A Technical Training Program with Reference to Kinematic Variables for Improving the Startup Skill in Swimming

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Background & Research Problem:

Scientific and technological advances are reflected greatly in the amazing achievements of the sports field. These advances included training, learning, assessment, officiating and analysis. These advances also increased the reliability of results and data. This led traditional methods to disappear. Elite levels in all sports, and especially in digital sports, depend on the application of kinematic laws.

Swimming was affected greatly with these advances as it is considered a rich field for applying kinematic laws in addition to technical aspects. This affects the digital record of swimmers. Considering swimming events, especially 50m free style, we can notice stunning advances in the dynamics of digital records. Research studies were applied to identify the factors and methods to be used in improving the digital record of swimmers.

Swimming is a digital sport that affects the development of all related sciences through methods of preparing and training swimmers to improve their physical and technical levels to help them reach high levels of competition.

Startup is a major skill as it affects the race result. It improves the digital record of swimmers, especially in short races (50-100m) and medley. Maglicho (1993) indicated that improving the startup may decrease the total time of race by 0.10 as the time of this skill represents 25% of total time of 50m race, 10% of 100m race and 5% of 200m race (19: 545).

Abdulghany, A. (1997), Ismail, I. (2000), Hannula (1995) and Dixon (1996) indicated that although there are various shapes for start, either according to the style (traditional - flash – round – arrow) or according to the technique, free style, butterfly and breast strokes are started from above the start cube while the start of back stroke is performed in water by pushing the wall. They are all agreed on one objective, that is to start strongly and quickly enough to finish the race in the least possible time through using the resistance from the cube to provide the body with max speed and efficiency to push the

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body forward. This produces flight velocity that is three times greater than the swimming sport (4) (16) (13) (12).

Algamal, G. (1997) and Stewart et al (1995) indicated that the push force of the swimmer from the start cube results from force generated by lower limps and power of the swimmer at the start. This identifies the direction and distance of flight towards water (8) (23)

Juergens, C. (1996) indicated that the swimmer should exert max effort to reach the farthest possible distance in the air (flight distance) as soon as possible and this requires a sequenced work of trunk, iliac, thighs and legs muscles all in order (11). Luhtanen & Komi (1994) and Stewart et al (1996) agreed that iliac and leg muscles are responsible for generating positive motor performance during start (17) (18). In addition, Tawfik, R. (2010) indicated that improving vertical velocity of body links towards water leads to concomitant improvements in specific strength of female swimmers (2).

Startup is of major importance for the swimmer's digital record. Therefore, several studies worked on improving the technical and physical preparation of this skill. Most studies concentrated on the flight phase when the swimmer leaves the block and reaction time.

The researcher noticed a decrease in the technical and skills levels of startup in junior swimmers of Tanta Sports Club. As startup is important for improving the digital record in swimming, the researcher is trying to improve it through improving flight angle, velocity and distance in addition to entry angle to water. Abu Al-Ela (1993) indicated that there were several trials to improve the technical performance level for startup but none of them provided a good alternative for this improvement (3). Alaa El-Din, G. (1989) indicated that mastering and improving the technical level is closely related to the correct details of movement and how to unify them (7).

Maglishcho (1993) indicated the importance of startup as it affects race time with 0.10 sec (19). Kamel, O. & Zaki, A. (1992), Abu Al-Ela (1994), Hassan, M. et al (1996) and Dixon (1996) indicated that improving startup requires concentration on increase leg muscles strength to reach maximal propulsion and flight distance while the feet leave the block (19) (20) (3) (14) (12). Juerhens (1996) indicated that the swimmers exerts maximal effort to reach the max flight distance possible as fast as he/she can and knee muscles are mainly responsible for positive and effective movement production from the legs during startup (17: 119).

Several studies based on mechanical analysis, kinematic characteristics and other physical and technical variables investigated the improvement of startup like Shafiq, M. (1986), Ibrahim, A. (1987), Stewart et al (1995), Abd El-Aziz, A. (1997), Al-Gamal, G. (1997), Abd El-Bary, W. (1998), Schnabel, U., & Küchler, J (1998), Raul et al (2000), Ismail, I. (2000) and Zaki, W. (2002). (22) (15) (23) (4) (8) (1) (25) (21) (16) (26).

