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Title:

Match Analysis of U9 and U10 English Premier League Academy Soccer Players using a Global Positioning System: Relevance for Talent Identification and Development.

Running head:

Match Analysis of Youth Soccer

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ABSTRACT

The purpose of this study was to examine the match activity profile of U9 and U10 elite soccer players and to establish if there were any differences between players who were subsequently retained or released by their clubs. Such information should prove valuable in the design of training programs for these very young players and in the talent identification and development process. A Global Positioning System was used to analyze 2-4 inter-academy 6-a-side matches of English Premier League Academy players (U9: N = 22 and U10: N = 12) who trained three times a week (4.5 h) . Speed zones were created based on 5 and 10 m sprint times and an independent sample t-test was employed for a statistical analysis.

Both squads covered ~4000 m in total or ~4700 $m \cdot h^{-1}$ during a match (NS between squads), with the U10s tending to cover a greater distance at moderate ($p = 0.10$) and high speeds ($p = 0.08$) than the U9s. Retained group covered a greater distance than released group (retained vs. released: 4478 ± 513 m vs. 4091 ± 462 m, $p < 0.05$) during a match and covered a greater distance during low speed running in absolute (1226 ± 259 m vs. 1005 ± 221 m, $p < 0.05$) and relative (1325 ± 235 $m \cdot h^{-1}$ vs. 1132 ± 210 $m \cdot h^{-1}$, $p < 0.05$) terms.

Thus, U9 and U10 players cover over 4000 m in match play and those players who are retained by academies cover a greater distance in total and at low speeds (2.1-3.1 $m \cdot s^{-1}$). This information may support the preparation of squad training programs and the talent identification and development process.

Key Words: association football, intermittent exercise, team sport.

INTRODUCTION

In youth soccer, Global Positioning Systems (GPS) have been commonly employed to analyze match running performance and most information is available for players between 11 and 16 years of age (6, 7, 11, 12, 15). For example, the U12 to U16 age groups (N = 20-25 in each group) from two English professional soccer clubs covered ~6200 $m \cdot h^{-1}$ (U12) to ~7000 $m \cdot h^{-1}$ (U15 and U16) during an 11-a-side match and the distances covered by high intensity running (with speed zones calculated using a 10 m flying sprint speed from the last 10 m of a 20 m sprint test) ranged from ~1800 $m \cdot h^{-1}$ for the U12 to ~2200 $m \cdot h^{-1}$ for the U16 (15). For 14 year old national youth players, the total distance covered during a match was ~6000 m and the players covered ~500 m by walking, ~3000 m by jogging, ~1650 m by medium intensity running, ~700 m by high intensity running and ~250 m by sprinting with the speed zones based on absolute speeds ranging from 0-0.4 $km \cdot h^{-1}$ for walking to over 18 $km \cdot h^{-1}$ for sprinting (11, 12). However, to date, there are no match analysis data on the distance covered for young elite players aged 9 and 10 years of age and no data concerning the distances covered in small sided games for these age groups. Thus the practical problem being examined here is to address the gap in the literature regarding the match distances covered in small-sided games by U9 and U10 age academy football players.

It has been argued that the players in the developing stages, such as 9 and 10 year olds, should not be considered as miniature adults (29) and hence, training programs should be specifically designed for these young players. Knowing the running distances during competitive matches for elite youth soccer players may support coaches and sports scientists to prepare training programs which are specific to the players' age and ability (9). Furthermore, if there is a difference between the match performance of young players who

are later retained or released by academies this information could assist in both the talent identification and development process.

A recent longitudinal study examined the anthropometric and performance characteristics that contributed to success in attaining full international appearances and/or a professional contract in U14-U16 French National Soccer Academy players. Those players who did gain an international appearance and/or a professional contract were taller and heavier and had a faster 40 m sprint speed, higher jump height and faster flying 10 m sprint speed (measured from the last 10 m of 40 m sprint) compared to players who did not gain a professional contract (21). However, whether or not performance during match play differs between players who at a later date are retained or released by academies has not been previously examined and studies comparing match distances run for players of different standards are only available for senior professional soccer players. Elite professional players have been shown to cover a 5 % longer total distance and 28% greater high intensity running during a match compared to moderate professional players (25). Thus the practical problem addressed in the present study is whether or not match analysis data in very young players can contribute to knowledge regarding which players at a later date may be retained by academies and thus can knowledge regarding match distances covered contribute to the talent identification and development process.

Therefore, the aims of the present study were: 1) to investigate the match performance of elite U9 and U10 soccer players; and 2) to examine if there was a difference in the match performance between retained and released youth soccer players. Based on the information available from previous research on older players, it was hypothesized that the U9 players would cover a shorter distance during match play than the U10 players and that the retained

players would cover a longer total distance and a longer distance at high speeds than released players during a match play.

METHODS

Experimental approach to the problem

As there was no match analysis data available at all for any standard of U9 and U10 players, an elite population was selected for the present study. The data was thought to be of value for clubs attempting to develop players to professional soccer standard and would provide a valuable comparison for later studies examining players competing at a lower level. Therefore, players were recruited from an English Premier League Academy, which represents the highest standard of youth development in England.

Match running performance of the U9 and U10 players and the same group of players divided into two groups of those who were subsequently retained and released by the academy was analyzed using a 1Hz GPS. The distances measured were categorized into speed zones which were walking, jogging, low speed running, moderate speed running and high speed running. All players participated in a 10 m sprint test with a 5 m split time and the results were used to calculate speed zones for each squad. The distances covered in each speed zone, the total distance covered and the percentage of time in each speed zone during a match were compared between the U9 and U10 squads to test the hypothesis that the U10s in comparison with the U9s and the retained in comparison with the released players would cover a greater total distance and a greater distance at high speeds.

