Innovations

The Association between Anthropometry, Physical, and Technical Skills and the Relative Age Effect on Gondar City Soccer Players Development Program

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Abstract: *The purpose of this study was to assess how young Gondar city soccer players' anthropometry, physical attributes, and technical performances were affected by their relative age. Cross-sectional research design was employed for this study. In the current study, 150 Under-17 and 90 Under-15years' players participated. These were further classified into quartiles based on the year of birth. Measurements of technical skills, physical fitness, and anthropometric dimensions were taken. The results showed that 68.5% of soccer players were born in the first half of the year (X^2= 9.012, p = 0.0432). Similarly, in both categories, no discernible variations were found in anthropometry, physical performance, or technical proficiency. According to these findings, there should be a greater percentage of young Gondar citysoccer players who were born in the first few months of the year, but from an anthropometric, physical, and technical standpoint, RAE does not always imply an advantage.*

Key words: *Anthropometry; Performance; Soccer; Physical fitness*

Introduction

Research has demonstrated that in various sports, the relative age effect (RAE) provides advantages to athletes who are generally older when it comes to opportunities for talent identification and development (Baker, Schorer, & Cobley, 2010). The difference between a person's birth date and a cut-off date used to categorize children and adolescents is referred to as their "relative age" (Simmons &Paull, 2001). An individual who was born in September is nearly one year older than an individual born in Pagumie (Pagumie is the thirteenth month in Ethiopian calendar which contains only five days). For instance, in an age-based system where

September 1st serves as the cut-off date, RAE may be seen as prejudice against athletes who were born later in an age cohort since it can result in selection bias because of physical, cognitive, psychological, and social characteristics (Dixon, Horton, & Weir, 2011; Musch & Grondin, 2001). The long-term effects for professional sports are evident given that selection bias in kids' and young sports may result in non-selection and talent dropout (Baker et al., 2010). Tactical, technical, functional, and psychosocial aspects interact to determine soccer performance (Williams & Reilly, 2000). For researchers and coaches involved in the process of identifying, selecting, and developing young soccer players, comprehending and explaining the variability of these factors and their relationship with soccer performance in various age categories have been a significant challenge (Vaeyens, Philippaerts, & Malina, 2005). The recommended selection year for international sports events is January 1st of each calendar year, as proposed by the Federation International de Soccer Association (FIFA) (Helsen, van Winckel, & Williams, 2005). Thus, young soccer players can compete in a certain competitive category if they were born between January 1 and December 31 of that year. The goal of this process is to create a more equitable training and sporting environment where practitioners have equal possibilities to succeed (Cobley, Baker, Wattie, & McKenna, 2009; Malina, Bouchard, & Bar-Or, 2004). The aim of this process could be conditioned by notable inter-individual differences concerning growth, development, and biological maturation, which are particularly noticeable during childhood and adolescence.

In team sports like soccer, the relative age effect or RAE, is a well-known phenomenon (Helsen et al., 2005; Musch & Grondin, 2001; Vaeyens et al., 2005). RAEs can be found in junior, young representative, professional, and other soccer participation criteria. They are distinguished by an overrepresentation of players who were born earlier in their selection year (Helsen et al., 2005; Mujika, Vaeyens, Matthys, Santisban, Goiriena, & Philippaerts, 2009). As a result, players who are semi-professional and recreationally older are given more opportunities to play (Vaeyens et al., 2005). Additionally, in U-17 national championships, having an older squad has been linked to a higher final league ranking (Barnsley, Thompson, & Barnsley, 1985). The primary theory explaining RAE has been the existence of variations in biological and physical maturation. Coaches choose athletes who are physically more qualified since older athletes typically exhibit higher physical features and reach puberty earlier than their younger counterparts (Cobley et al., 2009; Gil, Badiola, Bidaurrazaga-Letona, Zabala-Lili, Gravina, Santos-Concejero, et al., 2014; Malina et al., 2004; Musch & Grondin, 2001).