These studies indicate that the main purpose of startup is to push the swimmer away from the block as fast as possible. This phase requires using max pushing force from all body segments on the block as the resultant force is the sum of all forces. This force and works as an indicator of force exerted to provide the swimmer's body with acceleration to take off, fly and inter the water.

Therefore, the researcher though of using a training equipment to help swimmers control the flight angle, velocity and distance in addition to facilitating movement transfer from down the body up and forward to improve the startup. This equipment provides the swimmer with a specific angle for altitude in addition to specific flight distance, specific angle of landing and specific angle of water entry. This improves body altitude; power transfer and flight angle for swimmers who are weak in these variables.

Aim:

The current research aims to improve the startup of swimming through a technical performance program with recommended equipment with reference to kinematic variables and to identify its effects on 25m front crawl time.

Hypothesis:

There are statistically significant differences between the pre- and post-measurements of all variables under investigation in favor of post-measurements.

Methods:

Approach:

The researcher used the experimental approach (one-group design) with pre- and post-measurements.

Participants:

Participants (n=10) were purposefully chosen from junior swimmers (less than 14 years) of Tanta Sports Club according to the following criteria:

1. All participants have elite levels and digital records.
2. All participants know the four strokes, start, turn and touch.
3. All participants are punctual in their training.

Table (1) shows descriptive data of participants.

Table (1): growth variables and technical performance variables of participants
(n=10)

	Variables		Measurement	Mean	Media	SD	Squewness
1	Growth variables	Age	Year / moth	13.29	13.3	-0.13	-0.13
2		Height	Cm	154.18	154	0.44	0.44
3		Weight	Kg	53.88	54.7	-0.58	-0.58
4		Training period	Year / moth	4	4	0	0
1	Technical performance variables	Thigh range of motion	Degree	184.84	184	0.81	0.81
2		Knee range of motion	Degree	53.57	53.5	0.07	0.07
3		Ankle range of motion	Degree	35.63	35.8	-0.21	-0.21
4		Water entry angle	Degree	40.5	40.2	0.34	0.34
5		Flight velocity	Sec	3.9	4	-0.35	-0.35
6		Flight distance	Cm	1.85	1.75	0.73	0.73
7		Flight angle	Degree	29.5	29.2	0.47	0.47
-	25m time		Sec	16.95	16.92	1.07	0.08

Table (1) indicates that squewness values ranged between (3±). This indicates that data is free of radical distributions and have high homogeneity.

Data Collection Tools:

Physical Tests:

- Height
- Weight
- Thigh range of motion test
- Knee range of motion test
- Ankle range of motion test

Kinematic measurements:

- Flight velocity
- Flight distance
- Flight angle
- Water entry angle

Equipment:

- Medical balance for weights
- A restameter for heights
- A stopwatch
- A goniometer for the range of motion
- The recommended device for specifying flight angle and distance (annex 1)
- A computer set with ULEAD GIF animator v5 software to analyze flight velocity, distance and time
- Data collection log for physical and technical variables (annex 2)

The recommended device specifications:

The device is and iron belt (0.70 x 0.60 cm) with two bars attached to it (2.5m in height) in addition to another four bars (two of them, shown in blue are movable and fixed with ropes from the upper part to indicate flight distance, while the other two, shown in red, are fixed to the block to indicate flight altitude).

The recommended program:

The program includes technical exercises using the recommended device for improving flight angle and distance during startup (annex 2). The recommended program aims to improve the startup using these exercises and the recommended device.