The 1 Hz GPS has been previously shown to be both valid and reliable in terms of indicating the distance and speed covered by games players. The validity of GPS (1 Hz, SPI elite, GPSport, Australia) has been assessed using male and female adult games players (N = 9) using a circuit (487 m). They completed 14 laps in a trial and the circuit involved moving at

different speeds including walking to sprinting and various agility runs (8.5-52.3 m). The actual distance covered by the participants in the trial (6818.0 m) and the total distance measured by the devices only differed by 2.5 m and there was less than a 1% difference in the actual distance covered and the distance measured by the devices during agility runs (23). It is encouraging that the study attempted to replicate the movement patterns observed in field hockey, which has a similar movement pattern to soccer, and found very acceptable validity at the speeds and patterns of movement tested. For the reliability, intra- and inter- receiver coefficient of variation in 1 Hz GPS (SPI elite, GPSport, Australia) for the distance covered at speeds up to 5 $m \cdot s^{-1}$ is excellent at ~3% or less in both linear and non-linear movements. The coefficient of variation of 3% or less was also observed in linear movements at 7-8 $m \cdot s^{-1}$. Whereas the intra- and inter receiver coefficient of variation during non-linear movements at 7-8 $m \cdot s^{-1}$ was ~5% and ~6%, respectively (14).

Subjects

The participants in the study were U9 (N = 22, age: 9.1 ± 0.2 years, height: 136.2 ± 5.0 cm, body mass: 31.5 ± 3.6 kg, estimated chronological age at PHV: 12.8 ± 0.4 years (N = 19), 5 m sprint: 1.15 ± 0.04 s, 10 m sprint: 2.04 ± 0.07 s, Yo-Yo intermittent recovery test (level 1) performance: 1413 ± 245 m) and U10 (N = 12, age: 9.8 ± 0.4 years, height: 143.0 ± 5.7 cm, body mass: 36.6 ± 4.2 kg, estimated chronological age at PHV: 13.3 ± 0.2 years (N = 10), 5 m sprint: 1.14 ± 0.04 s, 10 m sprint: 2.03 ± 0.08 s, Yo-Yo intermittent recovery test (level 1) performance: 1427 ± 316 m) outfield players from an English Premier League Academy in the Midlands and they had at least 1 year of experience in soccer training and competition. There were 7 defenders, 3 midfielders, 7 strikers and 5 multi-position players in the U9 squad and 5 defenders, 4 midfielders, 2 strikers and 1 multi-position player in the U10 squad. When the players were separated into retained and released groups, there were 14 players in the

retained group (age: 9.3 ± 0.4 years, height: 138.6 ± 4.9 cm, body mass: 32.6 ± 3.9 kg, estimated chronological age at PHV: 12.9 ± 0.4 years, 5 m sprint: 1.14 ± 0.04 s, 10 m sprint: 2.02 ± 0.08 s, Yo-Yo intermittent recovery test (level 1) performance: 1431 ± 256 m) and 20 players in released group (age: 9.4 ± 0.5 years, height: 138.5 ± 7.0 cm, body mass: 33.7 ± 5.0 kg, estimated chronological age at PHV: 13.1 ± 0.4 years (N = 15), 5 m sprint: 1.15 ± 0.04 s, 10 m sprint: 2.05 ± 0.07 s, Yo-Yo intermittent recovery test (level 1) performance: 1408 ± 258 m). The players in the retained group were retained in an English Premier League Academy for at least two more seasons after the season in which the match analysis was completed. Within the released group, four players were released at the end of the season in which the match analysis took place, nine players were released during or at the end of the first season after the match analysis took place and seven players were released during or at the end of the second season after the match analysis took place. The players generally participated in three 1.5 hour technical training sessions (no physical conditioning or strength or power training) and one match per week during the season. Two coaches were in charge of each training session and they held UEFA (Union of European Football Associations) 'A' or 'B' coaching licenses. Players were provided with a written and verbal explanation of the study including all tests and measurements to be taken. Each player signed an assent form and completed a health screen questionnaire prior to participation in the study. Players' parent, guardian or care-giver signed the consent form prior to the start of the study. Players were free to withdraw from the study without giving any reasons and without any penalty regarding their academy position and these were explained to them verbally and in a written format. Players were withdrawn from a particular test if they did not have a satisfactory health status. The study was approved by Loughborough University Ethical Committee.

Biological maturity

The estimated chronological age at PHV of the players was determined using the chronological age, standing height, sitting height and body mass of each player (24) and the assessment took place in the May of the season 08-09 and 09-10.

Sprint test

A “flying” 5 m sprint time was obtained on an indoor new generation synthetic sports turf in the September of the season 08-09 and 09-10. A photoelectric timing gate (Brower timing system, Utah, USA) was placed at 0, 5 and 10 m and, the time was recorded nearest to 0.01 s. The players sprinted from 1 m behind the first timing gate with their preferred foot front. No backward movements were allowed just before initiating the sprint. Each player completed three sprints and the fastest sprint time was selected for the calculation of speed zones.

Yo-Yo intermittent recovery test (level 1)

The test was conducted on an indoor new generation synthetic sports turf in the May of the season 08-09 and 09-10. The test consisted of repeated running of 2 x 20 m back and forth between 2 lines. The timing was notified by audio bleeps from a CD player and the time allowed to complete each run was progressively shortened. The participants had a 10 s active recovery period which consisted of 2 x 5 m jogs in between running bouts. Participants were withdrawn from the test when they failed to reach the finish line in time twice during the test (20). The distance covered during the test was recorded and used as the test result. An intra-class correlation of 0.93 and coefficient of variation of 8.1% were reported in 28 adult males (20). Moreover, the coefficient of variation was 13% in seventeen 8-9 year old sedentary children (2).

