

# The impact of coordination abilities in improving the level of skill performance in national development for aerobic gymnasts under 11 years old.

**Dr. Aya Talla Ahmed Saad Ahmed**

lecturer at Department of Sports Training and Movement Sciences, Faculty of Physical Education – For Girls - Alexandria University

## Abstract:

*This study aims to determine the effect of special coordination abilities training in improving the level of skill performance among national development for aerobic gymnasts under 11 years old. Method: The experimental method was used for the sample under study, and pre- and post-measurements were conducted on it. The study was conducted on a sample of 10 aerobic gymnasts aged 9-11 years at Elite Sports Academy. The sample was chosen intentionally and placed in an equal group according to the basic variables and physical tests. The training program was implemented 4 sessions per week for 10 weeks, and data were collected before and after the training program. Results: The applied training program helped improve the level of coordination abilities of aerobic gymnasts ( $P < 0.05$ ), which was reflected in the level of skill performance in the aerobic gymnastics routine ( $P < 0.05$ ). Conclusion: The researcher recommends using the applied training program for special coordination abilities in order to improve the level of skill performance in the aerobic gymnastics routine.*

**Keywords:** (Coordination abilities, National development, Aerobic gymnastic )

## Introduction:

Gymnastics is one of the most exciting sports for many people because of its strength, excitement, beauty of performance, diversity of skills, and variety of equipment and tools (Dimitrova, 2015).

Aerobic gymnastics has two different forms, one as a sport for everyone and included in physical fitness, and the other as a competitive sport, which is a gymnastic activity with musical accompaniment to develop the individual's general physical shape with aerobic exercises basically and regularly according to the rhythm of music and with the aim of achieving general improvement in breathing and the body (Issa, 2016).

These routines can be performed in groups, in addition to the specific use of artistic movements, whose speed, range, and execution depend on the musical base used and the compatibility between the movement and the music (Carrick et al., 2007; Dimitrova, 2015; Omorczyk et al., 2018).

The motor performance of a gymnast requires neuromuscular coordination, and the gymnast's efficiency in performance depends on her coordination. The importance of coordination is highlighted in complex movements that require moving more than one part of the body at the same time, and this importance increases if the movement leads in different directions (Avalos-Ramos & Vega-Ramirez, 2020; Dimitrova, 2015; Issa, 2016).

Coordination abilities play a major role in accuracy and economy of effort during the performance of sports movements, and are represented in the ability to distinguish motor movements, accurately assess the body's position (spatial orientation), the speed of expected and sudden

movements of the body or one of its parts (reaction speed), and the ability to change the performance from one movement to another (motor control), the ability to integrate single movements into a combined complex movement (motor connection), and the ability to balance the body (static and dynamic balance) (Dunsky et al., 2017; Granacher et al., 2012; Grigoreet al., 2016; Heyward & Gibson, 2018).

The availability of a good level of coordination abilities in the athlete leads to shortening the time required to learn and acquire motor skills, thus motor skills are performed economically in the energy expended, and the high harmonic level enables the athlete to diversify skill performance in various sporting activities (Hafez, 2016; Miletic, 2005; Purenovic-Ivanovic et al., 2016).

Specific training means that type of training that is characterized by specificity in improving motor capabilities in specific places of the body by virtue of the nature of performing gymnastics skills, as it works to concentrate the necessary amount of muscle contraction force for proper performance, as well as the timing of their contraction. These special exercises are applied in a gradual manner, based on the foundations of the stages of learning skills, and according to the dynamic, temporal, and rhythmic structure (Vincent et al., 2013; Young, 2006).

The stage of 9-11 years (National development) is considered the first stage of establishing participation in aerobic gymnastics championships, which are specified by the International Gymnastics Federation. Through the researcher's work as a coach and international judge for aerobic gymnastics, she noticed the importance of developing coordination abilities at this stage, as the routine

includes movements of high difficulty with the coordination required by the performance within the routine in a distinct manner.

The movements are performed in different directions with high speed, which requires the gymnasts to have good coordination abilities in a specialized manner that is proportional to the motor performance of the skills to improve the level of the gymnast's performance, the aerobic gymnastics routine consists of skills of difficulty (D), acrobatic, transition, links, and sequence, which indicates the importance of the aerobic gymnast acquiring coordination abilities, not individually, but in a specialized manner, according to the skill performance of each element. This is what prompted the researcher to conduct this study in an attempt to improve the performance of the routine in aerobic gymnasts' group for the National development.

**Aim of the study:**

This study aims to improve the level of skill performance of aerobic gymnastics through:

1. Design a training program using some specialized coordination ability exercises and their impact on the routine level of aerobic gymnastics.
2. Determine the impact of the applied training program using some specialized coordination abilities exercises on:
  - Improving some of the coordination abilities associated with aerobic gymnastics for gymnasts under 11 years old.
  - Improving the performance level in aerobic gymnastics routine for gymnasts under 11 years old.

