise clear and reported as the magnitude of the observed value. Possible differences in playing time distribution (i.e. more or less than 50% of match time) between quartile/

semester of birth were also analyzed by calculating odds ratios and 90% CL. The magnitudes of the odds ratio were interpreted using Hopkins scale (Hopkins, et al., 2009). All statistical analyses were conducted using Microsoft Excel (Microsoft, Redmond, WA, USA).

Results

There was a clear bias ($p<.001$) in the birth distribution towards players born in the first semester of the 2-year period for all positions (Figure 1). Conversely, the effect of the date of birth on playing time for all the positions merged was limited, both when considering absolute playing time (i.e. only a likely small difference for Q7 vs. Q2, ES=0.39) (Figure 2a) or playing time distribution (Figure 2b). The effect of the date of birth on mean playing time within each playing position showed inconsistent results (Figure 3). Left wings born during the 3rd semester played very likely slightly-to-moderately more than players born during other semesters (S3 vs. S1, ES=1.05; S3 vs. S2, ES=1.13; S3 vs. S4, ES=1.33). Similarly, the effect of the birth date on the likelihood of playing more than 50% of the match time showed contrasting results. Left wings from the 3rd semester had slightly-to-moderately more chance to play more than 50% than players from other semesters (S3 vs. S1, OR=3.21; S3 vs. S2, OR=4.38). Left backs from the 1st semester had slightly-to-moderately less chance to play more than 50% of the games than players born later (S1 vs. S2, OR=3.08; S1 vs. S3, OR=3.29; S1 vs. S4, OR=8.81).



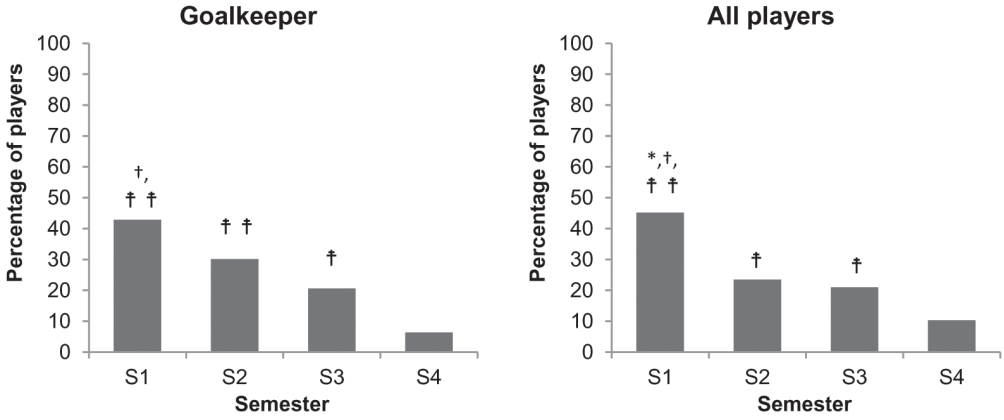


*Figure 1. Percentage of players born per semester within a 2-year selection period with respect to playing positions. S1 for January to June, S2 for July to December for even years and S3 for January to June, S4 for July to December for odd years. The magnitude of the odds ratio between the different variables is indicated by the number of symbols: 1 symbol stands for a moderate difference, 2 symbols for a large difference, 3 for a very large difference. Substantial difference: * for a difference vs. S2, † vs. S3, and ǂ vs. S4.*