Match analysis

Soccer matches were analyzed during the season 08-09 and 09-10 using a 1 Hz GPS (SPI Elite, GPSport, Australia). The match analysis took place in various parts of the season (September/October, December/January, February/March and May) to reflect the variation in match performance during the season (30). This system required players to wear a small backpack on their back which contained the device; players wore this equipment throughout the match. The matches were 6-a-side and were played on a flat grass pitch (dimension: 44.8 x 26.0 m, penalty area: 9.0 x 18.8 m, area per player: 97.1 m^2). The matches were part of the regular series of inter-academy matches between Premier League Academies during a season and they were played at ~11am on Sundays with match duration of 60 or 70 min (15 min x 4 or (20 min x 2 + 15 min x 2)). The players consumed ad libitum water, sports drinks and/or small snacks (sports bar, banana etc). Completion of at least a half of the duration of a match in two separate matches (mean ± SD = 2.9 ± 0.7 matches: range = 2-4 matches) was the criterion for inclusion in the study. Mean values from matches were calculated for each player. The GPS was accessing a mean of 7.6 ± 1.3 satellites with a mean horizontal dilution of precision of 1.20 ± 0.39 throughout all the matches analyzed. The coefficient of variation for match performance ($m \cdot h^{-1}$), reflecting the variation between matches for each player, was 6.7 ± 4.4% for total distance covered, 6.1 ± 3.6% for walking distance, 8.0 ± 6.5% for jogging distance, 13.8 ± 9.7% for low speed running distance, 18.1 ± 12.7% for moderate speed running distance and 25.8 ± 13.1% for high speed running distance (31).

Match activities

Sprint speeds over 5 m calculated from “flying” 5 m sprint time were averaged for each squad and five speed zones specific to each squad were calculated based on a mean of average “flying” sprint speed over 5 m from each squad (walking, jogging, low speed running,

moderate speed running and high speed running). "Flying" 5 m sprint time from the 10 m sprint test was used to calculate average sprint speed because the average sprint distance of the U15 elite Brazilian players was 8.6 m when stride length was used to estimate the distance covered by sprinting (26). The five speed categories were calculated by dividing the speed zones of 0.0 $m \cdot s^{-1}$ to two standard deviations below the squad mean of average "flying" sprint speed over 5 m into five equal categories. Running speeds faster than the fastest speed zone were also included in the high speed running category (table 1). The distances covered by the five locomotor categories were estimated using Team AMS software version 1.2 (GPSport, Australia) and they were presented in meters per hour ($m \cdot h^{-1}$). Also, mean playing time, total distance covered during a match in absolute terms and in $m \cdot h^{-1}$ and, the percentage of time spent in each speed zone during a match were calculated. These speed zones are similar to the zones described in previous studies which reported the match performance of U12-U16 youth soccer players (11, 12, 15).

****Table 1 here****

Statistical analyses

A Kolmogorov-Smirnov test was employed to examine whether or not the distribution was normal and homogeneity of variance was examined using Levene's test. An independent sample t-test was used to compare differences between the U9 and U10 squads and differences between retained and released groups. The effect sizes (*d*) for these differences were also calculated as (mean A – mean B)/ (pooled SD). Effect size values of 0.2, 0.5 and above 0.8 were considered to represent a small, moderate and large difference, respectively (31). A Pearson's product moment correlation was employed to examine the relationships between variables.

A-priori statistical power calculations were conducted on primary outcome variables (i.e., total distance covered during a match, high speed running distance). Assuming an independent t-test was the method of analysis, for total distance covered during a match, the a-priori calculation suggested a minimum of 27 subjects (with at least 12 in a group) would be needed to detect differences between 2 groups, assuming a statistical power of 80%, an effect size of 0.9 (15, 25) and an alpha level of 0.05. For high speed running distance, the a-priori calculation suggested that a minimum of 26 subjects (with at least 12 in a group) would be required to detect differences between 2 groups, assuming a statistical power of 80%, an effect size of 1.1 (25) and an alpha level of 0.05 (31).

The level of statistical significance was set at $p < 0.05$. Results are presented as mean ± standard deviation (SD) and PASW 18.0 was used for all the statistical analyses.

RESULTS

Match activities of U9 and U10 squads

Playing time

Mean playing time during a match was longer for the U9 squad compared to the U10 squad (U9 vs. U10: 55.9 ± 4.3 min vs. 50.9 ± 5.2 min, $p < 0.01$)

Distance covered

Distances covered during a match are presented in table 2 and distances covered per hour of a match are presented in figure 1. There were no differences in the total distance covered during a match for the U9 and U10 squads (U9 vs. U10: 4356 ± 478 m vs. 4056 ± 541 m, p = N.S.). Similarly, when the total distance covered during a match was standardized into meters per hour, there were no differences in total distance covered by the U9 and U10 squads (U9 vs. U10: 4675 ± 311 $m \cdot h^{-1}$ vs.4788 ± 466 $m \cdot h^{-1}$, p = N.S.). However, there was a tendency for the U10 squad to cover a longer distance ($m \cdot h^{-1}$) than the U9 squad during moderate speed running (U9 vs. U10: 496 ± 108 $m \cdot h^{-1}$ vs. 576 ± 170 $m \cdot h^{-1}$, p = 0.10, d = 0.62) and high speed running (U9 vs. U10: 178 ± 56 $m \cdot h^{-1}$ vs. 219 ± 70 $m \cdot h^{-1}$, p = 0.08, d = 0.69).