**Research hypotheses:**

1. There are statistically significant differences between the pre- and post-measurements in some coordination abilities associated with aerobic gymnastics for gymnasts under 11 years old, in favor of the post-measurement.
2. There are statistically significant differences between the pre- and post-measurements in performance level in aerobic gymnastics routine for gymnasts under 11 years old in favor of the post-measurement.

**Study procedures:**

**The method used:** The researcher used the experimental method for the sample under study and conducted pre- and post-measurements on it.

**The study sample:**

The study was conducted on a sample of 10 female aerobic gymnasts under 11 years old at Elite Sports Academy. The sample was purposively selected and placed in an equal group according to the basic variables and physical tests. Medical examinations were conducted to ensure the health safety of the female players in the sample under study.

**Sample selection conditions:**

- The athlete must be registered with the Egyptian Gymnastics Federation.
- The Practice period of the female player must not be less than 5-7 years.
- The approval of the player's parents to participate in the application of some study procedures to her.

*Table (1)  
Statistical characterization of the basic variables of the research sample (N= 10)*

<i>Variables</i>	<i>Mean</i>	<i>SD</i>	<i>Median</i>	<i>Skewness</i>	<i>Kurtosis</i>
<i>Age</i>	<i>10.12</i>	<i>0.59</i>	<i>10.20</i>	<i>-0.56</i>	<i>-0.0<sup>v</sup></i>
<i>Weight</i>	<i>37.81</i>	<i>2.04</i>	<i>37.05</i>	<i>0.56</i>	<i>-1.38</i>
<i>Height</i>	<i>138.10</i>	<i>1.91</i>	<i>138.00</i>	<i>-0.06</i>	<i>-0.87</i>
<i>Practice period / years</i>	<i>5.60</i>	<i>0.70</i>	<i>5.50</i>	<i>0.78</i>	<i>-0.1<sup>o</sup></i>

Table 1 illustrates that the data are moderate, not dispersed, and characterized by a normal distribution for the sample, as the values of the skewness coefficient were limited to (-0.56,0.78) which confirms the moderateness of the data for the research sample.

**Research measurements:**

**1. Flamingo Test (Static Balance):**

The subject stands on a balance beam on the instep of one foot, raises the other leg and pulls it towards the buttocks, and tries to maintain balance for one minute. The time is stopped if the raised foot touches the balance beam, and it is restarted again after the balance is restored, and the number of mistakes per minute is counted. The number of mistakes is equal to the number of points scored. seven mistakes give a score of 7 for example. If more than fifteen errors are made within one minute, the test stops, and the score is fifteen. Excellent <3, Very good 3-4, good 5-6,

sufficient 10-7, poor 11-14, inadequate 15 (Garcia-Lineira et al., 2023; Marcu, 2009).

**2. Y-Balance Test (Dynamic Balance):**

To conduct the test, place three stripes of tape on the ground in Y shape, the angles between the anterior stripe and both posterior stripes are 135 degrees with 90 degrees between the 2 posterior stripes (Fig.1). To start, the participant should stand on one limb at zero-mark position with his hands on the hip and ask him/ her to try to reach as far as possible along the tape stripe on the right foot. He/ She must repeat this with the same foot for a total of three successful times with the right foot. Followed by repeating this procedure by standing on the left foot to reach the anterior

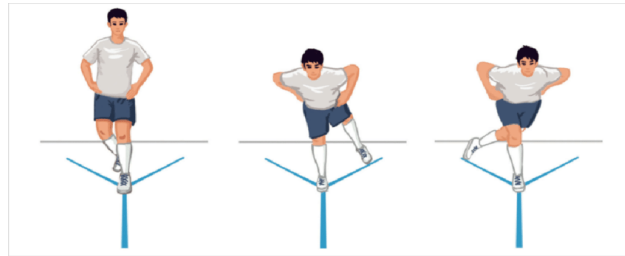
direction. This procedure is repeated for posteromedial and posterolateral reach directions. The tape should be only touched lightly with the toes and the examiner marks the most distal point of contact on the tape. A trial is not considered complete if the subject touches the tape heavily. To calculate the Y Balance Test score by using the following three equations:

$$\text{Absolute reach distance (cm)} = (\text{Reach 1} + \text{Reach 2} + \text{Reach 3}) / 3$$

$$\text{Relative (normalised) reach distance (\%)} = \text{Absolute reach distance} / \text{limb length} * 100$$

$$\text{Composite reach distance (\%)} = \text{Sum of the 3 reach directions} / 3 \text{ times the limb length} * 100. \text{ Reliability (ICC} = 0.88- 0.99) \text{ (Plisky et al., 2009; Shaffer et al., 2013).}$$

