**1 • SPORT TRAINING**

# IMPROVEMENT IN SPRINTING AND DRIBBLING OF NATIONAL INDONESIAN SOCCER PLAYERS (UNDER 23 YEARS)

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## ABSTRACT

AIM: This study gained more insight into the relation between improvements on sprinting with and without the ball in a group of national youth soccer players. METHODS: The sprinting and dribbling performances, measured by time scoring, (n=14) were tested before and after a twelve week intensive training period. Performance changes were analyzed by means of t-tests for paired data. A correlation matrix described the relation between the changes from T1 to T2 on sprinting and dribbling.

**RESULTS:** The players significantly increased their sprint performance ($p < 0.01$). Furthermore, they showed a tendency of increased dribbling performance, these results were only significant for the repeated dribble performance ($p < 0.05$). The current study indicates that sprinting performance is not directly related to dribbling performance ($r = 0.35$). A moderate relation was found between repeated sprinting and dribbling improvement from T1 to T2 ($r = 0.54$), no relation was found between the peak sprint and dribble performance improvement ($r = 0.26$). The baseline performance level influences the amount of improvement in both sprinting and dribbling, this supports the law of diminishing returns. Players with a higher performance level before the training period did not improve as much as the players with a lower performance level.

**CONCLUSIONS:** Sprinting and dribbling improvements are not directly related to each other, future training programs should contain more specificity and should also be individualized to increase performance improvements.

**KEYWORDS:** Training; motor skills; athletic performance; development; exercise

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## INTRODUCTION

In soccer, the most obvious difference between teams of various skill levels is the intensity of the game with high-speed actions being decisive to the more crucial moments of the game [1]. Earlier studies have demonstrated that sprinting is related to player performance [2, 3]. Sprinting usually only cover short distances at maximal effort (96% of the sprints are shorter than 30 metres), underlining the importance of the start and acceleration phase [4, 5]. High-speed actions not only represent straight sprinting, but also skills which are critical to soccer, such as turning, changing pace and sprinting with the ball (dribbling) [6]. Based on game analyses, elite soccer players should also focus on recovering rapidly from periods of high-intensity exercise [4, 7]. Therefore, the players' ability must include performing high-intensity actions (sprinting with and without ball) repeatedly [4].

During adolescence running speed improves [8, 9] and also the development of intellectual and motor skills leads to improved technical abilities [10]. Earlier studies indicated an increased sprinting performance in talented youth soccer players over the years [10-12]. A few studies also illustrated that dribbling performance develops in talented youth soccer players during adolescence [10-13]. These results imply that sprinting and dribbling are improving with age. To some degree these improvements in sprinting and dribbling are affected by growth and maturation [3, 11, 15]. Nevertheless, to reach the highest competition levels, access to adequate training during development is necessary [14]. It is known that expert performance is strongly determined by the amount of time a person engages in practice activity with the primary goal of improving some aspect of performance, i.e., deliberate practice [15].

High-speed actions in soccer require the components acceleration, maximum speed and agility [16]. A study with professional soccer players measured acceleration with a 10 m test, maximum speed with a flying 20 m test, and agility with a zig-zag test over 20 m with three 100° turns. In this study it is shown that the relations between all these components are weak ($r \leq 0.6$). Hardly any research has examined the relation between sprinting and technical elements in sports like sprinting while dribbling the ball [17].

Strength and conditioning programs for soccer require the development of, among other qualities, speed and speed endurance [18]. Earlier research has proven that speed training contributes to better performance in shuttle run sprints and eventually to better match performance [19-21]. It is known that in a relative short period, varying from 5 to 13 weeks, soccer players are able to improve their running speed, by high-quality and high-quantity practice, including besides soccer-specific training, strength and speed training [20, 22-24]. Performance improvements as a result of training programs are influenced by the pre-training level of the individual players [25]. Training programs most often show the largest improvement results in less trained players, they are more likely to improve their performance than higher skilled players, this phenomenon is called the principle of diminishing returns [26].

The majority of existing research has focused on training effects in sprinting tests, but not on training effects in skill tests. As far as the authors are aware of, the only existing study that investigated the effects of training on sprinting with and without ball is executed by Venturelli et al. [27]. A twelve week coordination-training program with preadolescent soccer players (mean age 11) was conducted. The results showed improved speed over 20 metres, with and without the ball after the twelve week training program. However, it is unknown if increased sprinting performance leads to increased sprinting performance with the ball.

