Relationship between power strength and anaerobic power index as a clear picture of the effect of strength training among young soccer elite players

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Purpose: muscle contraction has both mechanical to produce movement and metabolic properties to produce energy. However, manipulation of strength training planes (horizontal or vertical) subject to be an important training strategy to develop soccer-specific power-based actions. Depending on mode of exercise and more important the energy demands.

Material & Methods: this cross-sectional study was conducted to inspect the relation between power strength and anaerobic power index, proper to mode of exercise (vertical vs horizontal) among young soccer elite players. To achieve this goal, we based on anaerobic capacity repeat sprint test power index for 103 male players with mean age (18.55±0.48) years, involved in the Oran league competition division one. In addition to their strength in Vertical Jump (VJ) and Standing Long Jump Test (SLJ), conducted in the Omni sports complex of the institute physical education and sport Chlef.

Results: significant inverse correlations record between power strength and anaerobic power index in all comparisons practised. Support by the index of Max power anaerobic and fatigue as super predictors of players performance in horizontal plane. The opposite of vertical plane where the index of fatigue and Min power anaerobic are the super predictors.

Conclusions: our results confirmed that to have a clear picture of the effect of strength training on physical performance. Trainers must take in their consideration, the mode of exercise and their energy index power demands affirmed in present via the development of max power anaerobic to enhance not only minimal but also the index of fatigue requiring the good developments of neuromuscular function, in which max power anaerobic levels play a big part in maximizing scores not only in vertical plane but also in horizontal jump.

Keywords: youth training athletes, strength and conditioning, sports performance.

Introduction

Coaching is the 'degrees of freedom’ that might be expected in sports preparation and performance, given the complexity involved. Admitted as a multidimensional process to identify promotes talents [1]. Founded on critical predictors’ factor of sports type game success permitting the athlete to compete at the highest level [2]. Suggested by sport-confidence model under three types (i.e., physical skills and training, cognitive efficiency, and resilience) [3]. Reported by Moe buekers, et al (2015) via a multidisciplinary approach to identify talented soccer [4].

Admitted via this research through physical demands of soccer. Suggesting from player the ability to recover from a high-level intensity limit of a neuromuscular function with regard to the strength/power training methods used [5]. Claims by soccer sciences study via adequate training look at aerobic and anaerobic program energy regimes demands [6]. Advocate in recent studies through the dominance of short actions of maximum intensity allied to power and speed as physical qualities of extreme relevance for the physical performance of the players [7]. More closely with their training program aerobic and anaerobic endurance associated with training responses (faster or slower) in relation to the specificity of abilities demands as well as the physical quality looked-for individuals growing at different stages of physiological development [2].

Recommend soccer players to should be careful with intensity training in line to effect of the high neuromuscular (excitability and unit recruitment) stress [7].

Claims by strength, fitness, and speed improvements [8] relative to muscle strength and neuromuscular coordination [9] more associated with muscular power [10] and force produced by the velocity in a given movement [11]. Especially in sports intermittent regimen that are taxed by a glycolytic metabolism [12] depending on the maximum strength and anaerobic power of the neuromuscular system as essential skills associate with ability of soccer players to perform complex multi-joint dynamic movements [13].

Well-maintained in this study as one of the most common ability to enhance players muscle explosiveness in complex tasks processes of coordination and control of change in environment player execution with and without [14] technical or tactical problems.

Requiring from players, more manoeuvres to maintaining body control and minimizing loss of power or speed [15]. As well as decision-making related to tone muscular solicitation [16].

In light of these findings, namely focusing on determinants of sports performance that allow, in a practical way, to moni-
tor the training, enhance the work of the coach, and, conse-
quently, improve the athletic performance of the soccer play-
ers.

Upkeep by this study via the correlation between power
strength and anaerobic power index as a clear picture of the
effect of strength training on physical performance among
young soccer elite players. Reported via the manipulation of
training surfaces or planes as an important training strategy
to develop soccer-specific power-based actions. At a high
level of performance and well developments of neuromus-
cular function. Factors pertinent to uphold and/or develops
both physiological and physical measures associated with the
high-level performance of soccer players.