**Figure (1) Y-Balance Test**

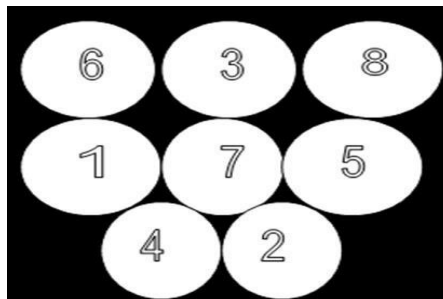


**3. The coordination test of moving between numbered circles:**

Draw eight circles, each with a diameter of 60 cm, on the ground and number them as shown in the (Fig.2). The subject stands on one foot inside the first circle, and upon

hearing the signal, he jumps on the same foot to reach the second circle, then the third and up to the eighth circle as quickly as possible. The time is calculated after reaching the last circle (Shalash, 2010).

**Figure (2) The coordination test of moving between numbered circles**



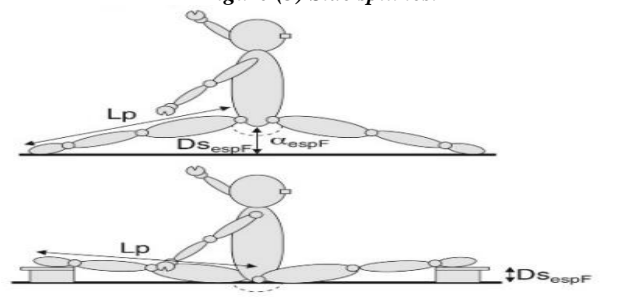
**4. Stand and Reach Test (Flexibility):**

The test begins by standing on a box with a numbered ruler attached to it, and the zero point is at the edge of the box. From a standing position, without bending the knees, the participant bends the torso downward slowly, trying to achieve the maximum possible reach. Points are calculated based on the maximum point on the ruler that the subject reaches ( $r= 0.46-0.67$ ) (Robert Wood, 2020).

**5. Side split test (Flexibility):**

The gymnast stands on both feet, abducts the lower extremities as far as possible while keeping the torso perpendicular to the floor. This test is modified for gymnasts who have reached 180 degrees where the gymnast raises their legs to the sides 20 cm while keeping their pubis in contact with the floor (Fig.3) (Douda et al., 2017; Sands et al., 2003).

**Figure (3) Side split test**

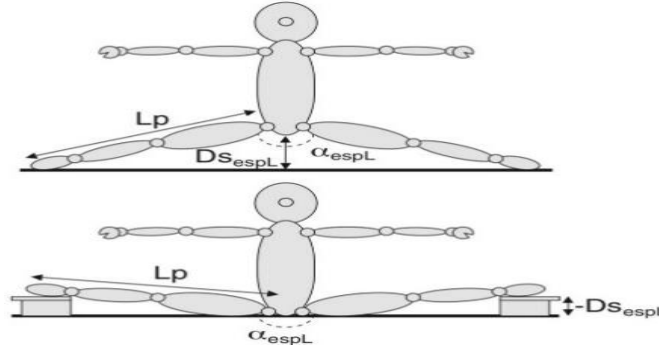


**6. Front split test (Flexibility):**

The gymnast stands on both feet, with the lower limbs as far apart as possible, one in a forward inversion position and the other in a backward inversion position, keeping the torso perpendicular to the floor. This test has been modified

for gymnasts who have reached 180 degrees by raising their legs to the sides 20 cm while keeping their pubis in contact with the floor (Fig.4) (Douada et al., 2017; Sands et al., 2003).

*Figure (4) Front split test*



**7. Vertical Jump Test (The ability to exert effort):**

The participant stands next to a wall and extends his inside hand to the wall, and a mark is made at the fingertips. The participant jumps upward, trying to touch the wall at the highest point. The distance difference between the two points is calculated. The participant makes three attempts and the best of them is recorded ( $r = 0.88 - 0.98$ ) (Loturco et al., 2018).

**8. The Plank Fitness Test (The ability to exert effort):**

This test aims to measure strength-endurance to keep the body elevated for as long as possible. The upper body is raised using the elbows and forearms, with the legs straight and the body weight on the toes. The thigh is lifted off the floor to form a straight line from head to toe. Once the participant is in the correct position, the stopwatch starts for as long as possible (Bohannon et al., 2018; Strand et al., 2014).