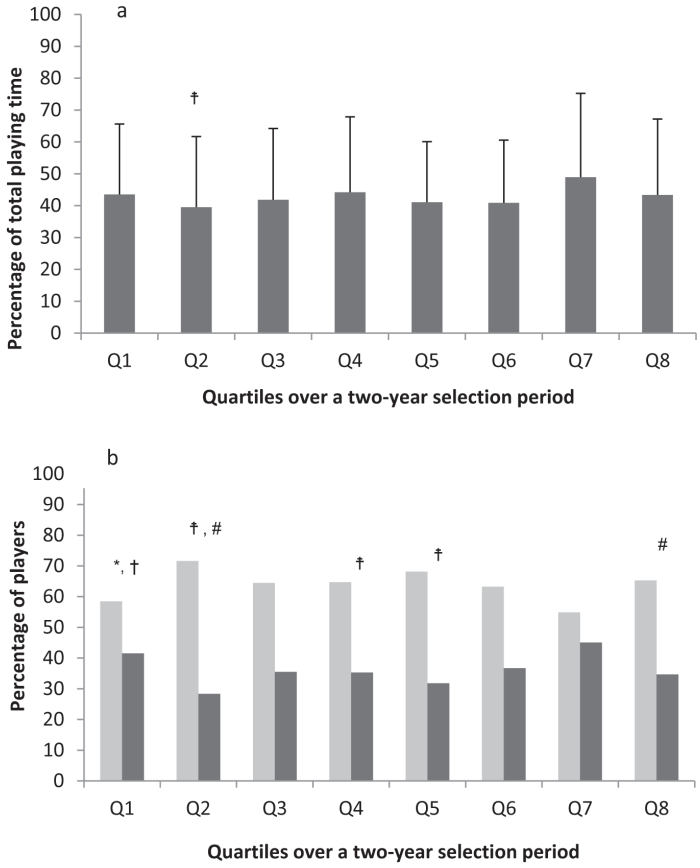


*Figure 2. (a) Average playing time (SD) expressed as a percentage of total playing time with respect to the quarter of birth over a two-year selection period. (b) Percentage of players playing less (dark bars) or more (light bars) than 50% of the total playing time, with respect to their quarter of birth. The magnitude of the between-quarter standardized differences and the odd ratios between the % of players playing less or more than 50% of match total time is indicated by the number of symbols: 1 symbol stands for a moderate difference, 2 symbols for a large difference, 3 for a very large difference. Substantial difference: * difference vs. Q2, † vs. Q5, ǂ vs. Q7 and # vs. Q8.*