Table (2): Components of the recommended program

Part	Duration
Number of weeks	6 weeks
Total number of units	3x6=18 units
Units per week	3 units
Unit duration	45 min
Total duration per week	45x3=2.15 hour
Total duration of program	13.30 hour

Table (3): duration of unit components

Part	Objective	Duration (min)
General warm-up	Preparing the involved muscles to activity	5
Specific warm-up (stretches – strength)	All working muscles	10
Training device – weight training	Recommended program	25
Cool down	Cool down	5

First pilot study:

The researcher performed a pilot study on a pilot sample (n=6) from the same research community and outside the main sample from 1-7-2013 to 7-7-2013 to fulfill the following objectives:

1. Assuring the functionality of the recommended device
2. Assuring the availability of tools in addition to its functionality
3. Identifying the anatomical markers for measuring joints' ranges of motion
4. Training assistants on how to take measurements correctly
5. Identifying timing and duration of measurements
6. Identifying suitable altitudes of the device and number of repetitions

Second pilot study:

The researcher performed a pilot study on a pilot sample (n=6) from the same research community and outside the main sample from 10-7-2013 to 16-7-2013 to make sure that participant will be able to perform exercises and to identify training volume and intensity in addition to number of repetitions.

Main Study:

Pre-measurements:

Pre-measurements of all research variables were taken from 17-7-2013 to 18-7-2013 at the swimming pool of Tanta Sports Club.

Main application:

The researcher applied the recommended program to participants from 19-7-2013 to 23-8-2013 using the recommended training device.

Post-measurements:

Post- measurements of all research variables were taken from 24-8-2013 to 25-8-2013 at the swimming pool of Tanta Sports Club

Statistical treatments:

The researcher used SPSS software to calculate mean, SD, median, squewness, flatness, (t) test, relative importance and improvement percentage.

Results:

Table (4): difference significance between pre- and post-measurements of participants on kinematic variables and the digital record (n=10)

	Variables		Pre-		Post-		Means differences	Standard error	(t)	Improvement percentage %
			Mean	SD ±	Mean	SD ±				
1	Technical performance variables	Thigh range of motion	184.84	3.11	213.68	2.76	28.85	2.52	11.45	15.61
2		Knee range of motion	7.57	2.87	10.2	2.03	2.63	0.38	6.92	34.74
3		Ankle range of motion	35.63	2.52	43.34	3.17	7.72	0.71	10.87	21.66
4		Water entry angle	32.1	2.64	40.5	1.68	8.4	0.65	12.92	26.17
5		Flight velocity	3.9	0.86	7.4	0.92	3.5	0.26	13.46	89.74
6		Flight distance	2.41	0.41	3.96	0.38	1.55	0.08	19.38	64.32
7		Flight angle	29.5	1.93	40	2.32	10.5	0.89	11.8	35.59
-	25m time		16.99	0.62	14	0.72	-2.99	0.24	12.44	17.57

(t) Table value on P≤0.05 = 1.72

Table (4) indicates statistically significant differences between the pre- and post-measurements of participants on the kinematic variables and digital record as (t) values ranged between (6.92) and (19.38) exceeding its table value. Improvement percentage ranged between (15.61%) and (89.74%) while (t) value for the digital record was 12.44 with 17.57% improvement.

Discussion:

Table (4) indicates statistically significant differences between the pre- and post-measurements of participants on the kinematic variables due to the application of the recommended training program using the training device. Results indicate that (t) values and improvement percentages were as follows:

- Improvement percentage and (t) value for thigh range of motion were 11.45 and 15.61% respectively.
- Improvement percentage and (t) value for knee range of motion were 6.92 and 34.74% respectively.
- Improvement percentage and (t) value for ankle range of motion were 10.87 and 21.66% respectively.

The researcher thinks that this is due to the effects of the recommended training program with the recommended training device as this device helps swimmers to identify flight angle and altitude in addition to providing additional pushing to compensate the decrease of lower limps strength and improves the range of motion for lower limp joints to increase flight distance. In addition, the gradual increase in bar altitude and distance helps increasing flight distance, angle and velocity. Several researchers indicated that the best angle for the optimum flight distance is 45 degrees. The recommended device can improve flight angle and entry angle as well. This is consistent with Al-Gamal (1997), Ismail, I. (2000), Shafiq, M. (1986), Ibrahim, A. (1987), Abd l-Ghany, A. (1997), Abd Elbary, W. (1998) and Zaki, W. (2002) (8) (16) (22) (4) (15) (1) (26).