The overall purpose of the current study was to gain more insight into the relation between (improvements on) peak sprinting and repeated sprinting with and without the ball in a group of national youth soccer players (average age 20 years). Sprinting with ball (indicated as dribbling in the current study) and without ball are measured over the same course, over short distances with quick changes of direction. It is investigated if a twelve week intensive training program can improve national youth soccer players' sprinting and dribbling performance and the way in which the changes in sprinting and dribbling are related. Furthermore, it is investigated if differences exist in performance changes over the twelve week period between players with a different performance level at baseline.

## MATERIALS AND METHODS

### Participants

Participants were 14 players of the Indonesian national youth soccer team. The players were considered to be the top players of their age category in their country. Nevertheless, these players did not have access to optimal training facilities, and a poor competitive structure during their youth and adolescence. Average age of the players was 20.3 years (± 1.4 years) and the average accumulated organized experience of the players was 11.2 years (± 2.4 years)  The Indonesian team ranking was 110 on the FIFA World Ranking (2005/2006, FIFA World Ranking, 2008).

### Procedures

All players were informed about the procedures of the study before giving their verbal consent to participate. The national soccer federation, trainers, and coaches of the team gave their permission for this study; all procedures were in accordance with the ethics committee standards of the Medical Faculty of the University of Groningen. The data were collected

in the Netherlands during their preparation for the qualification tournament for the Asian Games (2006). The training period was conducted under the supervision of highly qualified and internationally successful Dutch trainers and coaches. Date of birth, playing position, and accumulated years of organized soccer experience were administered. The Indonesian team performed two tests, one at the beginning of a twelve week training period and one at the end of the twelve week period. A familiarization testing period took place before the first testing session for the players to become acquainted with the test protocols. The (repeated) sprint and dribble performance was conducted with the Shuttle Sprint and Dribble Test (ShuttleSDT)[17]. The players completed this test on an artificial grass soccer field. Ambient temperature, humidity, and wind conditions were documented during every testing session. In advance of both testing sessions, the anthropometrics (stature, body mass, and percentage body fat) were measured. Stature was measured with a wall-mounted stadiometer and body mass was measured using a digital scale. Body fat percentage was estimated by means of leg-to-leg bioelectrical impedance (BIA) analysis (Valhalla BIA, Valhalla, Inc., San Diego, CA)[28]. Lean body mass was calculated by subtracting the percentage of body fat from the total weight of the players. During the complete training period of the Indonesian team, the trainers completed a diary with the amount and type of practice per individual.

### *Shuttle Sprint and Dribble Test (ShuttleSDT)*

The protocol consisted of six maximal sprints of 30 m and six maximal sprints of 30 m while dribbling a soccer ball [17]. The players were allowed a short rest between successive 30 m sprints and dribbles. The length of this rest period depends on how fast the trial is performed: the next trial started exactly 20s after the start of the previous trial. Each 30-m sprint has three 180° turns (Figure 1). Timing data were measured by means of photoelectric cell gates (TAG Heuer, Eraton BV Digital Timing Equipment, Weert, The Netherlands). Peak sprint or dribble performance is indicated by the time covered in the fastest of six 30 m trials; repeated sprinting or dribbling performance is the total time covered by all six 30 m sprints and dribbles respectively.

The percentage decrement (%DS) in peak sprint and peak dribble performance over the three trials was calculated as follows [29]:

%DS sprint = 100 – [(peak sprint time x 6 / repeated sprint time) x 100 ]

%DS dribble = 100 – [(peak dribble time x 6 / repeated dribble time) x 100 ]

The ratio of the peak sprint and peak dribble was calculated by dividing the peak dribble time by the peak sprint time. The same method is used to calculate the ratio of the repeated sprint and dribble time. The lower index was assumed to indicate better skill of controlling the ball [11].