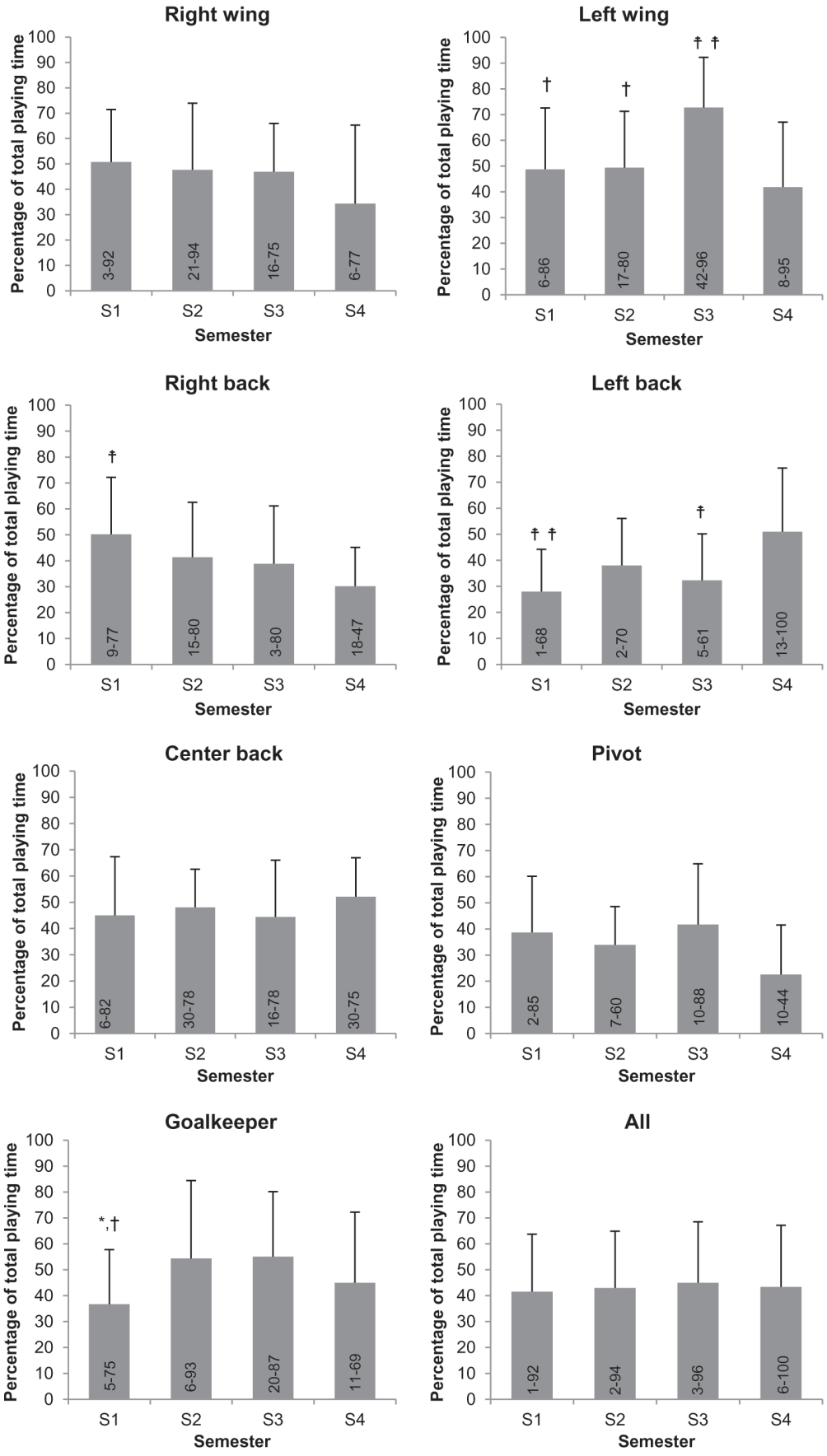


*Figure 3. Average playing time (SD) expressed as a percentage of total playing time being the function of the semester of birth with respect to playing positions. The numbers in the bars indicate playing time range. The magnitude of the standardized differences (effect size) between the different semesters is indicated by the number of symbols: 1 symbol stands for a moderate difference, 2 symbols for a large difference, 3 for a very large difference. Substantial difference: * vs. S2, † for S3, ǂ for S4.*