Aimed at present through the relation between power strength
and anaerobic power index to inspect the need of players to
increase their strength power-based vertical or horizontal
jump achievement.

Material and Methods of the research

Participants

A cross-sectional study was piloted among 103 male Soccer
players with mean (±SD) age of 18.55 (0.48) years, involved in
the Oran league competition division one. Their mean (±SD)
weight, height, body mass index, and some of the skinfolds
were 66.86 (2.92) kg, 1.72 (1.02) m, 19.45 (0.51) kg m⁻²,
55.62 (4.45) mm. In addition to their strength, which was evalu-
ated with Vertical jump (VJ) and Standing Long Jump Test
(STJ), additional to their index anaerobic capacity based on
Running-based Anaerobic Sprint Test (RAST). Which allows
us to compare their performance in vertical and horizontal
planes. Reported in similarities as indirect tests to esteem an
aerobic power. All tests were practised after the end of pre-
competitive phase. All participants are volunteers, first year’s
senior team. Table 1 describes the anthropometric charac-
teristics and power performance and index of the sample. All
tests were conducted in the Omni sports complex of the insti-
tute physical education and sport Chief.

Anthropometric

Height (H) was measured to the nearest 0.1 cm with a portable
stadiometer (Seca 213, Hamburg, Germany). Weight (W) was
assessed to the nearest 0.1 kg with a Seca 635, Hamburg,
Germany) instrument. All measures followed the rules of the
International Society for the Advancement of Kinanthropom-
etry [17].

Body composition

Eight skinfolds (triceps, subscapular, biceps, suprailiac, ab-
dominal, supraspinal, thigh, and calf) were assessed twice (at
0.1 mm) with a Harpenden calliper (British Indicators, Ltd.,
London, UK). The procedure was performed by the pedagogi-
cal laboratory of our institute.

The sum of 6 (triceps, subscapular, abdominal, supraspinal,
thigh, and calf) skinfolds (6SKF) calculated [18].

Running-based Anaerobic Sprint Test (RAST)

Developed to test a runner’s anaerobic performance. It pro-
vides coaches with measurements of power and fatigue in-
dex. This test requires the athlete to undertake six 35-meter
sprints with 10 seconds recovery between each sprint. Power
output for each sprint is found using the following equations.

Power = Weight x Distance² / Time³

Maximum power – the highest value
Minimum power – the lowest value
Fatigue Index = (Maximum power – Minimum power) / Total
time for the 6 sprints

All the condition of the environmental test was adjusted to
the regulations described by Federation International Roller
Sports (FIRS) [19].

Standing Long Jump Test

Also called the Broad Jump, is a common and easy to admin-
ist test of explosive leg power. The subject attempts to jump
as far as possible. A two-foot take-off) with swinging of the
arms and bending of the knees [16; 20].

Statistical Analysis

All statistical analysis was computed with the Statistical Pack-
age MedCalc Version 18.11.2.

Mean and the standard deviation was performed regarding
anthropometric and fitness characteristics. Regression anal-
ysis was used to predict the impact of a jump plane perfor-
ance on the index of anaerobic power, according to RAST
test validity.

Results of the research

All the relationships analysed between independent variables

| N=130 | W, kg | H, cm | BMI | Max Power (RAST), watts | Min Power (RAST), watts | Fatigue Index (RAST), watts | VJ, cm | SLG, m | 6SKF, cm |
|-------|------|------|-----|------------------------|------------------------|--------------------------|-------|-------|---------|
| Mean  | 66.86| 1.72 | 19.45| 900.61                 | 513.63                 | 11.20                    | 56.62 | 2.15  | 55.62   |
| S.D.  | 5.92 | 0.78 | 0.51 | 81.12                  | 42.62                  | 1.75                     | 5.89  | 1.89  | 4.45    |
| Min   | 64.10| 1.61 | 18.46| 714.69                 | 384.06                 | 7.51                     | 42.98 | 1.91  | 52.80   |
| Max   | 74.00| 1.77 | 20.65| 1 108.36               | 609.99                 | 14.81                    | 68.02 | 2.65  | 59.06   |
| Kurtosis | 1.39 | 2.48 | -0.40| 0.02                   | -0.30                  | -0.83                   | -0.80 | -0.80 | -0.40   |
| Skewness | 0.17 | 0.51 | 0.01 | 0.30                   | -0.09                  | 0.07                     | -0.03 | -0.03 | 0.01    |
| Variance | 8.55 | 0.01 | 0.26 | 6 580.89               | 1 816.48               | 3.05                     | 34.65 | 1.65  | 2.10    |
| Median | 66.80| 1.70 | 19.54| 895.60                 | 516.07                 | 10.98                    | 55.68 | 2.02  | 55.89   |
Table 1. Presents the average results obtained in the power (VJ and SLJ), power anaerobic index (Max Power (RAST), Min Power (RAST), and Fatigue Index (RAST)). As well as anthropometrics parameters (skinfolds (6SKF) and BMI).