****Table 2 here****

****Figure 1 here****

Percentage time

The U9 squad spent a lower percentage of time jogging compared to the U10 squad (U9 vs. U10: 33.2 ± 2.6% vs. 36.5 ± 2.8%, $p < 0.01$) and the U9 squad spent a higher percentage of

time in low speed running compared to the U10 squad (U9 vs. U10: 15.0 ± 2.4% vs. 12.6 ± 2.7%, $p < 0.05$). No significant differences between the U9 and U10 squads were found in percentage of time spent in standing and walking (U9 vs. U10: 46.4 ± 4.3% vs. 44.8 ± 5.8%, p = N.S.), moderate speed running (U9 vs. U10: 4.1 ± 0.9% vs. 4.8 ± 1.4%, p = N.S.) and high speed running (U9 vs. U10: 1.1 ± 0.3% vs. 1.3 ± 0.4%, p = N.S.).

****Figure 2 here****

Match activities of retained and released players

Playing time

There were no differences in mean playing time during a match between retained and released groups (retained vs. released: 55.4 ± 4.2 min vs. 53.2 ± 5.6 min, p = N.S.).

Distance covered

Distances covered during a match are presented in table 3 and distances covered per hour of a match are presented in figure 3. Retained players covered a greater distance than released players (retained vs. released = 4478 ± 513 m vs. 4091 ± 462 m, $p < 0.05$) during a match and covered a greater distance during low speed running in absolute terms (retained vs. released = 1226 ± 259 m vs. 1005 ± 221 m, $p < 0.05$). When the match running distances were standardized into meters per hour of a match, the retained players tended to cover a longer total distance (retained vs. released: 4844 ± 313 $m \cdot h^{-1}$ vs. 4624 ± 387 $m \cdot h^{-1}$, p = 0.09, d = 0.63) and showed a longer low speed running distance (retained vs. released: 1325 ± 235 $m \cdot h^{-1}$ vs. 1132 ± 210 $m \cdot h^{-1}$, $p < 0.05$) than the released players. However, no differences in distances covered by walking (retained vs. released = 1018 ± 75 $m \cdot h^{-1}$ vs. 1040 ± 83 $m \cdot h^{-1}$, p = N.S.), jogging (retained vs. released = 1760 ± 111 $m \cdot h^{-1}$ vs. 1734 ± 217 $m \cdot h^{-1}$, p = N.S.),

moderate speed running (retained vs. released = 545 ± 121 $m \cdot h^{-1}$ vs. 510 ± 147 $m \cdot h^{-1}$, p = N.S.) and high speed running (retained vs. released = 195 ± 67$m \cdot h^{-1}$ vs. 191 ± 63 $m \cdot h^{-1}$, p = N.S.) were observed.

****Table 3 here****

****Figure 3 here****

Percentage time

In percentage of time spent, the retained group tended to spend a lower percentage of time standing and walking (retained vs. released: 44.2 ± 3.6% vs. 47.0 ± 5.3%, p = 0.10, *d* = 0.61) and spent a higher percentage of time undertaking low speed running (retained vs. released: 15.4 ± 2.8% vs. 13.3 ± 2.4%, $p < 0.05$) compared to the released group. However, there were no differences in percentage of time spent in jogging (retained vs. released: 34.5 ± 1.9% vs. 34.3 ± 3.7%, p = N.S.), moderate speed running (retained vs. released: 4.5 ± 1.0% vs. 4.3 ± 1.2%, p = N.S.) and high speed running (retained vs. released: 1.2 ± 0.4% vs. 1.2 ± 0.4%, p = N.S.) between the groups.

****Figure 4 here****

Match performance and Yo-Yo intermittent recovery test

There was a positive relationships between the Yo-Yo intermittent recovery test performance (N = 34) and the total distance covered ($r = 0.36$, $p < 0.05$) and the distance covered at moderate speeds ($r = 0.49$, $p < 0.01$).

DISCUSSION

The aim of this study was, for the first time, to examine the match speeds and distances covered for U9 and U10 English Premier League Academy soccer players and to examine if differences existed between players subsequently retained or released by the academy. The main findings were that the total distance covered during a match was ~4000 m in absolute terms or ~4700 $m \cdot h^{-1}$ for the U9 and U10 squads. When the players were separated into retained and released players, the retained players covered a significantly longer total distance (by ~400 m) during a match and a significantly greater distance at low speed running (by ~200 m) than the released players. The information concerning match distances covered for the U9 and U10 players and the differences in the distances covered between retained and released players should prove valuable for football and conditioning coaches in the design of training programs and in the talent identification and development process. It will be of value for the players themselves to know that a high work rate may increase the chances of retention within the academy system.

All of the match analysis data in the present study are novel as the match analysis of U9 and U10 players has not been previously reported upon nor has match analysis data been presented for players who were subsequently retained or released by clubs. The U9 and U10 squads from the current study covered 4356 and 4056 m during a match respectively, with no significant differences between the squads. However, the U9 players did have a significantly longer playing time compared to the U10 players as the U9 squad contained less players and thus each player received slightly more playing time. A previous study showed that the U12 squads from two English professional soccer clubs covered an average of 5967 m during an 11-a-side match (15) and this was around 30% more than the distance covered by the U9 and