The first identification of RAE occurred in Canada as a result of the bias introduced in the birth date distribution of young hockey players chosen for national teams; the

most represented groups were those born in the first quarter of their corresponding birth year (Barnsley et al., 1985). Although the root causes of the RAE in a soccer context have not been identified through empirical research, it is generally accepted that players who were born in the first few months of the year have a physical advantage because of normative growth and/or biological maturation as well as more playing experience from their early participation. Thus, the maturation-selection hypothesis has been applied to this (Cobley et al., 2009; Helsen et al., 2005). This could lead to early selection and dropout for the comparatively younger, less biologically developed, but equally motivated players. Coaches and selectors are becoming increasingly concerned that talented soccer players who are developmentally delayed may not make it through the early phases of the sport. There have been few systematic attempts to investigate the physical and anthropometrical advantages claimed for relatively older players despite the maturation-selection theory being frequently mentioned in relevant literature (e.g., Gil et al., 2014). According to an early consensus from this research, there aren't many anthropometric and performance differences between players who were born in the first and bottom quartile of their annual age groups at the representative level. Since best youth players born in the last three months of the selection year tend to be earlier matures (Deprez, Vaeyens, Coutts, Lenoir, & Philippaerts, 2012; Deprez, Coutts, Fransen, Deconinck, Lenoir, Vaeyens, et al., 2013; Sherar, Baxter-Jones, Faulkner, & Russell, 2007), enabling them to compete in absolute terms with their relatively older peers, it has been implied that coaches and talent selectors are biased towards players with advanced physical attributes.

The aim of this study is to ascertain the relative importance of the physical advantages that comparatively older players possess concerning physical fitness and anthropometry as well as whether these variations occurred between age groups each year. Such data is required to better comprehend the factors that affect the representative youth soccer talent selection process and how those factors might change as a player progresses through the developmental stages. A large sample of Gondar city soccer project trainees in different age groups i.e. U13–U17 players were looked at in order to achieve this goal. Given the contradictory results and dearth of studies on the subject, more research should be done on this topic in Ethiopian soccer players generally and in the young Amhara Region specifically. To the best of the knowledge of this researcher, no study has shown how gender affects RAE at the project competition levels in the Amhara region. In order to better understand the RAE in project soccer players in the study area, this study focused on U-15 and U-17 age groups. According to earlier research (Baker et al., 2010; Cobley et al., 2009; Simmons & Paull, 2001; Vincent & Glamser, 2006) , there may be a relative advantage (RAE) among juvenile athletes, with a greater prevalence of the

RAE among male players. It's also expected that lower RAE magnitudes at the project level. Therefore, the purpose of this study was to look at how young Ethiopian soccer players' anthropometry, physical performance, and technical proficiency of Gondar City projects were affected by the birth quartile and the relative age effect.

Methods and materials

Study Design

For the current study a cross sectional study design was used.

Sample

In general, 240 male project soccer players were sampled, 90 from the Children category (U-15) and 150 from the young category (U-17) belonging to eight project teams that were registered in Gondar at regional-level.

Relative Age was used to gather data for the current study by classifying soccer players' birth dates into birth quartiles (Q1, Q2, Q3, and Q4). In terms of anthropometry, a single evaluator evaluated height, body mass, and skinfolds (triceps, sub scapular, and suprailiac) in accordance with the technique suggested by Lohman et al. (1988). Moreover, the Yo-Yo Intermittent Endurance Test, Level 2 was used to evaluate aerobic resistance in relation to physical performance (YY-IE2). The running-based anaerobic sprint test (RAST) was utilized to assess the relative anaerobic power. The time in seconds required for the longest sprints at five and thirty meters was used to calculate speed. Ultimately, the players' technical abilities (ball handling, dribbling, and precision of kicks) were assessed.

Data collection procedures

The study's data collection took place in February and March 2019, with three days in a week designated for test administration. Measurements of height, body mass, skinfolds, and physical fitness tests (speed at 5 and 30 meters and YY-IE2) were conducted on the first day. Tests for physical fitness, vertical leap, agility, and RAST were conducted on the second day. Technical skill tests were also used on the third day.

