

Effect of Functional Strength Training on the Strength of Muscles Core and Numerical Level in Young 110m Hurdles

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Abstract

The research aims to recognize the strength of the muscles core and some physical variables (abdominal muscle strength - back muscle strength - muscle strength of the two men - balance) and the numerical level of the young 110 m/barriers

The researcher classified previous studies according to the study's objective and arranged them upwards from the oldest to the newest. The researcher used the experimental methodology in the experimental design of one group using tribal and remote measurement to suit the nature of the research.

The research sample included 110 young players from the Cairo Under-16 region who were enrolled in the records of the Egyptian Athletics Federation for the 2018/2019 sporting season.

The number of training units for the application of the experiment reached 8 weeks from 9/4/2019 to 11/6/2019 using the dynamometer.

One of the most important results of the research was to improve the digital level of the 110m race/barriers in the research sample and that functional strength training contributes to improving muscle strength and balance.

Among the most important recommendations are:

For trainers:

Implementation of functional trainings in junior phases in training programs for 110 m/barriers contestants.

Applying and dividing functional trainings with the same intensity, repetitions and comfort used in the proposed program.

For the researchers:

Further studies similar to the nature of research on different contests, especially for Emerging players and different age stages.

Key Wordes : Strength training, Muscles center, functional .

تأثير تدريبات القوة الوظيفية على قوة عضلات المركز والمستوى الرقوى لناشئى ١١٠ م / حواجز

المستخلص :

يهدف البحث إلى التعرف على قوة عضلات المركز وبعض المتغيرات البدنية (قوة عضلات البطن - قوة عضلات الظهر - قوة عضلات الرجلين - التوازن) والمستوى الرقوى لناشئى ١١٠ م / حواجز

وقامت الباحثة بتصنيف الدراسات السابقة وفقا للهدف من الدراسة وتم ترتيبها تصاعديا من الاقدم الى الاحدث

وقد استخدمت الباحثة المنهج التجريبي بالتصميم التجريبي لمجموعة واحدة باستخدام القياس القبلى والبعدى وذلك لمناسبته لطبيعة البحث

واشتملت عينة البحث من ناشئى ١١٠ م / حواجز بمنطقة القاهرة تحت ١٦ سنة والمقيدون بسجلات الاتحاد المصرى لالعاب القوى للموسم الرياضى ٢٠١٨ / ٢٠١٩ من لاعبي النادى الاهلى وبلغ عددهم ٥ لاعبين تم اختيار ٢ لاعبين من نفس مجتمع البحث من نادى طلائع الجيش بهدف إجراء الدراسة الاستطلاعية عليهم .

وقد بلغ عدد وحدات التدريب لتطبيق التجربة الى ٨ أسابيع فى الفترة من ٢٠١٩/٤/٩ حتى ٢٠١٩/٦/١١ باستخدام جهاز الديناموميتر

وكانت من أهم نتائج البحث هى تحسين المستوى الرقوى لسباق ١١٠ م / حواجز لدى عينة البحث وأن تدريبات القوة الوظيفية تسهم فى تحسين القوة العضلية والتوازن

ومن أهم التوصيات:

بالنسبة للمدربين:

- تطبيق التدريبات الوظيفية فى مراحل الناشئين ضمن برامج التدريب لمتسابقى ١١٠ م/
حواجز.

- تطبيق وتقسيم التدريبات الوظيفية بنفس الشدة والتكرارات والراحة التى تم استخدامها فى
البرنامج المقترح.

بالنسبة للباحثين:

إجراء المزيد من الدراسات المماثلة لطبيعة البحث على مسابقات مختلفة وبصفة خاصة
للناشئين ومراحل سنوية مختلفة.

كلمات مفتاحية:

القوة الوظيفية ، عضلات المركز ، المستوى الرقمى

Effect of Functional Strength Training on the Strength of Muscles Core and Numerical Level in Young 110m Hurdles

Introduction and research problem:

Physical education has taken wide steps towards progress in this era based on the right scientific research technique in thinking about scientific researches and how to solve their problems to reach the highest practical athletic level.

Reaching high physical levels has become one of the indications of the progress and upgrade of countries in different scientific, technological and physical fields.

Field and track events have multiple problems in their different competitions whether in the track or field that urge experts, specialists and workers in this field to put subjective numerical, skill or physical solutions needing to place the most suitable solutions and to renew training operations techniques together with rating loads to increase performance efficiency to enable the player and practitioner to solve the same with scientifically

developed and modern technique in different competitions in general and in the field and track events in particular.