Improvement percentage and (t) value for flight angle were 11.80 and 35.59% respectively. The researcher thinks that is due to the gradual increase of mean angle from 29.5 to 40 degrees and the use of mechanical work of swimming. This enabled swimmers to exert more explosive power to overcome the training bar. This happened gradually as good start leads to good end. According to the equation (tangent=opposite / near), improvement in flight angle leads to improvement of flight distance. This is consistent with Halnnula (1995) and Dixon (1996) who indicated that good and quick start decreases the race time through the best use of optimum flight angle (13) (12).

Maglischo (1993) indicated that flight angle is the angle created by the diagonal line from the pool to the swimmer’s toe and it should be (43) degrees horizontal to the start block (19). This angle degree helps achieving the optimum flight distance and velocity. This is consistent with Al-Gamal (1997), Ismail, I. (2000),

Shafiq, M. (1986), Ibrahim, A. (1987), Abd l-Ghany, A. (1997), Abd Elbary, W. (1998) and Zaki, W. (2002) (8) (16) (22) (4) (15) (1) (26).

Improvement percentage and (t) value for flight distance were 19.38 and 64.32% respectively. The researcher indicates that the swimmer's head is a directional point and keeping it up leads to elevating the body center of gravity over the water. This drives the body to fly forward without descending quickly to water. Head's weight is 7% of body weight while arm weight is 6%. Trunk weight is 43% and legs weight is 12%. If the head, arms and trunk pass the right angle of the triangle then the flight distance will be equal to hypotenuse and the swimmer can make use of the 15m allowed according to swimming rules.

This is consistent with Jorgens (1996) who indicated that the swimmer should do his/her best to cover the farthest horizontal distance on air as quickly as possible and this means to use muscles of the trunk, buttock, thighs and legs in coordinated manner (17). This is also consistent with Al-Gamal (1997) who indicated that improving flight angle leads to improvements in flight distance (8).

Improvement percentage and (t) value for entry angle were 12.92 and 26.17% respectively. The researcher thinks that swimmers abducted arms towards the body to make use of trunk angular velocity with quick extension of shoulders immediately after water entry with an angle of 40.50 degrees. This is consistent with Abd El-Fattah, A. (1994) who indicated that water resistance increases if the body enters water flat as a large portion of the body will touch the water and the optimum entry angle is 45 degrees (6).

Improvement percentage and (t) value for flight velocity were 13.46 and 89.74% respectively. The researcher thinks that this is due to the effects of the recommended training program with the recommended training device as this device helps swimmers to identify flight angle and altitude in addition to providing additional pushing to compensate the decrease of lower limps strength and improves the range of motion for lower limp joints to increase flight distance, angle and velocity. Several researchers indicated that the best angle for the optimum flight distance is 45 degrees. The recommended device can improve flight angle and entry angle as well. This is consistent with Al-Gamal (1997), Ismail, I. (2000), Shafiq, M. (1986), Ibrahim, A. (1987), Abd l-Ghany, A. (1997), Abd Elbary, W. (1998) and Zaki, W. (2002) (8) (16) (22) (4) (15) (1) (26).

Results of this research are consistent with Abd El-Baseer, A. (1998) who indicated that the body should make straight entry with

optimum entry angle of 20-40 degrees as this decreases the body surface touching water during entry (2).

The application of the recommended program using the training device has led to improvements in flight distance, angle and velocity in addition to entry angle and ranges of motion for thigh, knee and ankle joints. This in turn led to improvements in the digital record of 25m front crawl for junior swimmers.

This is consistent with Ismail, I. (2000), Dixon (1996), Stewart et al (1995, Juergens (1996) and Al-Khodary, H. (1998) (16) (12) (23) (17) (9).

Conclusions:

In the light of this research aim, methodology and results the researcher concludes the following:

1. There are statistically significant differences between pre- and post-measurements of the thigh range of motion as (t) calculated value was (11.45) and improvement percentage was (15.61%).
2. There are statistically significant differences between pre- and post-measurements of the knee range of motion as (t) calculated value was (6.92) and improvement percentage was (34.74%).
3. There are statistically significant differences between pre- and post-measurements of the ankle range of motion as (t) calculated value was (10.87) and improvement percentage was (21.66%).
4. There are statistically significant differences between pre- and post-measurements of the entry angle as (t) calculated value was (12.92) and improvement percentage was (26.17%).
5. There are statistically significant differences between pre- and post-measurements of the flight velocity as (t) calculated value was (13.46) and improvement percentage was (89.74%).
6. There are statistically significant differences between pre- and post-measurements of the flight distance as (t) calculated value was (19.38) and improvement percentage was (64.32%).
7. There are statistically significant differences between pre- and post-measurements of the flight angle as (t) calculated value was (11.80) and improvement percentage was (35.59%).
8. There are statistically significant differences between pre- and post-measurements of 25m front crawl record as (t) calculated

value was (12.44) and improvement percentage was (17.57%).