Statistical procedures

Measures of central tendency (mean) and dispersion (standard deviation) were used to present descriptive data. The expected distribution of birth quartiles (reference population) and the observed distribution (athletes) were compared using the Chi-square test (X2). In order to test differences in anthropometry (height, weight, and sum of skinfolds), physical performance (static jumps and countermovement, speed at 5 m and 30 m, YoYo-IE2, RAST), and technical performance (ball control, dribbling, and kicking accuracy) according to the birth quartile, multivariate analysis of covariance (MANCOVA) was used in each of the competitive categories

(U-15 and U-17). A covariate that was taken into account was the birth year (2003 and 2004 for U-17, and 2004 and 2005 for U-15). A paired comparison of averages, modified by the Bonferroni test, was employed in univariate analysis when MANCOVA revealed a statistically significant effect. The Pillai Trace test was used to perform a statistical analysis of F. The SPSS v.23 program for Windows was utilized in each analysis. The significant level was set at, $p < 0.05$.

Results

Table 1 displays the distribution of soccer players into birth quartiles based on competitive category. When all U-15 and U-17 soccer players were taken into account, athletes born in the first and second quartiles were more prevalent than those born in the third and fourth quartiles. Sixty-five percent (65%) of athletes were born in the first half of the year. In contrast to the reference population, there was no discernible variation in the quartile birth date distribution in the category-specific study.

Table 1. Distribution of birth date quartiles of U-15 and U-17 soccer players compared to the reference population

Category	N	1st quartile	2nd quartile	3rd quartile	4th quartile	X^2
U-15	90	28	30	18	14	5.832
		-32.40%	-35.10%	-18.90%	-13.60%	p=0.11
U-17	150	40	65	30	15	3.019
		-26.70%	-35.60%	-22.20%	-15.50%	p=0.49
All	240	68	95	48	29	8.069
		-30.00%	-35.30%	-20.20%	-14.30%	p=0.0432

(X^2: chi-square test; 1st Quartile: Sep-Nov; 2nd Quartile: Jan-Feb; 3rd Quartile: Mar-May; 4th Quartile: Jun-Aug)

Tables 2 and 3 show the MANCOVA results for anthropometric characteristics and physical and technical fitness of U-15 and U-17 soccer players of different birth quartiles.

Table 2. Age, practice time, anthropometry and physical and technical performance of U-15 soccer players according to birth quartiles

Variables	1st quartile	2nd quartile	3rd quartile	4th quartile
	n=28	n=30	n=18	n=14
Chronological age (yrs)	14.81±0.14*	14.57±0.13*	14.02±0.18*	13.98±0.21*
Years of practice(yrs)	2.39±1.56	2.06±1.34	2.65±1.07	2.70±1.91
Anthropometry				
Height (cm)	157±12.56	156±12.01	155±16.52	158±19.50
Weight (kg)	46.92±5.09	43.85±4.43	44.66±9.85	46.15±3.43
∑ skinfolds (mm)	36.75±36.56	29.32±4.96	39.00±8.10	26.32±6.79
Physical performance				
Static jump (cm)	31.17±3.624	31.96±4.29	28.99±5.02	32.84±6.84
Speed at 5 m (sec)	1.20±0.16	1.17±0.15	1.20±0.22	1.18±0.26
Speed at 30 m (sec)	4.70±0.62	4.70±0.0.59	4.88±0.82	4.59±0.96
YY-IE2 (meters)	792±696.19	799±665.78	909±915.91	861±1081.36
RAST (w/kg)	7.73±3.43	8.14±3.29	7.99±4.52	8.90±5.33
Technical performance				
Control (touches)	58.35±18.99	42.79±16.4	43.14±17.62	56.50±11.63
Conduction (sec)	17.10±3.57	19.14±3.41	18.68±4.69	18.05±5.54
Precision (score)	7.72±5.95	8.46±5.69	5.69±4.83	8.90±3.25

Values adjusted by birth year 2003/2004,
***Significant difference among birth quartiles.**

In the linear combination of variables chronological age in birth quartile, differences were found between birth quartiles for both U-15 (F9.207=10,82; Pillai trace=0.96; p<0.001) and U-17 players (F9.120=7,90; Pillai trace=1.10; p<0.001).