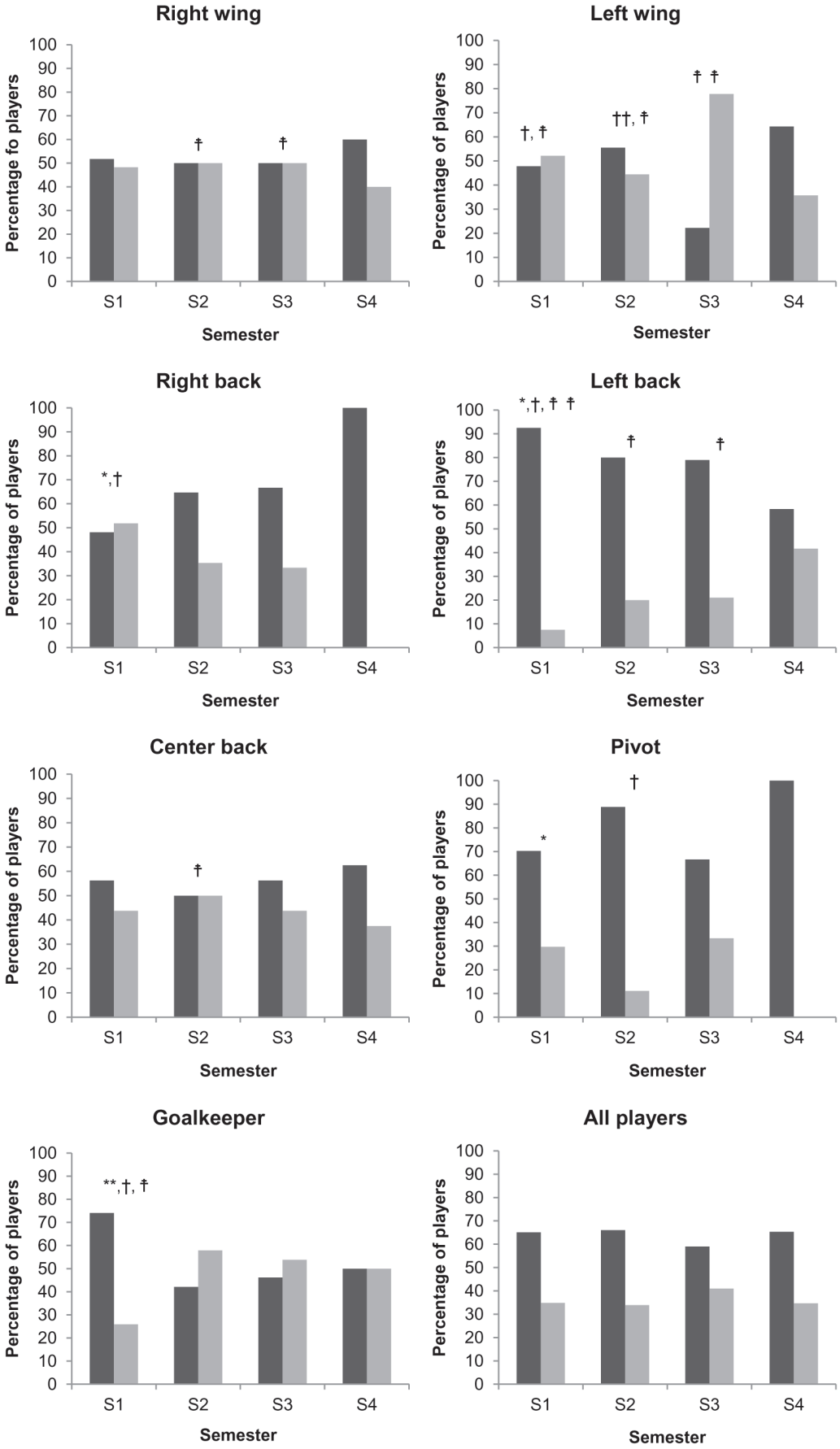


*Figure 4. Percentage of players spending less (dark bars) or more (light bars) than 50% of the total playing time with respect to their semester of birth over a two-year selection period, within each playing position. The magnitude of the odd ratios between the different variables is indicated by the number of symbols: 1 symbol stands for a moderate difference, 2 symbols for a large difference, 3 for a very large difference. Substantial difference: * vs. S2, † vs. S3, ŧvs. S4.*

Discussion and conclusions

The main purpose of this study was to determine whether the trimester or semester of birth within a two-year selection period influences player's selection in top national handball teams, as well as player's respective playing time when considering playing positions. The main observations were: 1) a strong selection bias towards players born earlier within a two-year selection period for all playing positions, and 2) an inconsistent effect of age (i.e. expected, reversed or a lack of it) on actual playing time during competitions.

We observed a strong selection bias consistently across all positions towards players born earlier within a two-year selection period (Figure 1). These results are in agreement with the within-year and within-two year RAE favoring relatively older players reported across Europe in soccer (Helsen, et al., 2012) and handball (Schorer, et al., 2009; Karcher, et al., 2013), respectively. Our results contrast, however, with other studies, where the RAE was reduced at the elite level in Australian Rules Football (Coutts, Kempton, & Vaeyens, 2013), soccer (Vaeyens, Philippaerts, & Malina, 2005) and in a variety of other sports (Cobley, et al., 2009). While there are clear evidences of RAE in many sports where strength and power are important physical capacities (Cobley, et al., 2009), an absence of it or a reversed RAE has also been observed within certain contexts – related to nationality, gender, age or playing position – in sports where the traditional RAE is predominant (Delorme, Boiché, & Raspaud, 2009; Schorer, et al., 2009; Williams, 2010; Romann & Fuchslocher, 2013). These studies suggest that certain contextual factors can influence the RAE and, in some cases, subgroups may exist which defy the typical birth distribution biases in these sports. It is therefore possible that the organizational pattern of international handball events (i.e. including players born over a fixed 2-year period in youth national teams) may explain those results (Schorer, et al., 2013).

A novel finding of the present study is that playing time was not dramatically affected by the semester of birth when pooling all players together (Figure 2a). We only observed a slightly longer playing time for players born in the 7th semester (i.e. between July and September of the second year) when compared with those born in the 2nd semester (i.e. between April and June of the first year). The likelihood to play more than 50% of total playing time tended to be greater for players born in the beginning or at the end of the two-year period, but, on the whole, there was little impact of the semester of birth on playing time distribution (Figure 2b). These data contrast with what would be expected at first, i.e. older players playing more. In fact, players born earlier in the periods are expected to have benefited from better training conditions (Hancock, et al., 2013), to have played more in their young age, and, due to the mentioned, to have finally turned into better players. Our data show for the first time that if the RAE applies to team selection (Figure 1), it does not clearly and consistently affect playing time (Figure 2a and b). This suggests that once selected, all players are likely to have the same chances to play, and/or differences in playing time might be more related to technical considerations than age *per se*. It is also possible that players born later in the periods may have gone through a more severe selection process earlier during their career, and those who 'survived' may have therefore matched their older team-mates' skills and efficiency, and may have developed specific mental abilities (Collins & MacNamara, 2012). However, because of the very large between-position-differences in game demands (Karcher & Buchheit, 2014) and players' body dimensions (Karcher, et al. 2014), within-position RAE analyses are probably of greater importance. In other words, the RAE might be more pronounced for some positions (with high physical and anthropometric requirements such as pivots or back positions) than others (with fewer requirements, e.g. wings). The following paragraph will tend to address this issue.