Table 2
Regression analyses relating Vertical Jump with power anaerobic index and anthropometrics parameters studies

| Dependent Y | Vertical Jump |
|-------------|---------------|
| Method      | Forward       |
| Enter variable if P< | 0.05          |
| Remove variable if P> | 0.1           |
| Sample size | 103           |
| Coefficient of determination R² | 0.9874        |
| R²-adjusted | 0.9872        |
| Multiple correlation coefficient | 0.9937        |
| Residual standard deviation | 0.6669        |

Regression Equation

| Independent variables | Coefficient | Std. Error | t    | P     | r partial | r semipartial | VIF |
|-----------------------|-------------|------------|------|-------|-----------|--------------|-----|
| (Constant)            | 6.4333      |            |      |       |           |              |     |
| Fatigue Index (RAST)  | 2.3809      | 0.06425    | 37.056 | <0.0001 | 0.9655 | 0.4157 | 2.885 |
| Min Power (RAST)      | 0.04582     | 0.002632   | 17.412 | <0.0001 | 0.8672 | 0.1953 | 2.885 |

Variables not included in the model
BMI, 6SKF Max Power (RAST)

Analysis of Variance

| Source  | DF | Sum of Squares | Mean Square |
|---------|----|----------------|-------------|
| Regression | 2  | 3489.3185      | 1744.6593   |
| Residual | 100 | 44,4794        | 0.4448      |
| F-ratio | 3922.4023 |          |             |
| Significance level | P<0.0001 |          |             |

Zero order and simple correlation coefficients

| Variable | VJ | BMI  | 6SKF | Max Power | Fatigue Index |
|----------|----|------|------|-----------|---------------|
| BMI      | -0.6741 |      |      |           |               |
| 6SKF     | -0.8037 | 0.7767 |      |           |               |
| Max Power| 0.3441  | -0.2601 | -0.2284 |           |               |
| Fatigue Index | 0.9743 | -0.6558 | -0.7844 | 0.3374 |               |
| Min Power| 0.9025 | -0.6091 | -0.7526 | 0.3483 | 0.8083 |

Residuals
Agostino-Pearson test for Normal distribution | accept Normality (P=0.1602)

and predictors are significant at P≤0.05. From the regression analyses, the program showed that Fatigue Index (RAST) and Min Power (RAST) were able to explain the changes in vertical jump performance. The opposite of Standing Long Jump Test in Table 3 were Max Power and Fatigue Index are the only predictors of the change in a player’s performance under this test.

Conclusions / Discussion
Our results in all comparisons practices are in conformity with the judgment report by Murtagh C.F., et al. (2018); that Strength training induces greater performance improvements in jump actions and these achievements varied according to the motor task [2]. Admitted by Portuguese experts in the association between vertical jumps and speed, acceleration in sprint seems to have great influence on CMJ performance [21–25]. Confirmed by Dragula L., et al., (2017) study as moderate correlations. Recorded by Wisløff U, et al., (2004) as strong correlations, spicily in half-squatting that increased sprint and jumping performance in soccer players [26]. Despite that, the central goal of strength/power training in a highly competitive sport is to improve the players’ specific and relevant athletic activities inherent in their sport [10; 21–24]. As well as soccer activity involves both breaking and propulsive forces as distinct contraction modes and velocities
Regression analyses relating Standing Long Jump Test with power anaerobic index and anthropometrics parameters studies

| Dependent Y | Standing Long Jump Test |
|-------------|-------------------------|