Figure 1 Course for ShuttleSDT
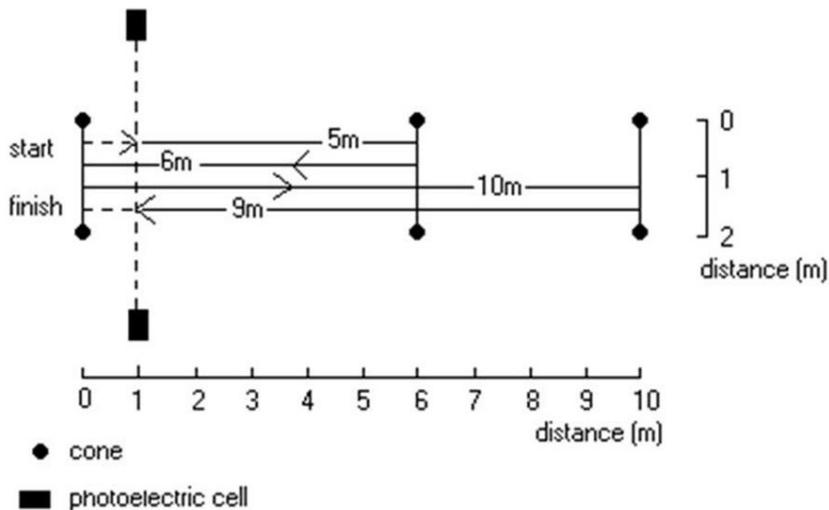


Since the ShuttleSDT was primarily developed for field hockey players [17], psychometry of these tests in soccer players was assessed. The reliability of the ShuttleDT was measured during pilot testing in 20 youth soccer players with an average age of 15.4 years (standard deviation ±1.9; range 12-19 years) [13]. The pilot testing showed that the ShuttleSDT is also reliable for soccer. The results showed good relative as well as absolute test-retest reliability. Intra Class Correlation (ICC) for the Shuttle Sprint was 0.81 and absolute reliability 0.20 (95% Confidence Interval (CI) 0.12 to 0.52). For the Shuttle Dribble ICC was 0.74 and absolute reliability was 0.02 (95% CI 0.37 to 0.34) [17].

### *Training diary*

For a period of twelve weeks (i.e., in between both test sessions of the Indonesian team) the trainers staff completed a diary with the amount and type of practice for every individual player. The amount was recorded in minutes per type of training. The type of practices were divided in speed (e.g., sprinting, starting, accelerating), technical (e.g., passing, dribbling, shooting), strength (e.g., weight training, plyometrics, circuit training), tactical (e.g., small-sided games, game-play with specific instructions), interval (high-intensity running followed by low-intensity running), and other training (e.g., recovery training). These types of practices were delineated by the scientific team to get insight in the training activities. The average amount and type of practice per week of the Indonesian players between T1 and T2 is presented in Table I. Besides the training program, the players performed one or two practice matches per week.

Table I Average hours of practice for the Indonesian youth soccer team during the twelve week training period

| Type of practice | Average amount of practice per week (Hours) |
|---|---|
| Speed | 1.3 (0.2) |
| Strength | 1.4 (0.2) |
| Technical | 0.8 (0.3) |
| Tactical | 1.5 (0.1) |
| Interval | 0.9 (0.3) |
| Other | 1.4 (0.2) |
| Total | 7.3 (0.9) |