U10 squads from the current study. When the total distance covered during a match was standardized per hour of a match, the U9 and U10 squads from the current study covered 4675 and 4788 $m \cdot h^{-1}$, respectively whereas the U12 players from the English professional soccer clubs covered 5978 $m \cdot h^{-1}$ (15) which suggests a difference of around 1200 m in distance covered per hour of a match between the U10 and U12 squads from the current and previous studies. This is a large difference between the two age groups (between U10 and U12) as the total distance covered per hour of a match has been previously reported to increase by only ~1200 m over 4 year groups (5928 $m \cdot h^{-1}$ for U12 to 7122 $m \cdot h^{-1}$ for U16) in English professional soccer clubs (15). This large difference in total distance covered during a match between the U10 squad reported here and the U12 squad from the earlier study was possibly due to a mixture of the differences in the number of players on a team and the pitch dimensions (18, 27) as well as due to the enhanced physical performance of the older players in terms of both speed and endurance (19). In the previous study (15), an 11-a-side match was played as opposed to a 6-a-side match in the current study and the pitch dimensions were 77 x 60 m (area per player = 210 m^2) in the earlier study and 44.8 x 26.0 m (area per player = 97 m^2) in the present study, respectively. It has been shown that the number of players does not influence the total distance covered during a match when the area per player was the same (18). However, a match with a greater area per player has been shown to provide a higher relative heart rate, blood lactate concentration and perceived exertion regardless of player number (27). Hence, the large differences in total distances covered between the U9 and U10 players from the current study and the U12 players from the previous study (15) may be due at least in part to a difference in the area per player.

Another potential reason for the large difference in total distance covered between the U9 and U10 players from the current study and the U12 players from the previous study (15) is the

use of a GPS with a different manufacturer and frequency between the studies (current: 1 Hz SPI Elite, GPSport, Australia vs. previous: 5 Hz MinimaxX, Catapult Innovations, Australia). Previously, when match analysis data from a 1 Hz and 5 Hz GPS worn during the same match was compared, the 5 Hz GPS estimated a 12% longer total distance covered during a match than the 1 Hz GPS (28). However, this difference in the sampling frequencies of GPS between studies only accounts for a fraction of the difference in the distances run between the U9/U10 players in this study and U12 players in other studies. Thus it seems likely there is a real physiological difference in performance between the U9/U10 players and the U12 players in other studies, possibly due to improvements in endurance fitness with age, as supported by the slightly higher (NS) Yo-Yo test performance of the U10 in comparison with U9 boys in the present study. However, 4000 m already represents a substantial distance covered for these very young boys with a short stride length because of their height and coaches may consider whether or not a small supplementary training program in addition to technical work might be included for this age group, at least as a preparation for the fitness work that is to follow in older age group squads.

During a match, the U9 and U10 squads covered 166 and 186 m by high speed running and 462 and 485 m by moderate speed running, respectively. When these distances were expressed relative to an hour of a match, the U10 squad showed a trend to cover a longer distance by high speed running and moderate speed running compared to the U9 squad even though the speed zones for high speed running and moderate speed running were slightly faster for the U10 squad. This may suggest that there is a development in the ability to complete high intensity running during a match between the U9 and U10 squads in this English Premier League Academy club. This is possibly because of a development in speed, agility, jump height and endurance with age (19) and such findings suggest that each age

group requires a specific training program. Moreover, if a coach moves an U9 age player into the U10 squad, the player needs to be able to cope with the match demands of the U10 squad.

The U10 squad jogged more than the U9s (distance covered and percentage of match time) whereas the U9s spent more time in low speed running (faster than jogging) than the U10s. This is possibly because the U10 squad was required to spend a longer time performing lower intensity exercise to recover compared to the U9 squad as the U10 squad tended to cover a longer distance than the U9 squad during moderate speed running and high speed running. The U9 squad spent more time in low speed running possibly because they tended to cover less distance in higher intensity exercises (moderate speed running and high speed running). Moreover, the U9 squad walked a significantly longer distance than the U10 squad during a match. However, this was due to the U9 players having a significantly longer playing time compared to the U10 squad as, when the distance walked was standardized into per hour of a match, the difference no longer existed.

The percentage of time spent in moderate speed running during a match was 4.1 and 4.8 % for the U9 and U10 squads, respectively. For high speed running, the percentage of time spent during a match was 1.1 and 1.3 % for the U9 and U10 squads, respectively. Using similar speed zones (based on senior player sprint performance), the English FA Premier (Senior) League soccer players spent 6.4 and 2.6% of total match time in moderate speed running and high speed running, respectively (4). These findings imply that the U9 and U10 elite soccer players may spend a lower proportion of match time in high intensity running than top elite professional soccer players and this is possibly because of differences in the area per player (1, 5, 27). Hence, for the U9 and U10 players to achieve a similar proportion of time in each speed zone in comparison to the elite senior players, the pitch dimensions

could be increased. However, as a result of the potential enhancement in the development of technical ability due to gaining more touches on the ball and because of the possible undeveloped understanding of technical elements by young boys, 6-a-side matches may be preferred by the coaches of U9 and U10 players (8, 10).

When the players were separated into retained and released players, the retained players covered a significantly longer distance than the released players during a match and covered a greater distance at low speeds (distance covered in absolute and relative terms and percentage of match time). In senior professional players, total distance covered during a match has been shown to distinguish the standard of soccer players (25). Moreover, 16 years old soccer players who competed at international level had a higher maximal oxygen uptake than same-age players from local and school teams (29) and endurance fitness has been shown to relate to total distance covered during a match in 14 year old soccer players (11, 12) and in the present study for the U9 and U10 players. The slightly higher (NS) Yo-Yo intermittent recovery test results of the retained players suggest that possibly the retained players had a higher peak oxygen uptake or enhanced endurance fitness in comparison with the released players. Such a difference in endurance fitness would provide more frequent involvement with the ball (17) in retained players which possibly offers more chances to improve technical ability in the retained players compared to the released players. Hence, the provision of endurance training to improve endurance ability may enhance the match running distance of players increasing involvement in the game, enhancing opportunities to improve technical ability (17) and thus improving the chances of being retained in the academy. Also it is possible that the greater distances covered by the retained players reflects an attitude of mind or enhanced reading of the game which enables them to be more fully engaged in match play.