Recommendations:

In the light of these conclusions, the researcher recommends the following:

- Using the recommended training device as it provides the swimmer with a specific angle of flight in addition to specific flight distance and specific point of entry. It helps identifying body altitude and transferring power from down to up. This improves the startup skill.
- Using the recommended training program as its exercises work on improving and modifying motor paths so that startup becomes more effective
- Using the recommended training device with various age groups with specific considerations concerning modification of altitude and distance of bars according to each age group abilities

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Annexes

Annex (1): The Flight Angle and flight Distance Device

Annex (2): Exercises of the Recommended Training Program

Annex (3): Data Collection Log for Variables under Investigation

Annex (1): The Flight Angle and flight Distance Device

The main aim of this device is to help coaches and swimmers to evaluate and identify flight angle and distance according to the abilities of each swimmer with reference to individual differences in heights, angular perception and flight distance perception. Linking these factors together improves the digital record of the swimmer.

The researcher initiated the flight distance and flight angle parts according to the performance from block release till the end of the startup phase. Each component has a separate unit. The following figure shows the device as a whole and how to fix its parts for flight angle and distance to the base.

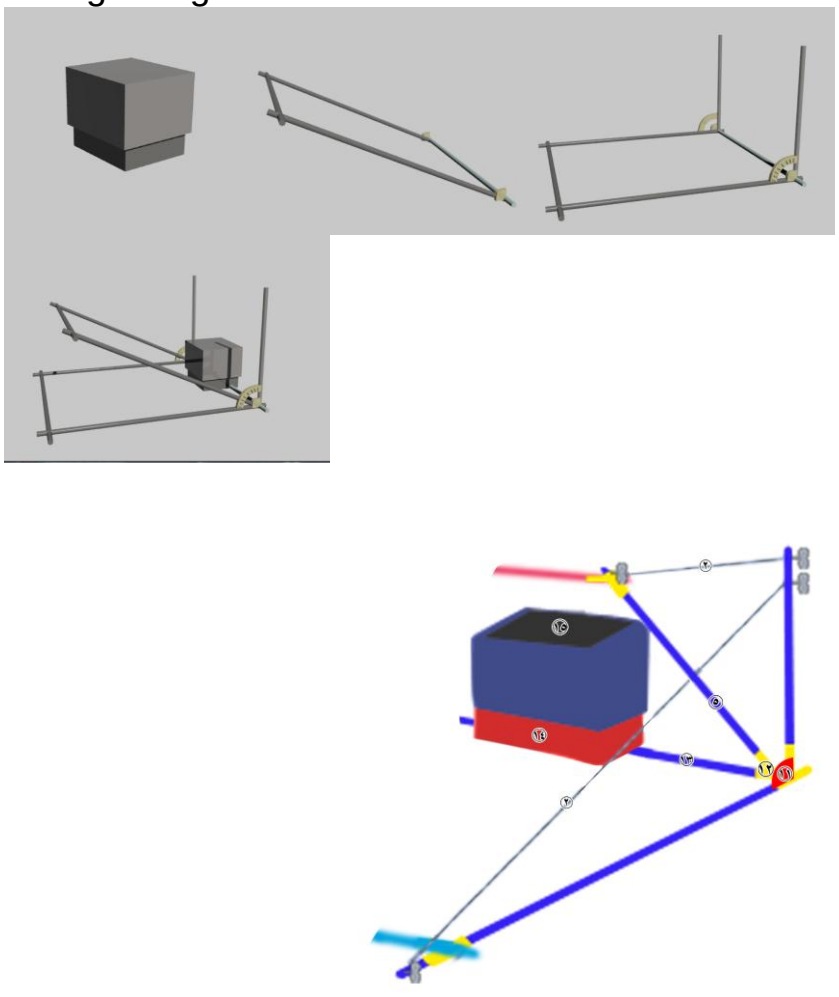


Fig.1 (Parts of the device)