Practicing several physical activities regularly leads to focus on muscular groups required by the nature of performance of the activity being practiced. However, neglecting the practice of the opposite muscular groups leads to strengthen the operated muscles without strengthening their opposite muscular groups and consequently they will be subject to much strain and injury due to strength imbalance between the operated muscle or muscle groups and its or their opposite muscle or muscles (10: 24- 25).

We know that the event of 110m hurdles is characterized by special nature and repeated motion and practiced by men without women.

It needs high technical requirements and speed performance with the whole speed event. It is also characterized by complex motor performance because it comprises the quick number and high motor rhythm while clearing ten hurdles along the event in addition to a developed level of special physical fitness elements together with neuromuscular coordination and comprehensive flexibility in all joints with high muscular strength balanced among operated flexors and extensors (1: 291).

Zaki Mohammed Mohammed Hassan (2004) added that the most injuries that happened to the player of field and track events were knee and ankle injuries (6: 75) (11: 126) (2: 5).

Muscular strength is considered the most important physical elements as it greatly effects on life generally and on physical field particularly. Performance in all physical activities depends on how the body moves and muscles control the body movement with contraction and extension by pulling limbs from position to another and when such contractions are more active the movement will be better (14: 28).

110 m hurdles race is an activity needs power and explosive force in the lower limb with proportional inclination of the trunk to the upper limb particularly during (launch, approach, take off and landing). Players' success in this game is due to exercises with resistance for posterior thigh muscle group.

The researcher thinks that the player needs strongly to change the level of body and approach according to the nature of the performance requiring integration among strength, balance, speed and power. Through her reviewing specialized references to outline muscle core groups operating in 110m hurdles race and take off, the researcher concluded the following muscle groups viz. trunk, legs, shoulders and arms.

Vom Hofe (1995), Ron Jones (2003) and Michael Boyle (2004) agreed that functional strength training were considered as training forms newly used in the athletic field and they were important exercises suitable for all ages of different training levels as they were introducing functions of the body movement and improvement and supporting the form of the athletic performance (33: 3) (30: 14) (25: 249).

Through her field experience as a coach, the researcher observed that there was clear failure in the young 110m hurdles racer in changing the level of the body and approach despite their importance that would effect on their results during the event that would depend greatly on muscles of the lower limbs, moreover, giving the young athletes traditional exercises would not contribute to upgrade their level and would not achieve integration between strength and balance at the same time.

From the foregoing, it is clear that those muscular groups are important in developing the numerical level and hence, the researcher selected exercises characterized by achieving strength and balance simultaneously and realizing functional strength to improve the numerical level due to its great importance for strengthening muscles core

That was confirmed by Amal Mohammed (2005) cited from “Marigg Roynalds” that traditional strength training particularly those performed on devices focusing on performance in a state of steady while functional strength training remove the external support used from devices and make several muscle groups act simultaneously integrated (3: 1, 2).

Therefore, the current research problem is concluded in placing modernized exercises that can develop the physical level and break down the state of boredom due to repetition of the training programs that differ from

each other in intensity, volume and using the same exercises with the same motor performance.

Research objectives:

They aim to propose functional training exercises and to know their effect on the following:

- 1- The strength of the muscles core and some physical variables viz. the strength of abdominal, back and leg muscles and balance.
- 2- The numerical level of 110m hurdles racers.

Research hypotheses:

- 1- There are significant differences between means of the pre and post measurements of the strength of the muscles core of the sample under investigation in favor of means of the post measurements.
- 2- There are significant differences between means of the pre and post measurements in the numerical level of the sample under investigation in favor of the mean of the post measurement.

Research terminology:

- 1- Functional strength training:

A group of exercises include acceleration, fixing and slowing down aiming at improving motor ability the central strength of vertebral column and the center of the body and the neuromuscular efficiency (21:87).

- 2- Muscles core (procedural definition):

They are muscular groups existed in the abdominal area and their opposite muscular groups in the back area.

Research procedures:

Method:

The experimental method of one experimental group was used with the pre and post measurements in order to suit the nature of the research.

Research community and sample:

The research people included the young 110m hurdles athletes in Cairo area under 16 years registered with Egyptian Athletics Federation in the 2018-2019 season. The main research sample of (5) athletes was chosen from Al-Ahly Club whereas (2) players were selected from the same research people belonging to Talaie Al-Gaysh Club to carry out the pilot study.