However, no significant differences were found in high intensity running (high speed running and moderate speed running) distances between retained and released players. This is an interesting finding as high intensity running distance has been reported to distinguish the standard of senior soccer players (25). This may be because the players from the current study spent a lower proportion of match time in high intensity running compared to the senior professional soccer players (4) possibly due to a difference in the area per player (27) between the current and previous (4) studies or because the anaerobic energy supplying pathways will not be fully developed in boys of this age (13, 16, 22).

In summary, the total distance covered during a match was approximately 4000 m for the U9 and U10 elite soccer players and only 600-700 m were covered by high intensity running which was achieved during 5-6% of match playing time. The U10 squad tended to cover a longer distance at moderate and high speeds compared to the U9 squad. This suggests that there is a possible development in the ability to perform high intensity match running activity from the U9 to the U10 squads. The players who were retained in the English Premier League Academy covered a greater total distance and covered a greater distance at low speeds compared to the players who were released. Thus, knowledge concerning the distances run in young players may prove valuable in the talent identification and development process and coaches could consider whether or not an introductory fitness training program targeting match distance run might be appropriate in this age group for all or some players.

PRACTICAL APPLICATION

Despite their young age, the U9 and U10 boys in a professional football academy covered over 4000 m in a match and the U10 boys tended to cover a greater distance at high and moderate speeds than the U9 boys. Thus, coaches and sports scientists may be best advised to create specific training programs for each age group. In addition, if an U9 player is moved up into the U10 squad, coaches and sports scientists need to consider if that player can cope with the physical demands of the older age group.

The U9 and U10 boys who were later retained by their academy covered a greater total match running distance and a greater low speed running distance than those players that were later released. Thus, the distances and speeds covered during match play for these age groups could form an important part of the talent identification and development process and coaches and sports scientists could consider recording match distances run occasionally through the season. In addition, an introductory modest fitness program may enhance match distances covered for players of these ages increasing their engagement with game and thus enhancing the chances of improving their match-play. For players with low endurance fitness enhancing this aspect of their performance may increase their chances of retention in an academy.

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FIGURE LEGEND

Figure 1. Mean and standard deviation ($m \cdot h^{-1}$) of total distance covered and distance covered by walking, jogging, low speed running, moderate speed running and high speed running in an hour of a match in the U9 and U10 squads. *significantly different at $p < 0.05$. [a]tended to be different ($p = 0.08$). [b]tended to be different ($p = 0.10$).

Figure 2. Mean and standard deviation (%) of percentage of time spent on standing and walking, jogging, low speed running, moderate speed running and high speed running in a match in the U9 and U10 squads. *significantly different at $p < 0.05$.

Figure 3. Mean and standard deviation ($m \cdot h^{-1}$) of total distance covered and distance covered by walking, jogging, low speed running, moderate speed running and high speed running in an hour of a match in the retained and released groups. *significantly different at $p < 0.05$. [a]tended to be different ($p = 0.09$).

Figure 4. Mean and standard deviation (%) of percentage of time spent on standing and walking, jogging, low speed running, moderate speed running and high speed running in a match in the retained and released groups. *significantly different at $p < 0.05$. [a]tended to be different ($p = 0.10$).

TABLES

Table 1. The speed zones for match analyses of the U9 and U10 squads presented in $m \cdot s^{-1}$.

	U9	U10
Standing and walking	0.0 - 1.0	0.0 - 1.0
Jogging	1.1 - 2.0	1.1 - 2.1
Low speed running	2.1 - 3.1	2.2 - 3.1
Moderate speed running	3.2 - 4.1	3.2 - 4.2
High speed running	> 4.1	> 4.2

Table 2. Mean and standard deviation (m) of total distance covered and distance covered by walking, jogging, low speed running, moderate speed running and high speed running in a match from the U9 and U10 squads.

		U9	U10
Total (m)	Mean	4356	4056
	SD	478	541
Walking (m)	Mean	966*	865
	SD	89	131
Jogging (m)	Mean	1560	1594
	SD	207	229
Low speed running (m)	Mean	1189*	927
	SD	239	208
Moderate speed running (m)	Mean	462	485
	SD	109	139
High speed running (m)	Mean	166	186
	SD	52	60

*significantly different to the U10 squad at $p < 0.05$.

Table 3. Mean and standard deviation (m) of distance covered by walking, jogging, low speed running, moderate speed running and high speed running in a match by retained and released players.

		Retained	Released
Total (m)	Mean	4478*	4091
	SD	513	462
Walking (m)	Mean	938	925
	SD	82	135
Jogging (m)	Mean	1627	1534
	SD	190	223
Low speed running (m)	Mean	1226*	1005
	SD	259	221
Moderate speed running (m)	Mean	505	446
	SD	125	110
High speed running (m)	Mean	180	167
	SD	66	51

*significantly different to released group at $p < 0.05$.