Fig.2 (indication bars for flight angle and distance)

Annex (2)

The Technical Exercises Program using the Recommended Training Device

Components of the recommended program

Part	Duration
Number of weeks	6 weeks
Total number of units	3x6=18 units
Units per week	3 units
Unit duration	45 min
Total duration per week	45x3=2.15 hour
Total duration of program	13.30 hour

Duration of unit components

Part	Objective	Duration (min)
General warm-up	Preparing the involved muscles to activity	5
Specific warm-up (stretches – strength)	All working muscles	10
Training device – weight training	Recommended program	25
Cool down	Cool down	5

Load Distribution of Technical Exercises

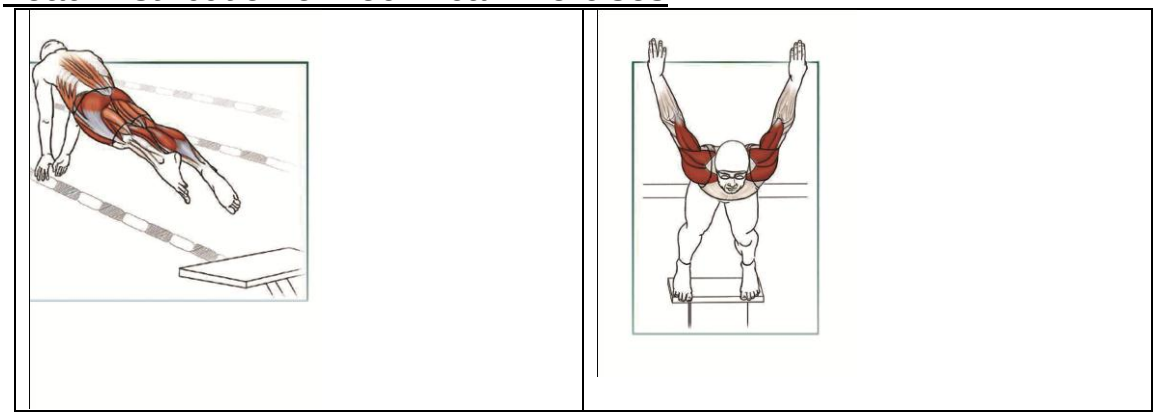


Fig. 3 (Working muscles during Startup)

Training loads (percentages):

Percentages indicate the intensity and volume of training loads to enable the swimmer reach maximum possible level according to his/her abilities. The maximum level matches the best level reached most of the time. If the swimmer fails to reach maximum level then

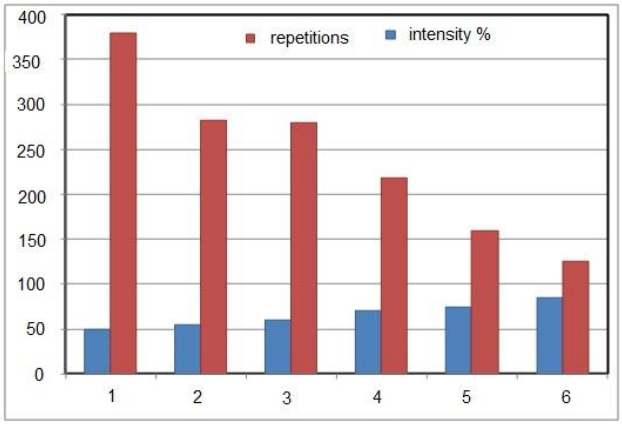
the coach and swimmer should reevaluate this max level and work on improving it through suitable exercises.