**9. Reaction Time Ruler Drop Test (Reaction Speed):**

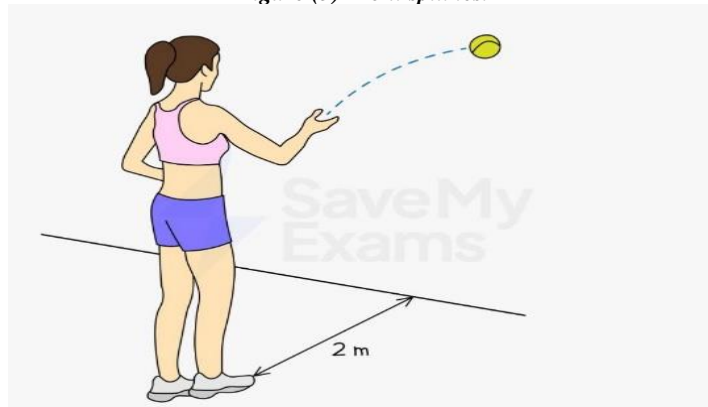
This test aims to measure reaction time, hand-eye quickness and attentiveness. The assistant holds the ruler between the

thumb and index finger so that the top of the participant's thumb is at the level of the zero cm line on the ruler. The assistant releases the ruler, and the participant holds it between his index finger and thumb as quickly as possible. The assistant records the distance between the bottom of the ruler and the top of the participant's thumb where the ruler has been caught. The test is repeated two more times, and the average value used in the evaluation is determined. To calculate the reaction speed from the following equation:  $d = vt + \frac{1}{2}at^2$  (Davis et al., 2000).

**10. Hand-eye coordination test:**

The participant stands 2 meters away from a smooth wall. When the start signal is given and the stopwatch is started, the participant throws a tennis ball with his right hand against the wall and catches it with his left hand, then throws the ball with his left hand and catches it with his right hand. This cycle of throwing and catching is repeated for 30 seconds (Fig.5). The assistant counts the number of catches for 30 seconds (Beashel & Taylor, 1997).

*Figure (5) Front split test*

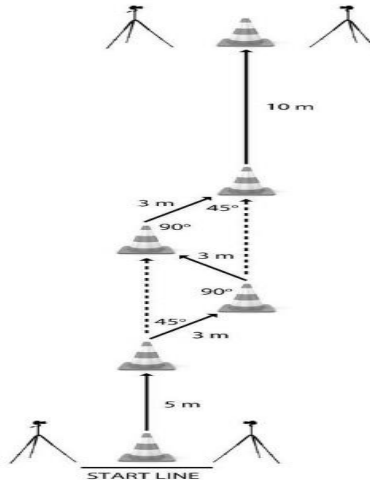


**11. CODAT Change of Direction and Acceleration Test:**

The dimensions and direction of movement for the CODAT are shown in Figure 6. A timing gate was placed at the beginning and end of the test. Participants performed the

test as quickly as possible. Participants also had to ensure that they cut around the markers, and did not go over them. Attempts were stopped and restarted if the participant cut over a marker, until 3 successful attempts were completed (Lockie et al., 2011; Sporis et al., 2009).

*Figure (6) CODAT Test*



*Table (2)*

*Statistical characterization of measurements of some coordination abilities associated with the aerobic gymnastics' routine N = 10*

<i>Variables</i>	<i>Mean</i>	<i>SD.</i>	<i>Median</i>	<i>Skewness</i>	<i>Kurtosis</i>
<i>Flamingo Test (Static Balance) / Times</i>	<i>10.90</i>	<i>1.10</i>	<i>11.00</i>	<i>-0.39</i>	<i>-1.24</i>
<i>Y-Balance Test - Relative reach distance (%)</i>	<i>45.60</i>	<i>4.65</i>	<i>46.00</i>	<i>-0.41</i>	<i>-0.45</i>
<i>The coordination test of moving between numbered circles/Sec</i>	<i>10.13</i>	<i>0.01</i>	<i>10.13</i>	<i>0.00</i>	<i>-1.03</i>
<i>Stand and Reach Test (Flexibility) / cm</i>	<i>11.10</i>	<i>0.99</i>	<i>11.00</i>	<i>0.61</i>	<i>-0.16</i>
<i>side split test (Flexibility) / cm</i>	<i>22.40</i>	<i>2.07</i>	<i>22.50</i>	<i>-0.01</i>	<i>-1.85</i>
<i>Front split test (Flexibility)/ cm</i>	<i>18.80</i>	<i>1.03</i>	<i>19.00</i>	<i>-0.27</i>	<i>-0.90</i>
<i>Vertical Jump Test / cm</i>	<i>28.20</i>	<i>1.99</i>	<i>28.00</i>	<i>0.29</i>	<i>0.55</i>
<i>The Plank Fitness Test / Sec</i>	<i>38.40</i>	<i>2.17</i>	<i>38.50</i>	<i>0.01</i>	<i>-0.78</i>
<i>Reaction Time Ruler Drop Test / Sec</i>	<i>0.18</i>	<i>0.01</i>	<i>0.18</i>	<i>0.76</i>	<i>-0.41</i>
<i>Hand-eye coordination test / Times</i>	<i>14.20</i>	<i>1.55</i>	<i>14.00</i>	<i>0.48</i>	<i>-0.46</i>
<i>CODAT Test / Sec</i>	<i>14.30</i>	<i>0.50</i>	<i>14.30</i>	<i>-0.09</i>	<i>-0.07</i>

Table 2 shows that the data for the coordination abilities under research are moderate, not dispersed, and characterized by a normal distribution for the sample, as the values of the skewness coefficient were limited to (-0.41, 0.76), which confirms the moderateness of the data for the research sample.