### *Statistical analysis*

Results were expressed as means ± standard deviations (mean ± SD). To check normality of the variables at T1, skewness and kurtosis variables z-scores were calculated. Results showed z-scores between -1.96 and 1.96 [30.] Therefore, the data were considered to be indicative of an approximately normal distribution. Differences on the consecutive trials for sprinting and dribbling were determined by comparing means using an one-way analysis of variance. Possible differences on peak and repeated sprint and dribble performances, %DS and the ratio dribble / sprint between the first (T1) and second measurement (T2) were determined by t-tests for paired data. Cohen's effect sizes (*d*) were used for interpretation of small (0.25), medium (0.50) and large (0.80) effects [31]. A correlation matrix illustrated the relation between the changes from T1 to T2 on (repeated) sprinting and (repeated) dribbling. First, the relationships between peak and repeated sprinting and dribbling at T1 were determined. Second, the relation between peak and repeated sprinting and dribbling changes from T1 to T2 were assessed. Finally, the relationships between the ShuttleSDT performances on T1 and the ShuttleSDT performance changes from T1 to T2 were assessed. All possible relationships were determined by Pearson correlations (r). The interpretation of the correlations were based on the following guidelines [32]: below 0.30 insubstantial correlation; 0.30 to 0.50 low correlation; 0.50 to 0.70 moderate correlation and above 0.70 high correlation [32]. To indicate if a significant difference existed in performance changes, the team was divided into two groups on the basis of peak sprinting performance during baseline by using the median. The two groups (7 players in each group) are compared on their progression from T1-T2. The possible differences in performance changes during the twelve week training period were conducted with an independent samples t-test. An alpha of 0.05 was adopted for all tests of significance.
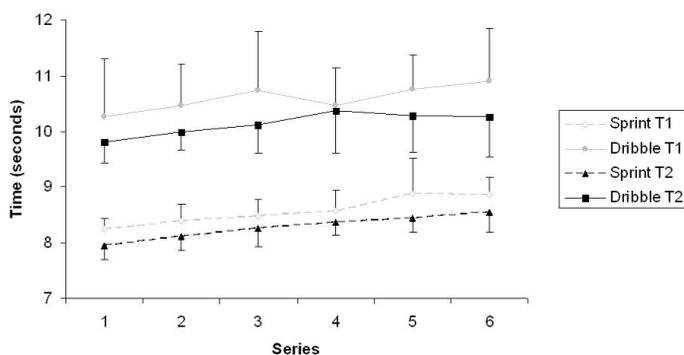
## RESULTS

Anthropometric data from the 14 Indonesian players from baseline (T1) to T2 is presented in Table II. Players' body mass and body fat percentage decreased during the twelve week period, hence their lean body mass increased ($p < 0.05$).

Table II Anthropometrics of the Indonesian youth soccer team at T1 and T2 (mean ±sd)

|  | T1 | T2 | P |
|---|---|---|---|
| **Body mass (kg)** | 69.9 (4.9) | 69.3 (5.1) | 0.043 |
| **Bodyfat%** | 12.4 (2.8) | 10.4 (2.4) | < 0.001 |
| **Lean body mass (kg)** | 61.2 (4.1) | 62.0 (4.1) | 0.008 |

Figure 2 shows the results for all six sprint and dribble performances at T1 and T2. The results indicate that the first out of the six sprints with or without ball is on average the fastest. The first sprint at T1 and T2 is significantly faster than the second sprint ($p < 0.05$). For dribbling the differences between the first and second trial do not significantly differ (T1: $p = 0.224$ and T2: $p = 0.079$). The sprinting performance decreases on average over the six trials at T1 and T2. Dribbling performance seems to decrease over the consecutive trials as well. Only at T1 the average time of the 4th dribble seems to be faster than the average time on the 3rd dribble but this difference is not significant ($p = 0.218$) and is due to one player who performed his peak dribble during this fourth trial. At T2 the average dribbling performance does not seem to decline after the 4th trial ($p = 0.644$).

Figure 2 Average team results on the 6 trials of the ShuttleSDT before (T1) and after the twelve week training period (T2).

Standard deviations (SD) are only illustrated in one direction for clarity, in reality SD's should be illustrated both ways.

Table III shows the results for the T1 and T2 performances on the ShuttleSDT, the pre- and posttests are compared with paired t-tests (n = 14). The tests indicated that the players show a significant improvement ($p < 0.05$) from baseline (T1) to T2 on peak as well as on repeated (6x) shuttle sprint performance. The dribble test performance tends to improve as well (small effect sizes), however this improvement is only significant for the repeated (6x) dribble test ($p < 0.05$). The decrement in percentage sprint and dribble performance were not significantly different from T1 to T2 ($p > 0.05$). The ratio (repeated) dribble divided by (repeated) sprint performance both do not differ significantly from T1 to T2 ($p > 0.05$).