Least squares multiple regression

| Method          | Forward |
|-----------------|---------|
| Enter variable if P< | 0.05    |
| Remove variable if P> | 0.1     |

Sample size 103
Coefficient of determination R² 0.4009
R²-adjusted 0.3890
Multiple correlation coefficient 0.6332
Residual standard deviation 0.1521

Regression Equation

| Independent variables | Coefficient | Std. Error | t     | P     | r partial | r semipartial | VIF   |
|-----------------------|-------------|------------|-------|-------|-----------|--------------|-------|
| (Constant)            | 1.2030      |            |       |       |           |              |       |
| Max Power             | 0.001612    | 0.0001972  | 8.174 | <0.0001 | 0.6329    | 0.6326       | 1.128 |
| Fatigue Index         | −0.02826    | 0.009164   | −3.084| 0.0026 | −0.2947   | 0.2387       | 1.128 |

Variables not included in the model
BMI, 6SKF, Min Power

Analysis of Variance

| Source         | DF | Sum of Squares | Mean Square |
|----------------|----|----------------|-------------|
| Regression     | 2  | 1,5479         | 0.7740      |
| Residual       | 100| 2,3128         | 0.02313     |

F-ratio 33.4641
Significance level P<0.0001

Zero order and simple correlation coefficients

| Variable      | VTJ         | BMI          | 6SKF         | Max Power    | Fatigue Index |
|---------------|-------------|--------------|--------------|--------------|--------------|
| BMI           | 0.01162     |              |              |              |              |
| 6SKF          | 0.05112     | 0.7767       |              |              |              |
| Max Power     | 0.5865      | −0.2601      | −0.2284      |              |              |
| Fatigue Index | −0.02682    | −0.6558      | −0.7844      | 0.3374       |              |
| Min Power     | 0.09774     | −0.6091      | −0.7526      | 0.3483       | 0.8083       |

Residuals
Agostino-Pearson test for Normal distribution accept Normality (P=0.1885)

that require all force-velocity potential of the neuromuscular system.

Our data based on VJ and their correlation with anaerobic power indicators. Confirmed that optimal levels of maximum strength depend on neuromuscular system ability force production [11]. Recorded in this study by mean of Fatigue and Min Power index as the only predictors of the change in vertical performance. In the benefits of over anaerobic power max developments to enhance the jump performance in all aspects and planes. Support by Max Power and Fatigue Index as the only predictors of the change in Standing Long Jump Test players performance.

Confirmed by its complexity manoeuvre that requires players to combine components of vertical leg power, horizontal leg power, and a complex motor scheme (involving rudimentary calculations of impulse and take-off angle) in combination with a full-body coordinated movement to jump to maximum potential [27]. In the opposite of the vertical jump, which request leg power to jump with maximum potential. Admitted by the impact of neuromuscular system ability force production in the achievement of greater power strength [14; 16]. Independently of a player’s level, strength-related [28] to role of neuromuscular system ability force production as one of the most important factors [28] affecting maximal power pro-
It was possible to designate inverse correlations between power anaerobic index with the performance in vertical jumps or horizontal jump. Despite this relation, suggest that jumps are an easy and good prediction sports training tool in the benefits of over anaerobic power max developments to enhance the jump performance in all aspects and planes specially intermittent sports. Demanding from players and coaches to understanding the role of neuromuscular system ability force production as one of the most important factors affecting maximal power production. Supported by Muscle contraction and its relation with metabolic properties to produce energy. Claims through exercise planes or surfaces (horizontal or vertical) that must be taken as a training strategy to develop soccer-specific power-based actions. Support by similarities in standing long jump distance that may give a better overall impression of an athlete’s current power abilities (max power relative to fatigue index) than Vertical jump (index fatigue relative to Min power). Predict in this study as a clear picture of the effect of strength training on the power index to manipulation training planes (horizontal or vertical). Recommended as an important training strategy to develop soccer-specific power-based actions among the young soccer elite.

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