Warm-up and cool down:

These two components are very important to be done at the beginning and end of each training unit according to the training schedule with various intensities as seen in the following tables:

شدة التدريب	Volume	
45%	3x15-18 reps	45%
50%	18:20 reps	50%
60%	12:15 reps	60%
70%	10:12 reps	70%
80%	8:10 reps	80%
90%	6:8 reps	90%

Weeks	Weekly reps	Weekly intensity
1	380	%50
2	282	%55
3	280	%60
4	219	%70
5	159	%75
6	126	%85
Total	1446	



The diagram indicates intensity and volume of technical exercises

Warm-up:

م	Content	Duration	Intensity	Volume	
				Reps	Sets
1	400m jogging		% 50	1	1
2	400m multiple runs		% 50	1	1
3	Multiple jumps			8	4
4	Up-to-down flexibility			8 lower limp	6
5	Body parts stretches			----	

Week (1)

Three repetitions (Saturday – Monday – Wednesday) – Intensity 45:55%

Exercise	Intensity	Reps	Sets
1	%50	20:18	18-15× 3
2	%45	20:18	18-15× 3
3	%50	20:18	18-15× 3
1	%45	20:18	15-12 × 3
3	%50	20:18	15-12 × 3
2	%45	20:18	15-12 × 3
4	%50	20:18	15-12 × 3
2	%55	18:15	15-12 × 3
5	%60	15 : 12	15-12 × 3
7	%55	18:15	15-12 × 3
5	%50	20:18	15-12 × 3
3	%55	18:15	15-12 × 3
1	%50	20:18	15-12 × 3
14	%45	20:18	15-12 × 3
Total reps		380 تكرار	

Week (2)

Three repetitions (Saturday – Monday – Wednesday) – Intensity 50:60%

Exercise	Intensity	Reps	Sets
6	%55	17-15	15-12× 3
11	%50	17-15	15-12× 3
10	%55	17-15	15-12× 3
13	%50	17-15	15-12× 3
7	%55	17-15	15-12× 3
12	%50	17-15	15-12× 3
10	%55	17-15	15-12× 3
6	%60	15-12	15-12× 3
8	%65	15-12	15-12× 3
7	%60	15-12	15-12× 3
12	%55	17-15	15-12× 3
5	%60	15-12	15-12× 3
8	%55	17-15	15-12× 3
11	%50	17-15	15-12× 3
Total reps		282	

Week (3)

Three repetitions (Saturday – Monday – Wednesday) – Intensity 55:65%

Exercise	Intensity	Reps	Sets
1	%60	17-15	15-12× 3
2	%55	17-15	15-12× 3
10	%60	17-15	15-12× 3
11	%55	17-15	15-12 × 3
5	%60	17-15	15-12× 3
12	%55	17-15	15-12 × 3
3	%60	17-15	15-12× 3
4	%65	15-12	15-12× 3
1	%70	12: 10	15-12× 3
10	%65	15-12	15-12× 3
13	%60	17-15	15-12× 3
4	%65	15-12	15-12× 3
5	%60	17-15	15-12× 3
14	%55	17-15	15-12 × 3
Total reps		280	

Week (4)

Three repetitions (Saturday – Monday – Wednesday) – Intensity 60:70%

Exercise	Intensity	Reps	Sets
7	%65	15-12	12-10× 3
2	%60	15-12	12-10× 3
9	%65	15-12	12-10× 3
14	%60	15-12	12-10× 3
1	%65	15-12	12-10× 3
11	%60	15-12	12-10× 3
3	%65	15-12	12-10× 3
8	%70	12-10	12-10× 3
7	%75	11 -9	12-10× 3
1	%70	12-10	12-10× 3
5	%65	15-12	12-10× 3
8	%70	12-10	12-10× 3
3	%65	15-12	12-10× 3
12	%60	15-12	12-10× 3
Total reps		219	

Week (5)

Three repetitions (Saturday – Monday – Wednesday) – Intensity 70:80%

Exercise	Intensity	Reps	Sets
7	70%	10-12	2× 8-10
2	65%	10-12	2× 8-10
6	70%	10-12	2× 8-10
14	65%	10-12	2× 8-10
5	70%	10-12	2× 8-10
13	65%	10-12	2× 8-10
10	70%	10-12	2× 8-10
5	75%	11-9	2× 8-10
1	80%	10-8	2× 8-10
10	75%	11-9	2× 8-10
6	70%	10-12	2× 8-10
5	75%	11-9	2× 8-10
7	70%	10-12	2× 8-10
11	65%	10-12	2× 8-10
Total reps		159	