**Table (3)**  
*Statistical characterization of the performance level in aerobic gymnastics routine* *N = 10*

<i>Variables</i>	<i>Mean</i>	<i>SD</i>	<i>Median</i>	<i>Skewness</i>	<i>Kurtosis</i>
<i>Difficulty</i>	<i>1.17</i>	<i>0.26</i>	<i>1.20</i>	<i>-0.60</i>	<i>-0.13</i>
<i>Execution</i>	<i>6.30</i>	<i>0.18</i>	<i>6.25</i>	<i>0.82</i>	<i>-0.45</i>
<i>Artistry</i>	<i>6.52</i>	<i>0.22</i>	<i>6.50</i>	<i>0.00</i>	<i>-1.57</i>
<i>Total Score</i>	<i>13.00</i>	<i>0.27</i>	<i>13.00</i>	<i>0.09</i>	<i>-1.71</i>

Table (3) illustrates that the statistical characterization of the performance level variables of the research sample that the data is moderate, not dispersed and characterized by the normal distribution of the sample, as the values of the skewness coefficient were limited between (-0.60, 0.82), which confirms the moderation of the data for the research sample.

**Training program protocol for some coordination abilities associated with the aerobic gymnastics' routine:**

- The training program period for research samples is 10 weeks.
- Analysis the aerobic gymnastics routines for the national development age under 11 years old and design a training program for specific coordination abilities for skills performance within the aerobic gymnastics' routine.
- Choosing coordination exercises in the same direction, strength and speed of performance of the skills within the aerobic gymnastics' routine.
- The program included specialized coordination ability exercises, 4 sessions per week, taking into account:
- The intensity of the training load ranges between 60-95 % of each player's maximum ability (individual training).

- The repetitions for performing the exercises range between 8-30 reps and sets from 1-3.
- The session time ranges between (70-90) minutes, and the rest period between reps is 30-45 seconds and between sets is (2-3) minutes.
- Graduation of training load is based on the number of specialized coordination exercises, repetitions, sets and rests within a monocycle and Combine exercises with each other.

**Statistical Analysis:**

All data were analyzed using SPSS Version 25 at a confidence level of (0.95) corresponding to a significance level (probability of error) of 0.05, which is as follows:

- Mean.
- Standard deviation.
- Median
- Skewness coefficient.
- Flatness coefficient.
- Paired Samples T test
- Percentage change.

**Results:**

*Table (4)*

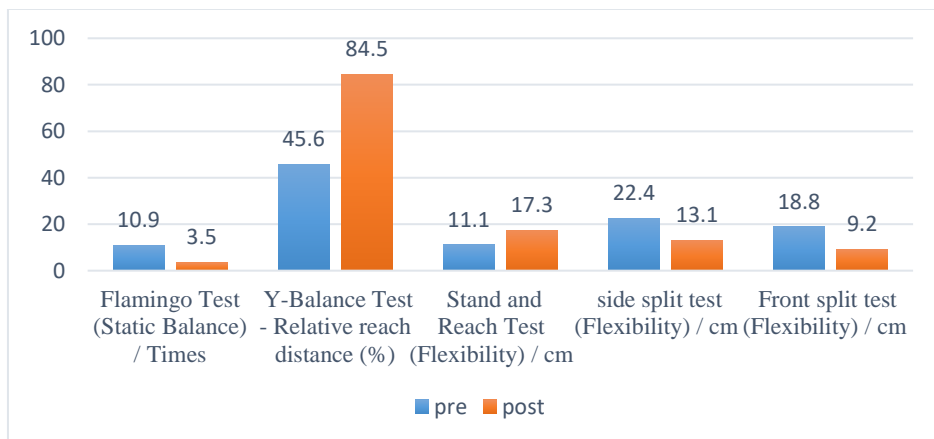
*The significance of the differences between the pre- and post-measurements in some coordination abilities associated with the aerobic gymnastics routine* *N= 10*