Table (1)
Equivalence of the research sample in growth variables
(n=7)

| No. | Variables | Units | \bar{x} | M | SD | Skewness Coefficient |
|-----|--------------|-------|-----------|------|------|----------------------|
| 1 | Height | cm | ۱۸۷ | ۱۸۵ | ۲.۹۸ | ۲.۰۱۳ |
| 2 | Weight | kg | ۷۹ | ۸۰ | ۱.۸۸ | ۱.۵۹۶- |
| 3 | Age | yr | ۱۷.۳ | ۱۷.۵ | ۰.۸۹ | ۰.۶۷۴- |
| 4 | Training age | yr | ۵ | ۴ | ۱.۵۳ | ۱.۹۶۱ |

Data in Table (1) illustrate that values of skewness coefficient are between ± 3 indicating that the research sample is homogenous in growth variables.

Means and tools of collecting data:

The researcher used tools, devices and tests suiting the nature and aims of the research and mechanisms of the work in the practical application of the research experiment.

I. Means and tools:

- 1- Restameter.
- 2- Dynamometer.
- 3- Swiss balls (Rubber balls of exercises).
- 4- Free weights of different weights (bars, dumbbells and hoops).
- 5- Medical balls of (3, 5, 7kg).
- 6- Casio stopwatch to the nearest time.
- 7- Rubber bands.

II. Physical tests used (Att. 1):

- Test of strength of back muscles measured by dynamometer.
- Test of strength of leg muscles measured by dynamometer.
- Test of strength of abdominal muscles (lying down and knee bent sit up).
- Bridge position stability test leaning on the front and one leg.

III. Test of (the numerical level).

The researcher conducted (2) two pilot studies where the first one was from 12 to 13/3/2022 on a sample of (2) players from the main sample to assure of the validity of tools and devices used and to train

assistants whereas the second pilot study was carried out from 26 to 27/3/2022 to rate training loads of the training program.

The main experiment:

After she had carried out the pilot study and attaining the results emerged, the researcher made the main study as follows:

I. Pre-measurements:

They were taken for the research sample individuals from 4 to 5/4/2022 on the playground belonging to the sporting school, Abbasia including:

The 1st day: assessment of growth rates (height, weight, training age) and physical measurements.

The 2nd day: (the numerical level)

II. The main study:

The research sample underwent a unified program containing in its content the proposed functional strength training program applied by the researcher for 8 weeks from 9/4/2022 to 11/6/2022.

Steps of layout the training program:

According to the analysis of training programs indicated by scientific references and previous studies such as Cress *et al.* (1996)(22), Plamondon *et al.* (1999) (33), Yasumura *et al.* (2002)(34), Cymara *et al.* (2004)(23), Doaa Mohammed Abdel Monem (2004)(4), Mahmoud Mohammed Ahmed and Mohammed Mohammed Al-Dahrawi (2004)(16), Amal Mohammed Mohammed (2005)(3), Nada Hamed Rammah and Nariman Mahmoud Al-Husseini (2005)(21), Mahmoud Mohammed Mahmoud (2006)(16) and Azza Khalil Mahmoud (2007)(12).

The researcher followed the following steps when making the layout of the training program:

Bases and standards of building the program:

- Availability of security and safety elements.
- The program content should be suitable for the nature and characteristics of age under investigation.
- The program should be integrated during its different stages.
- The program should consider individual differences.
- Considering the principle of waiving the level of load.
- The program should be flexible and applicable.

- Considering the selection and ranking exercises within the program.
The proposed exercises of functional strength training (Att. 2):

Fabiocomana (2004)(25), Dave Shmitz (2003)(24), Michael Bayle (2003)(28), Ron Jones (2003)(34), Scott Gaines (2003)(35) and Vom Hofe (1995)(37) agreed that functional strength training should contain the following:

a- Outlining the goal of the proposed exercises:

The goal of the group of functional strength training should be strengthening muscles core viz. abdominal and back muscles to know their effect on the numerical level of 110m hurdles event.

b- Foundations considered when placing functional strength training:

When placing exercises to strengthen muscles core (abdominal and back muscles), the following principles were considered:

- Core stability

Movements performed with few repetitions, simple or medium intensity with gradual progress in performance to achieve self stability and neuromuscular control in muscles core.

- Core strength

Movements of more dynamism use external resistances in all levels to achieve muscular strength and motor integration.