Table III Results (mean ±sd) on the ShuttleSDT before (T1) and after the twelve week training period (T2)

| | T1 | T2 | T | p | Effect size (d) |
|---|---|---|---|---|---|
| **Peak 30 m sprint (s)** | 8.19 (0.23) | 7.90 (0.23) | 4.96 | < 0.001 | 0.53 |
| **Peak 30 m dribble (s)** | 9.90 (0.53) | 9.64 (0.24) | 1.86 | 0.086 | 0.30 |
| **6x 30 m sprint (s)**<br>**6x 30 m dribble (s)** | 51.44 (1.71)<br>63.30 (3.80) | 49.68 (1.34)<br>60.84 (2.53) | 3.79<br>2.44 | 0.002<br>0.030 | 0.50<br>0.36 |
| **% Decrement sprint (6x)** | 4.44 (1.71) | 4.59 (1.66) | -0.25 | 0.805 | 0.04 |
| **% Decrement dribble (6x)** | 6.50 (3.13) | 4.86 (2.43) | 1.50 | 0.157 | 0.28 |
| **Ratio peak dribble / sprint** | 1.21 (0.06) | 1.22 (0.05) | -0.70 | 0.498 | 0.09 |
| **Ratio repeated dribble / sprint (6x)** | 1.24 (0.06) | 1.23 (0.06) | 0.26 | 0.801 | 0.08 |

Note: A Cohen's d around 0.20 reflects a small, around 0.50 a moderate and around 0.80 a large effect size

The correlation matrix  is illustrated in Table IV. At baseline (T1) peak and repeated sprinting as well as peak and repeated dribbling were highly correlated to each other. Peak sprint and peak dribble performance show a low correlation, while the repeated sprint and repeated dribble showed a moderate relation at baseline. Comparable results are found by comparing the sprint and dribble improvements from T1 to T2. The peak and repeated part of the sprint and dribble improvements respectively, are highly related to each other. Peak sprint and peak dribble improvements show low correlations, while the repeated portions of the sprint and dribble improvements correlate moderately. By comparing the baseline scores with the performance improvements, strong relations were assessed between the repeated sprint baseline score and the repeated sprint improvement. Also high correlations were found between the peak dribble baseline score and the peak dribble improvement. The repeated dribble score at baseline was highly related to the peak and the repeated dribble improvement.

Table IV Correlation matrix for the Sprint (S) and Dribble (D) times at T1 and the changes (Δ) from T1 to T2

|  | T1PeakS | T16xS | T1PeakD | T16xD | Δ peakS | Δ 6xS | Δ peakD | Δ 6xD |
|---|---|---|---|---|---|---|---|---|
| **T1PeakS** | 1 | 0.84** | 0.35 | 0.38 | 0.48 | 0.58 | 0.31 | 0.23 |
| **T16xS** |  | 1 | 0.59* | 0.62* | 0.33 | 0.70** | 0.51 | 0.39 |
| **T1PeakD** |  |  | 1 | 0.84** | 0.41 | 0.69** | 0.90** | 0.58* |
| **T16xD** |  |  |  | 1 | 0.26 | 0.61* | 0.80** | 0.81** |
| **Δ peakS** |  |  |  |  | 1 | 0.72** | 0.26 | 0.12 |
| **Δ 6xS** |  |  |  |  |  | 1 | 0.70** | 0.54* |
| **Δ peakD** |  |  |  |  |  |  | 1 | 0.77** |
| **Δ 6xD** |  |  |  |  |  |  |  | 1 |

\* $p < 0.05$

\*\* $p < 0.01$

The total group of players is divided in two groups by means of the baseline peak sprint scores, this is illustrated in Table V. The players with the lower sprinting performance score at T1, improved significantly more during the 12 week period on peak dribbling than the players with a higher sprinting performance score at T1 ($p < 0.05$). Also, all other performance changes showed a tendency whereby the players with the lower sprinting performance score at T1 improved more than the players with a higher sprinting performance score at baseline, the results of repeated dribbling are borderline significant.

Table V Comparison of the change from T1 to T2 between the best and less performers at T1 within the Indonesian youth soccer team

|  | T1 peak sprint | Δ T2-T1 | t | p |
|---|---|---|---|---|
| **Δ T2-T1 Peak 30 m sprint** | ≥8.29<br><8.29 | - 0.37 (0.22)<br>- 0.21 (0.20) | 1.37 | 0.195 |
| **Δ T2-T1 Peak 30 m dribble** | ≥8.29<br><8.29 | - 0.48 (0.66)<br>- 0.04 (0.23)* | 3.62 | 0.004 |
| **Δ T2-T1 6 x 30 m sprint** | ≥8.29<br><8.29 | - 2.74 (1.92)<br>- 0.77 (0.76) | 1.67 | 0.137 |
| **Δ T2-T1 6 x 30 m dribble** | ≥8.29<br><8.29 | - 4.92 (3.82)<br>- 0.59 (3.12) | 2.17 | 0.051 |