The effect of the semester of birth on mean playing time (Figure 3) and the likelihood of playing more than 50% of total match time (Figure 4) was different within each playing position. Surprisingly, left backs showed a reversed RAE, although this position requires speed, power (Karcher & Buchheit, 2014) and specific anthropometric (Karcher, et al., 2014) qualities, which are expected to be more developed in older players. A possible explanation for these surprising findings may be related to the fact that this group of relatively younger players may have benefited from a more favorable (less competitive) environment to develop better technical skills (Burgess & Naughton, 2010). In contrast, an 'expected' RAE was observed for right backs. Since tall and left-handed players are not common in general population (Raymond & Pontier, 2004), they are generally the first target of scouting teams in handball (Karcher, et al., 2014). It is therefore possible that within such a reduced pool of players, the taller and/or more advanced players received greater attention at the start of their career, and may have turned into better players (who, in turn, play more today).

It is worth noting that some of the differences observed may actually not be a reflection of actual RAE trends, but may rather be related to i) the small sample size examined for some semesters due to the unequal birth distribution (e.g. left wings, S1 n=23, S2 n=9, S3 n=9, S4 n=14), and ii) the very large range of playing time (e.g. left backs: 13-100%). Additionally, in some teams some key players may sometimes play for almost the entire

match time, which likely biases the results for their respective playing position. For example, during the 2012 Olympic Games, M. Hansen (Denmark) played 99.7% of the entire tournament time; his individual statistic clearly affect the playing time profile of left backs born in the 4th semester (Figure 3 and 4).

In conclusion, the present study showed for the first time that despite its large effect on players' selection, players' relative age had a limited and position-dependent effect on their actual playing time during top-level competitions. The current findings suggest that the reasons supporting the relative age effect with respect to team selection are at odds with current coaches' practice in the field, i.e. the supposed 'superiority' of older players is not consistently reflected by their playing efficiency during matches (i.e. utilization by coaches). Future research should include groups with a larger sample size and examine the impact of the relative age on playing time in younger categories, where some large variations in physical and anthropometric variables exist between players born within 1- or 2-year periods. Longitudinal studies are also required to examine the consistency of the observed trends, since some international players may play at the same position and in the same team for more than 10 consecutive years.

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UTJECAJ DATUMA ROĐENJA NA VRIJEME PROVEDENO U IGRI TIJEKOM MEĐUNARODNIH RUKOMETNIH NATJECANJA S OBZIROM NA IGRAČKU POZICIJU

Iako je utjecaj relativne dobi igrača potvrđen u rukometu, takve analize ne uzimaju u obzir stvarno vrijeme provedeno u igri tijekom natjecanja, a što može snažnije utjecati na uspješnost tijekom utakmice. Cilj je ovog istraživanja bio utvrditi utjecaj relativne dobi igrača na vrijeme igranja tijekom međunarodnih natjecanja s obzirom na igračku poziciju. Analizirane su postave nacionalnih selekcija (477 igrača) koje su igrale četvrtinu finala na Olimpijskim igrama 2012. godine, Svjetskom prvenstvu 2013. te Europskom prvenstvu 2014. godine. Informacije o mjesecu i godini rođenja za srednje, lijeve i desne vanjske igrače, lijeva i desna krila, vratare i kružne napadače prikupljeni su iz službenih startnih popisa svake momčadi. Igrači su podijeljeni u kvartile definirane prema datumu rođenja (Q1 – siječanj do ožujak, Q2 – travanj do lipanj, Q3 – srpanj do rujan i Q4 – listopad do prosinac) te prema tomu jesu li rođeni u parnoj ili neparnoj godini. Vrijeme provedeno u igri za svakog igrača dobiveno je iz službenih statistika. Veličina učinka analizirana je u odnosu na minimalnu značajnu praktičnu vrijednost. Uočili smo snažnu selekcijsku pristranost prema igračima koji su rođeni ranije unutar dvogodišnjeg selekcijskog perioda za sve igračke pozicije (χ^2, $p<0,001$). Ipak, utvrđen je i nekonzistentan utjecaj dobi (tj. očekivan, suprotan ili izostanak utjecaja) na stvarno vrijeme igranja tijekom natjecanja. Zaključno, ovo je istraživanje prvi put pokazalo da, usprkos velikom utjecaju na selekciju igrača, relativna dob igrača ima ograničen te o pozicijama ovisan utjecaj na stvarno vrijeme igranja igrača tijekom velikih natjecanja. Rezultati pokazuju da su razlozi za podržavanje utjecaja relativne dobi igrača u kontekstu selekcije igrača u ekipu u suprotnosti s trenerovim stvarnim korištenjem igrača.

Ključne riječi: *utjecaj relativne dobi, selekcija momčadi, veliko natjecanje*