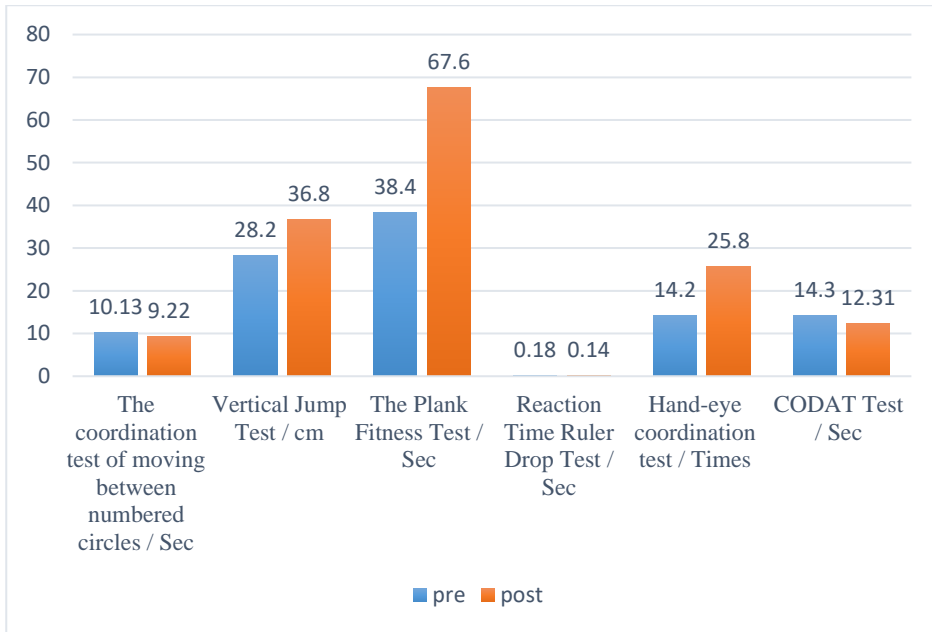
Variables	Before		After		Mean difference	T value	P value	Percentage %
	Mean	SD	Mean	SD				
<i>Flamingo Test (Static Balance) / Times</i>	10.90	1.10	3.50	0.71	7.40	17.34*	0.00	67.89
<i>Y-Balance Test - Relative reach distance (%)</i>	45.60	4.65	84.50	4.81	38.90	18.67*	0.00	85.31
<i>The coordination test of moving between numbered circles / Sec</i>	10.13	0.01	9.22	0.10	0.91	29.10*	0.00	8.98
<i>Stand and Reach Test (Flexibility) / cm</i>	11.10	0.99	17.30	1.06	6.20	14.89*	0.00	55.86
<i>side split test (Flexibility) / cm</i>	22.40	2.07	13.10	1.20	9.30	12.00*	0.00	41.52
<i>Front split test (Flexibility) / cm</i>	18.80	1.03	9.20	1.03	9.60	19.24*	0.00	51.06
<i>Vertical Jump Test / cm</i>	28.20	1.99	36.80	1.32	8.60	10.01*	0.00	30.50
<i>The Plank Fitness Test / Sec</i>	38.40	2.17	67.60	3.10	29.20	24.52*	0.00	76.04
<i>Reaction Time Ruler Drop Test / Sec</i>	0.18	0.01	0.14	0.01	0.04	7.89*	0.00	22.22
<i>Hand-eye coordination test / Times</i>	14.20	1.55	25.80	1.32	11.60	22.28*	0.00	81.69
<i>CODAT Test / Sec</i>	14.30	0.50	12.31	0.15	1.98	12.80*	0.00	13.85

\* Significant at 0.05 = 2.262

Table 4 shows that there are statistically significant differences between the pre- and post-measurements in the specialized coordination abilities variables, where the calculated T-value ranged between (7.89, 29,10), which are greater than T-table value at the level of (0.05), and the percentages of change are limited to (8.98, 85.31%)

*Figure (7) The mean of the pre- and post-measurements in coordination abilities*





**Table (5)**  
*The significance of the differences between the pre- and post-measurements of the performance level in aerobic gymnastics routine N= 10*

Variables	Before		After		Mean difference	T Value	P value	Percentage %
	Mean	SD	Mean	SD				
Difficulty	1.17	0.26	2.08	0.23	0.91	7.17*	0.00	77.78
Execution	6.30	0.18	7.85	0.37	1.55	12.87*	0.00	24.60
Artistry	6.52	0.22	7.99	0.37	1.47	15.39*	0.00	22.55
Total Score	13.00	0.27	16.69	1.11	3.69	12.19*	0.00	28.38

\* Significant at 0.05 = 2.262

Table 5 illustrates that there are statistically significant differences between the pre- and post-measurements in the variables of the performance level in aerobic gymnastics routine, where the calculated T-value ranged between (7.17, 15.39), which are greater than T-table value at the level of (0.05), and the percentages of change are limited to (22.55, 77.78%).