The univariate analysis revealed that the chronological age difference in both competitive categories (U-15 - F3.69 = 260.27 p <0.001; U-17 - F3.40 = 192.07, p <0.001) was the cause of the birth quartile difference. Anthropometry (U-15: F 9.207 = 0.75; Pillai Trace = 0.09; p = 0.67; U-17: F9.120 = 0.47; Pillai Trace = 0.10; p = 0.89), physical fitness (U-15: F18.198 = 0.54; Pillai Trace = 0.14; p = 0.93; U-17: F18.111 = 1.11; Pillai Trace = 0.46; p = 0.35), and technical performance (U-15: F9.207 = 1.65; Pillai Trace = 0.20; p = 0.10, U-17: F9.120 = 0.75; Pillai Trace = 0.16; p = 0.66) were the only categories in which significant differences were seen between quartiles.

Significant differences were not observed among birth quartiles in relation to the practice time (U-15: $F_{3.43} = 0.32$; $p = 0.81$; U-17: $F_{3.30} = 0.75$; $p = 0.53$).

Table 3. Age, practice time, anthropometry and physical and technical performance of U-17 soccer players according to birth quartiles.

Variables	1st quartile	2nd quartile	3rd quartile	4th quartile
	n=40	n=65	n=30	n=15
Chronological age(yrs)	16.73±0.13*	16.29±0.12*	16.01±0.15*	15.83±0.18*
Years of practice(yrs)	6.10±5.76	4.21±4.61	3.67±7.21	5.25±8.00
Anthropometry				
Height (cm)	171.40±11.16	172.65±9.77	170.06±12.19	169.09±14.77
Weight (kg)	62.2±13.45	62.09±11.78	61.59±14.70	57.55±17.80
∑ skinfolds (mm)	39.1±20.82	38.69±18.23	41.27±22.90	37.10±27.55
Physical performance				
Static jump (cm)	28.57±7.27	28.72±6.37	27.81±7.95	27.39±9.63
Countermovement(cm)	34.62±7.54	33.29±6.60	33.43±8.24	31.96±9.98
Speed at 5 m (sec)	1.13±0.16	1.13±0.14	1.15±0.17	1.15±0.21
Speed at 30 m (sec)	4.43±0.52	4.56±0.45	4.63±0.57	4.42±0.69
YY-IE2 (meters)	833.83±558.80	994.10±489.22	700.34±610.37	921.58±739.37
RAST (w/kg)	9.24±1.98	8.56±1.73	8.06±2.16	8.77±2.61
Technical performance				
Control (touches)	58.98±68.3	51.49±59.82	58.76±90.64	55.54±90.41
Conduction (sec)	19.18±4.46	19.36±3.91	18.85±4.87	18.29±5.90
Precision (score)	7.35±5.64	8.34±4.94	8.40±6.16	10.34±7.46

Values adjusted by birth year 2004/2005, except for variable chronological age
* Significant difference among birth quartiles.

Discussions:

The presence of RAE in this group was confirmed by the results, which indicated that 68.5% of players were born in the first two quartiles. But when it came to anthropometry, physical and technical ability, individuals born in the first half of the selection year did not exhibit any appreciable advantages over those born in the second half. Mujika et al. (2009) and Gil et al. (2014) found comparable results on the presence of RAE in Spanish soccer players (55.3% and 66%, respectively), for Votteler and Honer in Germany (61%) and Deprez et al. (2012) in Belgium (64%). According to reports by Carling et al. (2014) in France (77%) and Massa et al. (2014) in U-14 (78%) and U-16 Brazil soccer players (71%), this asymmetry may be even more pronounced at more competitive levels. One of the potential causes of RAE has