- Core power

Movements characterized by producing force and converting it into instantaneous speed.

Foundations the researcher considered when applying the experiment:

- Characteristics of the load directed to develop the strength of muscles core using functional strength training:

The program was applied at the rate of 4 times a week with 90 min. for 8 weeks during the special preparation period and hence, the program contained 32 training units. Intensity of functional training was graded through weeks from 55% to 80% of the max for young athletes.

- Unified warm up was carried out in the training units on the research sample with an aerobic load of 30% to 50% intensity containing exercises contributed to increase body temperature to condition muscles to work and to activate blood circulation. Such exercises were varied running and jumps then varied stretch exercises.
- The main part was conducted containing exercises of general preparation for the research sample and its content targeted the major body parts.
- The experimental variable i.e. functional strength training was applied in the part of special preparation of the training unit for the research sample.

The unified main part in the training units was conducted. It contained a part of training on the event of 110m hurdles, repetition of diverse movements of varying the level of the body and front approach with different rates outlined with a duty.

The unified part of cool down was carried out in the training units for the research sample. It contained exercises contributing to gain recovery such as swings and stretches.

Post-measurements:

They were taken for the research sample in variables under investigation with the same previous conditions from 13 to 14/6/2022.

Statistical manipulations:

The researcher used the following statistical method to treat data of the sample:

- | | |
|-----------------------------|-----------------|
| - Arithmetic mean | - Median |
| - Standard deviation | - Skewness |
| - Proportion of improvement | - Wilcoxon test |

Data presentation and discussion:

Presentation and discussion of the 1st hypothesis:

There are significant differences between means of the pre and post measurements in assessments of the strength of muscles core in the sample under investigation in favor of means of the post-measurements.

Table (2)

Wilcoxon's Test to compute significance of differences between means of the pre and post measurements of the strength of muscles core in the sample under investigation (n=5)

| No. | Variables | Units | Groups | \bar{x} | Categoric s \bar{x} | Total categori es | Z- values | Improve ment % |
|-----|---|-------|------------------|-----------|--------------------------|-------------------------|--------------|-------------------|
| 1 | Test of back muscles strength, Dynamometer | kg. | Pre measurement | 103.70 | 0.00 | 0.00 | 2.032 | 0.98% |
| | | | Post measurement | 109.80 | 3.00 | 10.00 | | |
| 2 | Test of leg muscles strength, Dynamometer | kg. | Pre measurement | 140.80 | 0.00 | 0.00 | 2.070 | 0.03% |
| | | | Post measurement | 148.70 | 3.00 | 10.00 | | |
| 3 | Lying down knee bent sit up | No. | Pre measurement | 26.80 | 0.00 | 0.00 | 2.032 | 19.40% |
| | | | Post measurement | 32.00 | 3.00 | 10.00 | | |
| 4 | Turn around the body vertical axis for 15 sec. then performing the bridge | No. | Pre measurement | 22.20 | 3.00 | 10.00 | 2.070 | 11.71% |
| | | | Post measurement | 19.70 | 0.00 | 0.00 | | |
| 5 | Bridge position stability by front and one | sec. | Pre measurement | 2.498 | 0.00 | 0.00 | 2.032 | 02.90% |
| | | | Post | 3.820 | 3.00 | 10.00 | | |

| | | | | | | | |
|-----------|--|-------------|--|--|--|--|--|
| leg stand | | measurement | | | | | |
|-----------|--|-------------|--|--|--|--|--|

Value of tabulated (Z) at (0.05) level = 1.96

Data in Table (2) show that the value of computed (Z) is higher than that of the tabulated at (0.05) level indicating that there are significant differences between means of the pre and post measurements in the strength of muscles core in favor of mean of the post-measurement.

The researcher attributed the results improvement to the effect of the proposed exercises by using functional strength training varied and directed to developing abdominal and back and lower limbs muscles in particular and all body muscles in general. The functional strength training included a number of exercises contributing to improve some physical fitness components such as balance and muscle force that could assist in strengthening abdominal and back muscles in particular by using varied training tools and means like Swiss balls leading to improve physical elements under investigation as well as the training program applied to the experimental group.

Also the improvement was extended to flexibility and stretch exercises used in the warm up period helped produce force as using such exercises could decrease the internal resistance in the muscle thus alarming sense muscular spinners increasing strength and speed of muscle contraction.