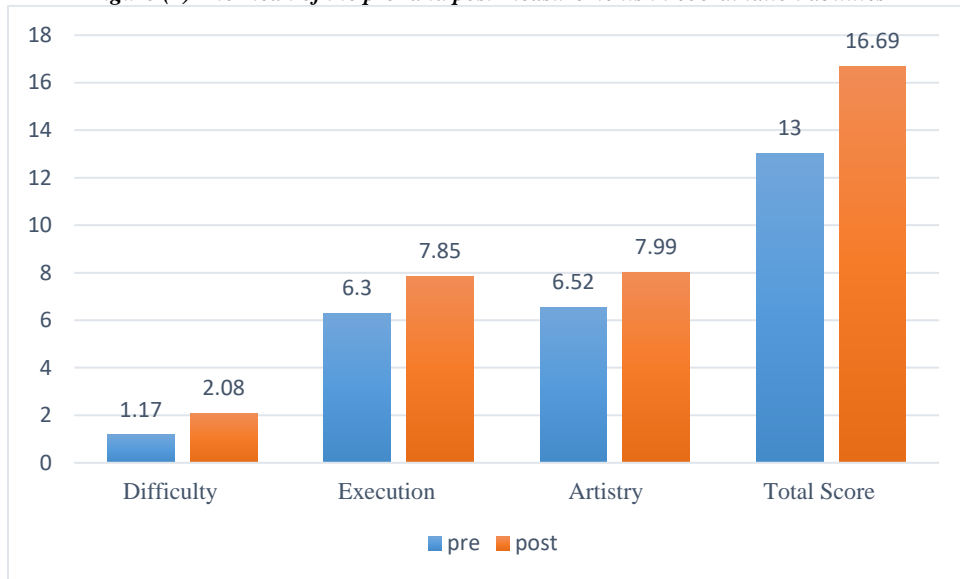
**Figure (7) The mean of the pre- and post-measurements in coordination abilities****Discussion:**

Table (4) on the differences between the pre- and post-measurement and the percentage of improvement for the research sample in the level of special coordination abilities shows that there are statistically significant differences in favor of the post-measurement for aerobic gymnastics players under 11 years old, which in turn was reflected in the level of skill performance. The results of the Flamingo Test (Static Balance) show that the mean test value before implementing the training program was 10.90 falls per minute, and the average test value after implementing the training program was 3.50 falls per minute. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (17.34), which is greater than the t-table value (2.262), and the percentage of improvement was 67.89%. This is consistent with the study (Garcia-Lineira et al., 2023; Marcu, 2009), which confirmed that if the number of falls exceeds 10 during the test, it indicates a decrease in the level of static balance.

As it is clear from the results of the Y-Balance Test - Relative reach that the mean value of the test before implementing the training program was 45.60% and the mean value of the test after implementing the training program was 84.50%. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (18.67), which is greater than the t-table value (2.262), and the improvement rate was 85.31%. This is consistent with the study (Plisky et al., 2009; Shaffer et al., 2013), which indicated that a decrease in the average value of the Y-balance test below 47% indicates a decrease in the level of dynamic balance.

The researcher attributes these changes to the positive impact of the training program implemented using some special coordination abilities exercises, which led to improving the level of static and dynamic balance in the research sample.

The results of the coordination test of moving between numbered circles show that the mean test value before implementing the training program was 10.13 seconds, and the mean test value after applied the training program was 9.22 seconds. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (29.10), which is greater than the t-table value (2.262), and the improvement rate was 8.98%. This is consistent with the study (Dunsky et al., 2017; Granacher et al., 2012; Grigoret al., 2016; Heyward & Gibson, 2018), which confirmed that special coordination exercises lead to improving the ability to link motor and the ability to change direction. The researcher attributes these changes to the effectiveness of the training program applied using some special coordination ability exercises, which led to improving the level of ability to link motor and the ability to change direction.

The results of the Stand and Reach Test show that the mean test value before implementing the training program was 11.10 cm, and the mean test value after applied the training program was 17.30 cm. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (14.89), which is greater than the t-table value (2.262), and the improvement rate was 55.86%. This is consistent with the study (Robert Wood, 2020), which confirmed that a decrease in the average test value below 15 cm indicates a low level of flexibility. It is also consistent with the study (Avalos-Ramos & Vega-Ramiréz, 2020; Dimitrova, 2015; Issa, 2016), which confirmed that special coordination exercises lead to improving the level of flexibility.

The results of the Side split test and Front split test, where the gymnast raises his legs to the sides by 20 cm, show that the mean test value before implementing the training program was (22.40, 18.80) cm, respectively, and the mean test value after applied the training program was (13.10-9.20) cm. The significance of the differences between the pre- and post-measurement was in favor of the post-

measurement at the 0.05 level, as the calculated t-value was (12.00, 19.24), respectively, which is greater than the t-table value (2.262), and the improvement rate was (41.52, 51.06) %, respectively. This is consistent with the study (Douda et al., 2017; Sands et al., 2003), which confirmed that an increase in the mean test value of more than 15 cm indicates a decrease in the level of flexibility in the hip joint. It also agrees with the study (Avalos-Ramos & Vega-Ramírez, 2020; Dimitrova, 2015; Issa, 2016) which confirmed that special coordination training leads to improving the level of flexibility. The researcher attributes these changes to the effectiveness of the training program applied using some special coordination abilities exercises, which led to improving the level of flexibility in the research sample for aerobic gymnasts under 11 years old.