\* significant difference with the 'less' performance group

## DISCUSSION

The overall purpose of the current study was to gain more insight into the possible relation between improvements on maximum sprinting and repeated sprinting with (dribbling) and

without ball in a group of national youth soccer players. The youth soccer players were the best players from Indonesia (average age 20.3 years ± 1.4). Nevertheless, these players did not have access to optimal training facilities, and a poor competitive structure during their youth and adolescence. To improve overall performance, the Indonesian youth team performed a twelve week training period under the supervision of highly qualified and successful Dutch trainers and coaches. To investigate the changes in sprinting and dribbling performance, pre- and post tests were performed measured with the Shuttle Sprint and Dribble Test [13, 17]. The players significantly increased their (repeated) sprint performance, and showed a tendency of increased dribbling performance, however these results were only significant for the repeated (6x) dribble performance. Furthermore, the results of the current study indicate that an improvement in sprinting performance is not directly related to increased sprinting with ball (dribbling) performance.

During the twelve week training period, the peak sprinting performance on the ShuttleSDT of the Indonesian players improved on average 0.29 seconds. This time difference can be essential to be in time to receive a ball, cover the defense, sprint past an opponent, etc. Also, the players significantly improved their repeated sprint by 1.76 seconds. Numerous bouts of sprinting and turning are mainly covered by the anaerobic metabolism [3]. However, high aerobic capacity is needed to recover from these high activity efforts [33, 34]. An earlier study indicated that both anaerobic as well as aerobic energy systems contribute to the energy supply during the ShuttleSDT [35]. The sprinting performance results indicate that both the players' anaerobic and aerobic capacity significantly improved over the twelve week training period. Our results are in line with previous research, various studies addressed increased sprinting performances after short-term training programs [22]. Dribbling performance showed an improvement over the twelve week training period, however, the improvement on the peak dribble performance was not significant. A reason for the lack of significant improvement in peak dribbling might be the age of the Indonesian national youth team players. Earlier research has suggested that in the early years of development (up to puberty) a greater change exist in development of motor skills than after puberty [5]. Since dribbling requires more complex motor skills than sprinting, it is not surprising that dribbling shows less improvement at age 20 than sprinting. Nevertheless, the average dribbling improvement was 0.26 seconds which may be relevant, since this time difference might be essential in match play in winning possession of the ball, dribbling around an opponent, or scoring a goal [5, 7]. Repeated dribbling performance (6x) showed a significant improvement, illustrating less variation in the successive dribbles at T2 compared to T1. This indicates less 'errors' under fatigue. Earlier research has also indicated that the execution of  technical skills following effects of fatigue, can cause an increase in playing errors [4, 36]. Therefore, the players' ability must include performing high-intensity dribbles repeatedly [4, 36]. The Indonesian players showed increased ball control, also under fatigue, over the 12-week training period and hence the players showed more effective handling of the ball.

The only study, as far as the authors know, that investigated the effect of training on sprinting with and without ball was executed by Venturelli et al. [27]. The difference between both studies was the age of the subjects, 20 years in the current study versus 11 in the earlier study. In addition, the test conducted in Venturelli's study did not include changes of direction, in contrast to the ShutttleSDT in our study. Venturelli et al. found that coordination-training significantly improved the sprinting with ball performance after twelve weeks, this in contradiction to solely sprint training. Only sprint training did not improve the sprinting with ball performance over twelve weeks [27]. In the present study all players completed the same training program. The training program was carefully composed, containing all elements that are needed to improve overall soccer performance and therefore also sprinting and dribbling.