Week (6)

Three repetitions (Saturday – Monday – Wednesday) – Intensity 80:90%

Exercise	Intensity	Reps	Sets
8	75%	11-9	2× 6-8
2	70%	11-9	2× 6-8
6	75%	11-9	2× 6-8
12	70%	11-9	2× 6-8
5	75%	11-9	2× 6-8
9	70%	11-9	2× 6-8
8	75%	11-9	2× 6-8
3	80%	10-8	2× 6-8
5	90%	8-6	2× 6-8
1	80%	10-8	2× 6-8
6	75%	11-9	2× 6-8
3	80%	10-8	2× 6-8
12	75%	11-9	2× 6-8
11	70%	11-9	2× 6-8
Total reps		126	

Technical Exercises Used in the Recommended Program

- Ex1: Stand on the block and perform vertical jumps using the recommended device to feel pushing from feet
- Ex2: Stand on the block and extend and flex knees with feet stable on the base of the training device to improve flexibility of ankles and knees
- Ex3: Stand on the block and extend and flex knees several times then jump forward and upward into the water (repeat). To improve flexibility of knees and ankles and strength of thigh and leg muscles
- Ex4: Stand on the block with repeated jumps on the training device to feel the pushing of feet (vertical jumps) then jump in water with feet (without the distance bar of flight angle bar).
- Ex5: same as ex4 and repeat several times
- Ex6: repeat ex4 and swing arms forward and upward to increase flight distance (without the distance bar of flight angle bar).
- Ex7: assume flash start position on the device. Extend the back and keep head high and in line with the backbone. Concentrate your eyes on the back flag and jump in water (without the distance bar of flight angle bar).
- Ex8: same as ex7 with locking the device base so as not to benefit from the pushing force
- Ex8: Stand on the block with hands between feet. Swing arms backwards then forwards and upwards with the signal to lower arms (without the distance bar of flight angle bar)
- Ex9: Stand on the block and assume quick squat downwards while moving arms upwards to stretch muscles then get into water (without the distance bar of flight angle bar).
- Ex10: Stand on the block then jump repeatedly until flight distance reaches 4-6m (without the distance bar of flight angle bar)
- Ex11: Stand on the block of the device. Fix the flight angle bar on 25 degrees. Jump without knee falling (knees lower towards water before jump) so as not to acquire altitude due to pushing with feet. Suitable flight angle leads to longer flight distance and decreases arm and leg movement when entering water.
- Ex12: Same as ex11 but stand on the block so as not to benefit from the pushing force

- Ex13: Stand on the block and fix the flight angle bar on 25 degrees. Assume steady position with head up and eyes forward. Legs, thighs and back are in position for jumping. With the signal extend your muscles and push with thighs downwards to slight squat position to extends muscles with arms moving upwards fluently. Repeat with 35 degrees for flight angle.
- Ex14: Same as ex13 but stand on the block so as not to benefit from the pushing force
- Ex15: Perform glide jump to change flight direction and duration through changing jumping angle. Most swimmers do so.
- Ex16: Stand on the block of the device. Fix the flight angle bar on 25 degrees and flight distance of 4m with flash start to make use of the pushing force generated from the base. Repeat several times.
- Ex17: Same as ex16 but stand on the block so as not to benefit from the pushing force
- Ex18: repeat ex16 with increasing flight angle and distance according to individual differences
- Ex19: Same as ex18 but stand on the block so as not to benefit from the pushing force
- Ex20: repeat ex 18 and 19 to fix flight distance and angle for each swimmer

<u>Indications for using the training device</u>

1. During jumping, legs should be fully extended. Push the block forward and upward with feet. Arms beside ears in a fluent position to transfer center of gravity forwards
2. Push your hands forward to the farthest possible distance as this moves center of gravity forward and lead the body to fall in water in the right time with the right angle. At entry, arms move outwards and forwards while the head is in line with the backbone.
3. Training should be three times per week for flash start using the recommended device and according to technical standards of the training program.
4. Arms should lead body movements towards water until reaching the suitable entry angle.