The results of the Vertical Jump test show that the mean test value before implementing the training program was 28.20 cm, and the mean test value after applied the training program was 36.80 cm. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (10.01), which is greater than the t-table value (2.262), and the improvement rate was 30.50%. This is consistent with the study (Loturco et al., 2018), which confirmed that a decrease in the average test value below 30 cm indicates a decrease in the level of effort and ability to jump. The results of The Plank Fitness Test show that the mean test value before implementing the training program was 38.40 seconds, and the mean test value after applied the training program was 67.60 seconds. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (24.52), which is greater than the t-table value (2.262), and the improvement rate was 76.04%. This is consistent with the study (Bohannon et al., 2018; Strand et al., 2014), which indicated that a decrease in the average test value below 60 seconds indicates a decrease in the level of effort. The results of the Vertical Jump and Plank Fitness Test are consistent with the study (Dunsky et al., 2017; Granacher et al., 2012; Grigoreet al., 2016; Heyward & Gibson, 2018) which confirmed that special coordination exercises improve the level of ability to exert effort and accomplish motor tasks. The researcher attributes these changes to the positive effect of the training program applied using some special coordination ability exercises, which led to improving the level of ability to exert effort and accomplish motor tasks in the research sample for aerobic gymnasts under 11 years old.

The results of the Reaction Time Ruler test show that the mean test value before implementing the training program was 0.18 seconds, and the mean test value after applied the training program was 0.14 seconds. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (7.89), which is greater than the t-table value (2.262), and the improvement rate was 22.22%. This is consistent with the study (Avalos-Ramos & Vega-Ramírez, 2020; Dimitrova, 2015; Issa, 2016), which confirmed that special coordination exercises lead to

improving the level of reaction speed and the ability to change direction.

The results of the Hand-eye coordination test show that the mean test value before implementing the training program was 14.20 times within 30 seconds, and the mean test value after applied the training program was 25.80 times within 30 seconds. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (7.89), which is greater than the t-table value (22.28), and the improvement rate was 81.69%. This is consistent with the study (Beashel & Taylor, 1997), which indicated that a decrease in the average test value of less than 15 times within 30 seconds indicates a decrease in the level of reaction.

The results of the CODAT Test also show that the mean test value before implementing the training program was 14.30 seconds, and the mean test value after applied the training program was 12.31 seconds. The significance of the differences between the pre- and post-measurement was in favor of the post-measurement at the 0.05 level, as the calculated t value was (12.80), which is greater than the t-table value (22.28), and the improvement rate was 13.85%. This is consistent with the study (Beashel & Taylor, 1997), which indicated that a decrease in the average test value of less than 15 times within 30 seconds indicates a decrease in the level of reaction. It is also consistent with the study (Avalos-Ramos & Vega-Ramírez, 2020; Dimitrova, 2015; Issa, 2016), which confirmed that special coordination exercises lead to improving the level of reaction speed and the ability to change direction.

The researcher attributes these changes to the effectiveness of the training program implemented using some special coordination abilities exercises, which led to improving the level of reaction speed and the ability to change direction in the shortest possible time for aerobic gymnasts under 11 years old.

This was reflected in improving the level of skill performance in the aerobic gymnastics routine, as it is clear from Table (5) on the differences between the pre- and post-measurement in the level of skill performance for the aerobic gymnastics routine that there are statistically significant differences in favor of the post-measurement in the variables (difficulty value - Execution value - Artistry value - total score value), as the calculated t value reached (7.17- 12.87- 15.39- 12.19) respectively, which is greater than the t-table value (2.262) at the 0.05 level, and the percentage of improvement was (77.78- 24.60- 22.55- 28.38) % respectively. This is consistent with the study (Avalos-Ramos & Vega-Ramírez, 2020; Dimitrova, 2015; Issa, 2016), which confirmed that the level of coordination abilities directly affects the level of skill performance for the aerobic gymnastics' routine. The researcher attributes these changes to the positive impact of the applied training program using some specialized coordination abilities exercises, as improving the specific coordination abilities reflected in the components routine by performing of elements of higher difficulty value and developing the level of ability to link the movement and coordination exercises between the arms and legs in the sequence and transition,

which was reflected in the mean value of the total score for the aerobic gymnastics routine.

**Conclusion:**

Through the research results, the researcher concluded the following:

1. The applied training program led to a significant improvement in the level of coordination abilities specific to the skill performance of the aerobic

gymnastics' routine under 11 years old, as the calculated T value ranged between (7.89-29.10).

2. The applied training program using special coordination exercises led to a significant improvement and development in the level of skill performance of the aerobic gymnastics' routine under 11 years old, as the calculated T value ranged between (7.17- 15.39).

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