Figure 1

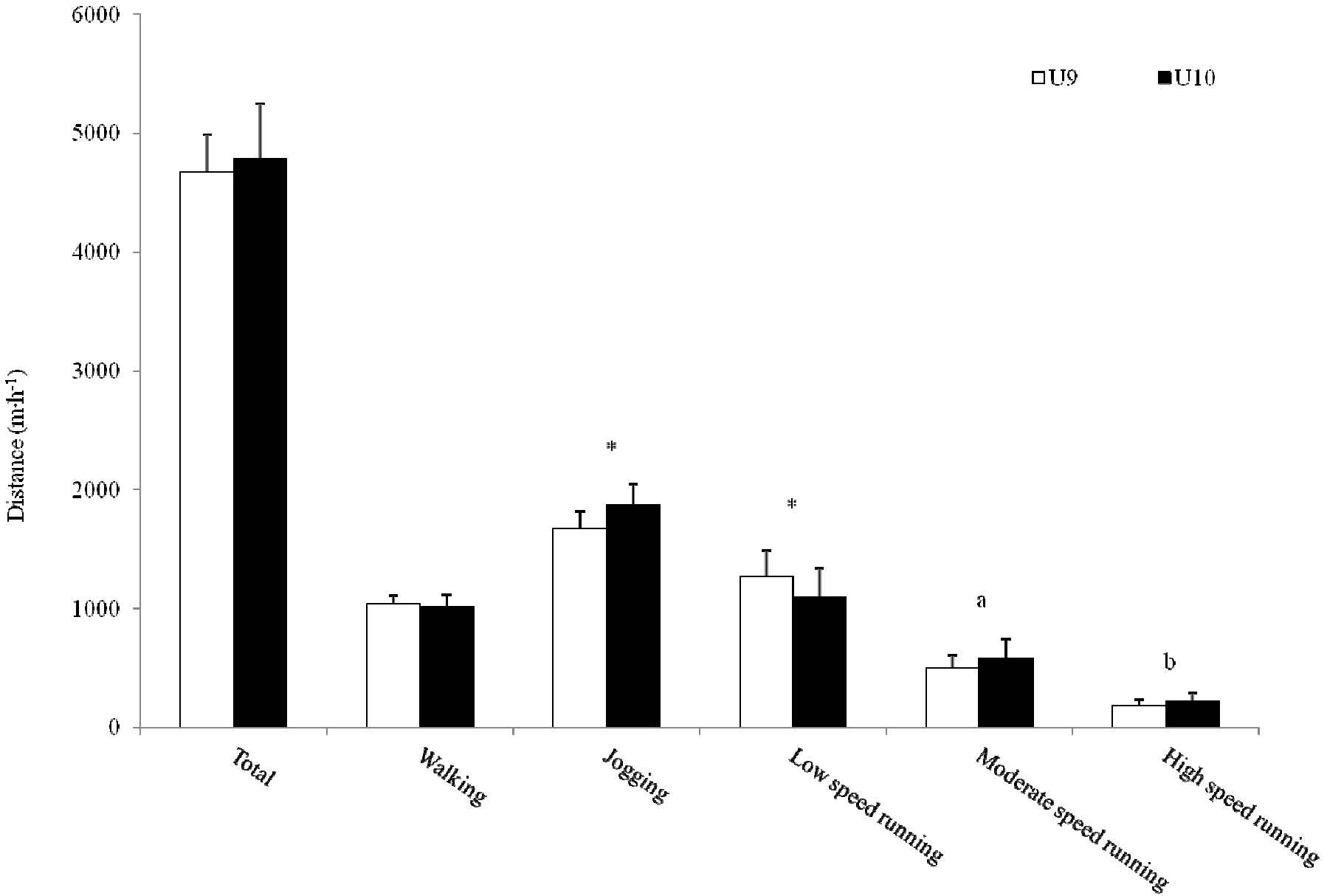

Figure 2