Earlier studies have not examined the relation between sprinting with and without the ball in soccer-specific tests in talented or elite soccer players. The present results during baseline testing showed that the peak performance and repeated performance of sprinting, respectively dribbling are highly correlated with each other. This indicates that the players who showed high peak performance (with and without ball) were also able to repeatedly execute the sprint with and without ball. The relation between peak sprinting and peak dribbling is low, while the relation between repeated sprinting and dribbling is moderate. This indicates that the fastest sprinters are not the fastest at the dribbling task. A suggestion for this finding might be that dribbling relies on a different mechanism than sprinting. Not only the anaerobic system is used for peak dribbling, but to execute the dribbling task the coordination system is also more appealed. The repeated sprints and dribbles show a stronger relation than the peak sprint and peak dribbles, this is probably due to the larger role of the aerobic system in energy contribution. The correlations found in the current study between peak and repeated sprinting, and respectively between peak and repeated dribbling are in line with earlier research conducted by field hockey players on the ShuttleSDT[17]. The current study showed that the improvements within sprinting and dribbling are highly related to each other. The improved peak sprint (or dribble) performance showed a high correlation with improved repeated sprint (or dribble) performance after the twelve week training program. However, the improvement on peak sprinting showed a low correlation with the peak dribbling improvement. The repeated sprint and repeated dribble improvement were moderately correlated. This indicates that improvement in sprinting performance is not directly related to the dribbling performance improvement. All players underwent the twelve week training program engaging in identical activities nevertheless, specific technical and tactical training might have been dissimilar for the different positions, in addition every individual can experience identical practices different[25].

The results in the current study suggest that improvement in sprinting does not indicate the same improvements in dribbling over the same course. The baseline score of the sprint, respectively the dribble was highly correlated with the improvement times, this indicated that baseline performance level influences the extent of improvement. This is

in agreement with the results in the current study. It is indicated that not all 14 players of the Indonesian team improved to the same extent during the twelve week training period. Comparing the improvement of the players with a lower and higher sprinting performance score at T1 with each other, showed that the high performance sprinters did show less improvement than the players with lower sprinting performance scores. The players with a lower sprinting performance level at the start of the twelve week training period did improve their (repeated) sprinting and dribbling performance enormously. This underlies that pre-training level influences the internal load imposed on the individual and, consequently, the training outcome [26]. Therefore, future training programs should differ between individuals with a higher and lower baseline performance. Also, to attribute the performance outcomes to the training program, future research should not only take into account the external training load, but also the internal load [37], as every individual can experience identical practices different.

The results indicate that the players showed significant improvements on sprinting performances, but not on peak dribbling performances. A possible reason for this finding is that the training program was not specific enough for improving dribbling performance. On average, 11% of the training sessions per week  were dedicated to technical training, in contrast 18% to speed training and 12% for interval training. This indicates that more time was spent in training speed (endurance) compared to  technical skill training, including the specific skill dribbling. A recommendation to increase dribbling performance over 12 weeks would be to include a larger portion of the training week to training on the specific technical skill dribbling and consequently improving the players' coordination. This underlies the principle of specificity, a principle of training that is fundamental for securing optimal adaptation and improving performance [38]. In addition to earlier knowledge and the results found in the current study another recommendation for training programs is to individualize the training programs, including individual exercise prescriptions related to the baseline performance level of the players. During the twelve week training period the players increased in  body mass and lean body mass, hence their body fat percentage decreased. Various test batteries also revealed that athletes who perform better on change-of-direction sprinting tests tend to have a lower percentage of body fat [39, 40], and therefore more lean body mass to contribute to speed. A larger capacity of lean body mass, stands for more muscle mass, and most likely more strength. It appears that strength has an influence on change of direction speed over short distances [41]. Thus, the improved performances on sprinting and dribbling in the current study might be attributed to the training period, partly due to an increase in muscle tissue.

## CONCLUSIONS

The national youth soccer players improved (repeated) sprinting and dribbling performances during a twelve week training period. The results indicated that peak sprinting and dribbling performances are not related to each other. Also the peak sprinting and dribbling improvements showed low correlations. Therefore, sprinting and dribbling stress different systems  responsible for high-performance and therefore training programs should include more specificity. The repeated sprinting and repeated dribbling performances are somewhat more related. It is indicated that the performance level at the beginning of the training period determines the degree of improvement. Players with a higher performance level before the training period did not improve as much as the players with a lower performance level. Therefore, future training programs should be more individualized and specific to increase performance improvements. Hardly any research is conducted regarding improvement of specific technical skills after training programs. By means of the ShuttleSDT, sprint and dribble performances with quick changes of direction, relevant for soccer players can be easily recorded. Therefore, the ShuttleSDT can assist coaches to easily administer if performance gains in soccer players occurred after a training period.

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