been identified as competition during the selection process (Cobley et al., 2009). Soccer players born in the first quartile have doubled the chance of being selected in the Program of Identification and Development of Talents in Germany compared to those born in the fourth quartile. Athletes born on the first quartile have a four times higher chance of being selected for elite teams than those born on the fourth quarter. In a case study conducted at "São Paulo Futebol Clube," Massa et al. (2014) discovered that in Brazil, 50.8% and 41.9% of soccer players born in the first quartile in the U-14 and U-16 categories, respectively, compared to 6.3% and 12.9% in the 4th quartile, respectively. In Japan, great soccer players who were born in the first quartile accounted for 37.9% to 58.8% of the total, while those who were born in the fourth quartile made up 3.2% to 13.5% (Hirose, 2009). In Europe, comparable outcomes are noted for the U-15 to U-18 age groups. Birth quartile disparities are typically less in amateur and/or regional school-level teams, like the one in this study, where selection procedures are less stringent. RAE was not verified in the current study when the U-15 and U-17 categories were examined independently. Lack of significance in the values found may have to do with soccer players' lesser level of competition. However, RAE was verified in the U-15 category (67.5% born in the first semester) and the absolute percentage observed in the U-17 category (62.3% born in the first half) were comparable to those found in U-17 players who participated in FIFA's international events, according to the analysis by half (data not shown). Therefore, the problem of insignificance within categories is probably due to the small sample size, featuring a limitation of this study.

Another explanation about RAE is that the physical advantages of relatively older athletes (Cobley et al., 2009; Gil et al., 2014; Malina et al., 2004; Musch & Grondin, 2001) , of this hypothesis has not been confirmed by researchers. In this study, it was found that relative age has no influence on anthropometric characteristics and physical performance of U-15 and U-17 soccer players. Similar findings were reported by Carling et al. (2009), who discovered that, with the exception of height, there were no appreciable variations in birth quartiles for body weight and physical performance. Deprez et al. (2013) observed a trend of taller and heavier soccer players on the first quartile had no significant differences in anthropometry and aerobic fitness. The same authors did not find that birth quartiles had an impact on vertical jump performance or speed at 5 and 30 meters in another investigation. Gil et al. (2014), however, noted that soccer players born in the first quartile who were also larger and taller performed higher in agility and speed events. Malina et al. (2007) claimed that Soccer players born in the latter half of the second half were not always at a disadvantage compared to those born in the first half. There is a proof which confirms that athletes who are relatively young can do better than those who are older due to biological variability. Malina et al. (2007) claimed that the low pubertal variance within the sample was the potential reason of results and observed

no differences in U-14 soccer players' size, experience, physical attributes, or technical performance. According to Deprez et al. (2013), the sample homogeneity with regard to biological maturation was due to the variations in aerobic performance observed among players between the ages of 10 and 19. This study also proved that physical and physiological traits are significantly influenced by maturation, particularly throughout adolescence. Furthermore, it is hypothesized that younger soccer players benefit from a compensatory impact since they can physically compete with relatively older players as they tend to attain their maximal growth velocity earlier (Deprez et al., 2013). It's critical to realize that soccer success is a product of multiple performance factors interacting with one another rather than being primarily determined by one of them. Some writers make the observation that a young soccer player's shortcomings in one performance factor could be made up for by superior performance in another. According to Reilly et al. (2000), one should only be reasonable in the majority of performance dimensions rather than exceptional in all of them in order to be a successful soccer player. This study's drawbacks include its small sample size, particularly for the U-15 category, and its inability to extrapolate results to other categories or players at higher competitive levels. Furthermore, the participants' prior experiences such as their participation and practice in other sports prior to soccer were not controlled.

Conclusions

In this paper, the effect of relative age on anthropometry, physical and technical performance of young Gondar city soccer players was examined. It was also observed that the presence of RAE has no significant differences among birth quartiles for anthropometry, physical and technical performance of U-15 and U-17 soccer players. The causes and possible solutions related to RAE should be better investigated in future studies.

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