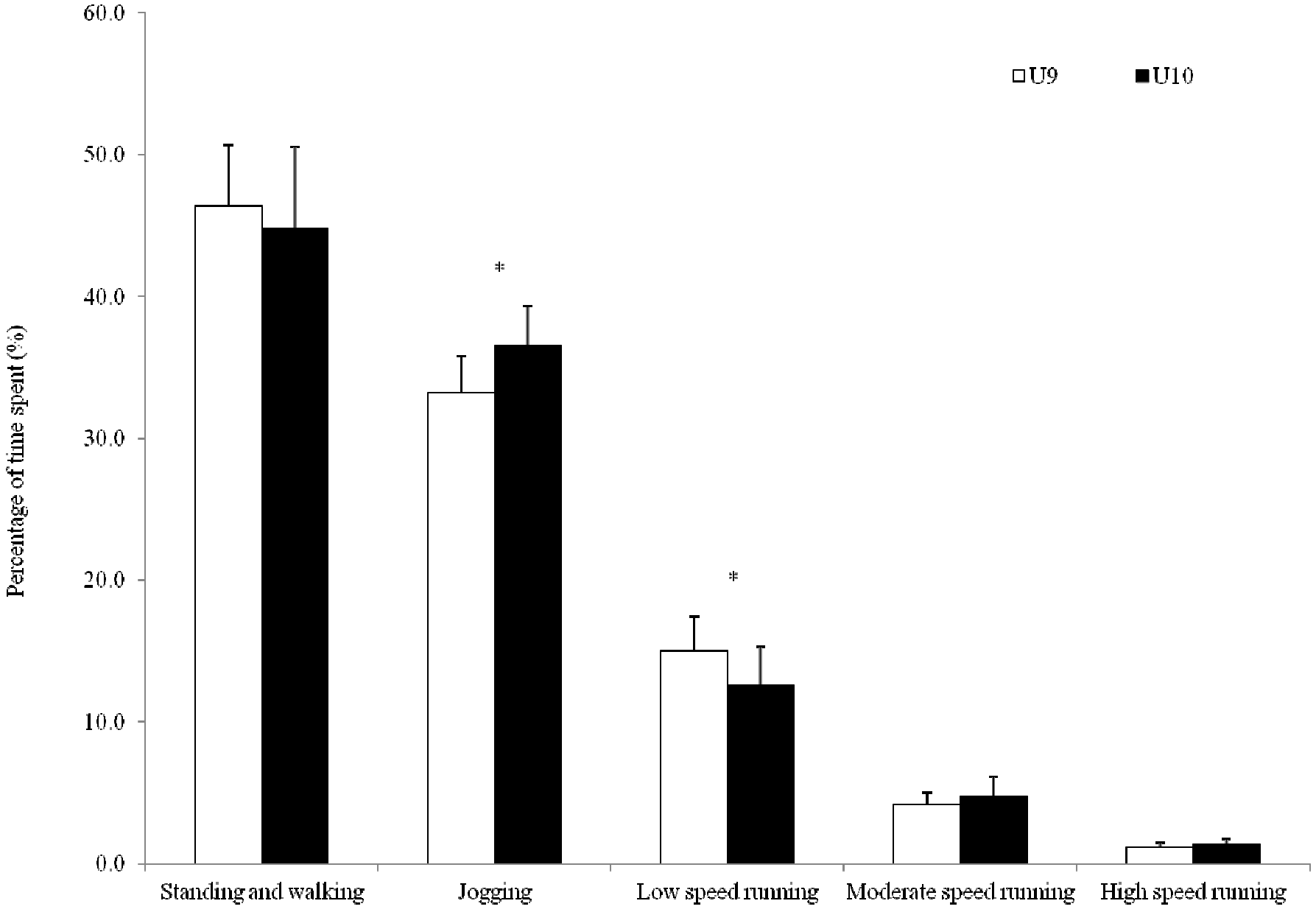

Figure 3

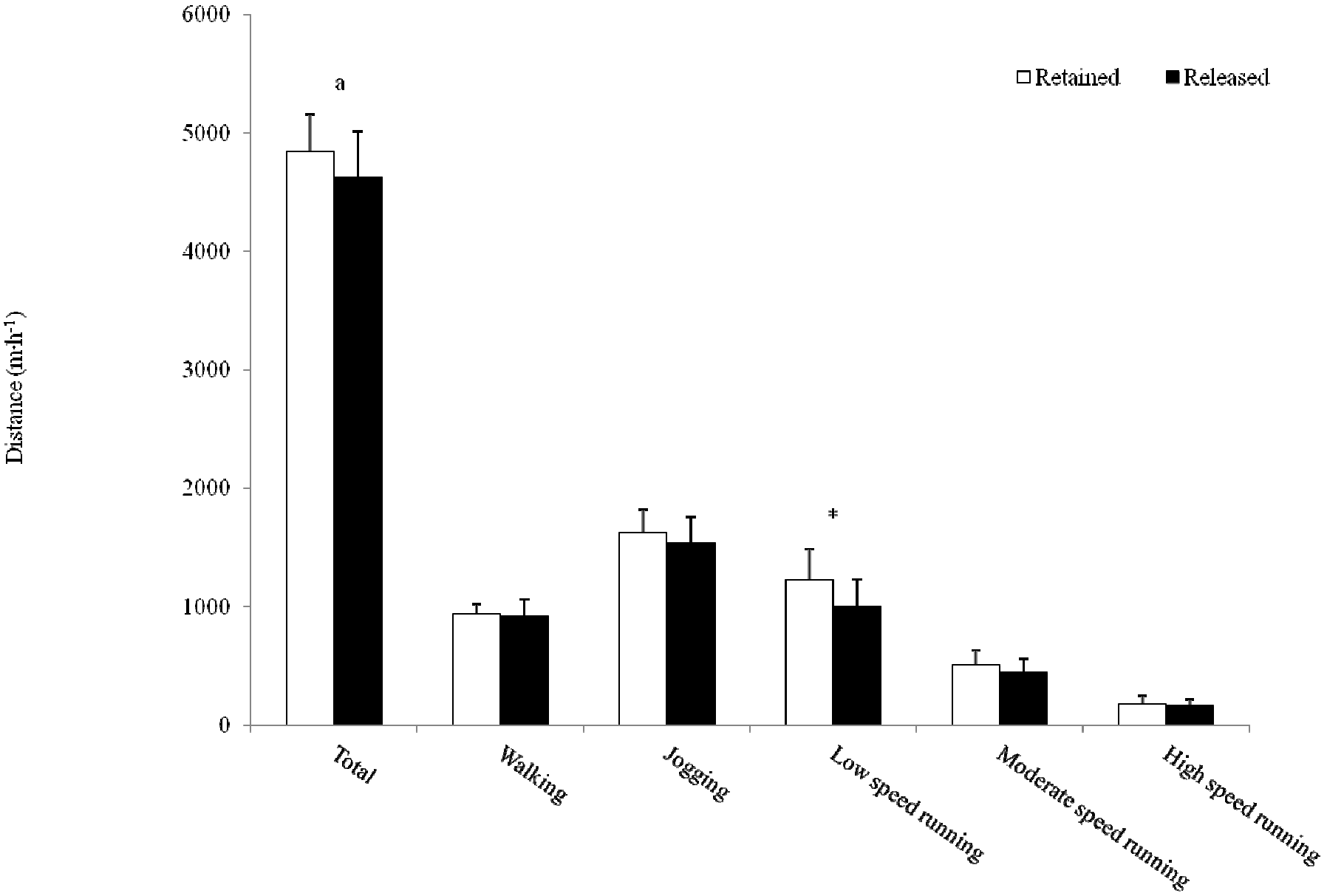

Figure 4