The current study results agreed with those of Stricevic et al. (1991)(36), Norris (1993)(30), O-Sullivan et al. (1998)31) and Plamondon et al. (1999)(33) who concluded that effectively strengthening abdominal muscles and thus back muscles i.e. the strength of muscles core would greatly depend on selecting a group of exercises suitable for the specialized activity containing skills and different movements and also suitable for the age level performing such exercises.

Dave Schmitz (2003)(24) indicated that the most features of functional strength training would be focusing on the group of muscles core i.e. abdominal and back muscles as the strong muscles core would connect the lower limbs to the upper limbs and consequently, such exercises would be the best in improving the strength of muscles core i.e. the body center and balance.

The results of this study were in harmony with those of Cress et al. (1996)(22) and Yasumura et al. (2002)(38) that functional strength training could contribute to improve muscular strength and balance.

Presentation and discussion of the results of the 2nd hypothesis:

There are significant differences between means of the pre and post measurements in the numerical level in the sample under investigation in favor of the mean of the post measurement.

Table (3)
Wilcoxon's test to compute significance of differences between means of the pre and post-measurements for the numerical level of the sample under investigation (n=5)

| No | Variables | Units | Groups | \bar{x} | Categoric s \bar{x} | Total categories | Z- values | Improve ment % |
|----|--------------------|-------|---------------------|-----------|--------------------------|---------------------|--------------|-------------------|
| 1 | Numerical level | m | Pre measurement | 187.20 | 0.00 | 0.00 | 2.06 | %2.79 |
| | | | Post measurement | 191.40 | 3.00 | 10.00 | | |

Value of tabulated (Z) at (0.05) level = 1.96

Data in Table (3) illustrate that value of computed (Z) is higher than that of the tabulated at (0.05) level indicating that there are significant differences between means of the pre and post-measurements in the numerical level in favor of mean of the post-measurement.

The researcher attributed the improvement in the numerical level to the effect of the proposed exercises by using functional strength training and the training program applied to the research sample individuals as the exercises simulate the nature of performance and they take the same motor path of the event.

Safia Ahmed Mohie Al-Din and Samia Rabie (2002) cited from Ezador Dankan confirmed that emission of power would be from the body center and such power would be flowing for infinity and it would emit activity in the body.

The results of this study agreed with those of Yasumura et al. (2002)(38), Cymara et al. (2004)(23) and Alaa Mahmoud Quinawi (2007)(13)

that mastering functional exercises the athlete would reach a higher level of stability, balance and stronger performance that would contribute to improve the numerical level in addition to functional strength training of multiple directions and levels.

Also the results of this study agreed with those of Yasumura et al. (2002)(38), Cymara et al. (2004)(23), Alaa Mahmoud Quinawi (2007)(13) and Redha Mohammed Ibrahim (2009)(5) that the main goal of functional strength programs could be realizing muscle strength, self stability and neuromuscular control in muscles core as well as force production and converting it into instantaneous speed towards the required direction that would contribute to achieve the skill level.

The researcher attributed that to integrated and multiple movements for improving motor ability of the event, central strength (body center), neuromuscular efficiency and balance positively affecting the relationship between the strength of muscles core and the athlete's numerical level.

These results agreed with those of Amal Mohammed Mohammed (2005)(3) and Nada Hamed Rammah and Nariman Mahmoud Al-Husseini (2005)(21) that the goal of using functional exercises would be improving the level of skill performance.

Moreover, the results of the study of Mahmoud Mohammed Ahmed and Mohammed Mohammed Al-Dahrawi (2004)(16), Mahmoud Mohammed Mahmoud (2006)(17) and Azza Khalil Mahmoud (2007)(12) confirmed the relationship between functional exercises and improvement of the level of skill performance according to the scope of specialization.

Conclusions:

In the light of the research objectives and hypotheses and on the basis of the results emerged, the researcher achieved the following conclusions:

- Functional strength training would have positive effect on all physical variables under investigation represented by strength of back, abdominal and leg muscles, motor balance and stable balance.
- Functional strength training would have positive effect on the event of 110m hurdles under investigation represented by the numerical level.

Recommendations:

On the basis of the results concluded, the researcher recommended the following:

For coaches:

- Applying functional exercises in young athletes stages within 110m hurdles young training programs.
- Applying, placing and classifying functional exercises with the same intensity, repetitions and intervals used in the proposed program.
- Using functional strength training in a form simulating the motor path and time of the event and considering their classifications.

For researchers:

- More studies similar to the research nature should be carried out on different competitions particularly for young players and different ages.

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