A Program for Major Taper and its Effects on Some Technical Variables and Resisting Fatigue in 100m Front Crawl Swimmers

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Introduction:

Annual training plans have developed greatly recently due to the increased number of competitions in which the athlete participates. The focus is no longer on a single completion per year and the coach is now responsible for preparing the athlete to achieve the athletic form several times a year. Accordingly, the annual plan now contains several seasons and each season ends with a competition (**Kherbit & Abd El-Fattah 2016**).

Major taper for athletes means decreasing the training load before competitive performance in a way that enables athletes to recover physiologically and psychologically from accumulated training stress (**Neville et al. 2008**).

Progressive training loads for re-tapering programs have positive effects on speed strength, fest strength and muscular strength of legs and back. These factors exert more influence over technical performance and are used most by athletes who are more vulnerable to fatigue due to overuse during training and competitions. This asserts the positive effects of the program over compensation after re-tapering and reaching peak performance during competition phase. This is true for sports that include many movements that may lead to heavy eccentric muscular contraction that leads to muscular inflammation and manifests itself as muscle pain during heavy training phases. But with the use of tapering load, muscular exhaustion clearly decreases and muscle pain disappears (**Ghazy et al. 2016; Papacosta et al. 2013**).

Major Taper organizes progressive training loads used for preparing athletes positively and effectively during preparation phase for major competitions (Baioumy&Ghazy,2015). Re-tapering can fulfil the same objective as Major Taper but with more than one peak. This requires the coach to consider the physical and technical condition of athletes (**Al-Qot 2013; Ghazy et al. 2016**). Previous studies asserted the significance of tapering for improving the physical, technical, skills, psychological and mood conditions at the end of heavy training phase in preparation for competitions (**Karimi et al. 2013; Fukuda et al. 2013**).

In most sports activities, physiological demands of training are almost the same as official competitions as high-intensity training leads to increases in heart rate to the extent of activating fitness. At the same time, training stimulates indicators of observed exertion through increasing blood lactate concentrations (**Hill-Haas, et al. 2010**).

Fatigue resistance is a major problem that faces athletes as it may hinder physical performance. Therefore, any try to delay fatigue may contribute effectively in improving athletic performance (**Sayed 2019**).

Wilson & Wilson (2008) indicated that decreasing loads before competitions is a systematic method to reach peak physiological fitness. It is a complex technique as the load should be decreased through several variables like intensity, volume, rest and number of training units per week. **Karimi et al** (2014) asserted the importance of taper for improving physical performance and the concentrations of metabolic/anabolic hormones.

Swimming performance is divided into four major phases: start – free swim – turn – end (**Chakravorti, et al 2012**). Start in free-style, front and butterfly is very important to be quick. So, the swimmer should have all necessary components of a quick start like quick and strong reaction so that he/she can respond quickly to the start signal and to have the strength and power for a strong push to move away strongly off the block. In addition, he/she should have the suitable techniques and skills for that. Studies of start concentrate on comparing different start techniques with special focus on the advantages and disadvantages of new techniques compared with the commonly used flash start (**Vilars-Boas, et al. 2000**).

Turn is a basic skill that affects the swimmer’s speed in completing the race distance. Turn time contributes to almost 19-20% of total race time in 100m swim as it takes 2:3 seconds from the glide turn (**Puel, et al., 2012; Morais, et al 2019**). The turn is a complex phase with motor overlap and complexity due to water resistance over the swimmer’s body during turn (**Pereira, et al. 2007; Lyttle & Benjanuvatra,2004**).

The researcher noticed that some coaches depend on trial and error without considering the amount of decrease, the duration of load decrease period or load formation during this progressive decrease of loads for two or three weeks according to the objectives of training and competition. Long taper can decrease the swimmers' efficiency and lead them to lose acquired adaptations with previous preparation programs during the season. Therefore, taper is a very critical period of the season as it identifies the outcomes of the training program which means adaptations at the end of this period that is considered as the final product of training and recovery effects to reach the best race performance. The researcher is trying to study the effects of a recommended training program for major taper on fatigue and other selected components of race duration (start – turn) in addition to the digital record of 100m front crawl.

Aim:

The current research aims to identify the effects of a Major Taper program on:

1. Race duration components (start – turn) in junior swimmers of 100m front crawl.
2. Fatigue resistance in junior swimmers of 100m front crawl.

Hypotheses:

1. There are statistically significant differences between pre- and post-measurements for the effects of the major taper program on race duration components (start – turn) in junior swimmers of 100m front crawl in favour of post-measurements.
2. There are statistically significant differences between pre- and post-measurements for the effects of the major taper program fatigue resistance in junior swimmers of 100m front crawl in favour of post-measurements.

Methods:

Approach:

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

Participants:

Research community included (20) swimmers of short distance front crawl from Toshki Sporting Club (less than 14 years) who were registered in Alexandria Zone for Swimming. After acquiring the approval of technical system and consents of parents, (10) swimmers were selected for the main sample while the other (10) were selected for the pilot sample. Table (1) shows descriptive data of the experimental group.

Table (1): Descriptive data of the research group (n=10)

S	Variable	Measurement	Mean	Median	SD	Squewness	Kurtosis
A	Basic variables						
1	Age	Year	13.20	13.00	0.41	1.60	0.59
2	Training experience	Year	1.83	1.83	1.37	1.76	3.00
3	Height	m	1.56	1.54	0.10	-0.05	-0.82
4	Weight	kg	48.86	48.45	13.56	0.88	0.92
5	BMI	Kg/m^2	19.79	19.15	3.74	1.29	2.87
B	Start						
1	15m duration	Sec	9.42	9.31	2.10	0.06	2.49
2	Duration between in-water and exit	Sec	2.75	2.57	0.74	1.41	2.75
3	Distance between in-water and exit	m	3.66	3.70	0.77	0.21	0.79
C	Turn						
1	Turn duration	Sec	14.12	13.82	2.34	0.74	0.47
2	Push to exit duration	Sec	2.79	2.60	1.08	0.99	0.52
3	Push to exit distance	m	2.87	2.80	0.80	0.27	0.78
D	Half Race Duration						
1	First 50m	Sec	42.76	41.27	7.13	0.61	-0.38
2	Second 50m	Sec	49.07	48.84	8.13	0.66	0.18
E	Fatigue resistance						
1	Fatigue resistance	%	6.37	6.94	3.18	-0.58	-0.08

Table (1) indicated that Squewness values for all research variables were between (±3). This indicates data normality for the research group.

Data Collection Tools:

Tests and measurements:

First: kinematic components of race duration (start)

- 15m duration for start.
- Duration between in-water and exit
- Distance between in-water and exit

Second: kinematic components of race duration (turn)

- Turn duration (7.5 exit – 7.5 in)
- Push to exit duration
- Push to exit distance

Third: Fatigue Resistance

$$\frac{\textbf{Duration of first 50m x 2 - 100}}{\textbf{Duration of second 50m x 2}} \quad \textbf{X 100}$$

(Derar 2004)

Tools and Equipment:

- A restameter for measuring heights and weights
- A digital stop-watch for measuring the digital record (1/100 sec)
- A legal 50m swimming pool.
- Data recording form for each swimmer
- Two surface and underwater cameras.
- Camera tripod
- A laptop (Dell)

<u>Components of the technical program for start and turn and the major taper program:</u>

The technical program was based on the study of Maglscho (2003)

1. Program duration was (4) weeks during general and specific preparation phases
2. Each week includes (6) training units
3. Each training unit lasts for (120) minutes.
4. Total number of units is (24).

A two-week Major Taper program was applied in preparation for the Republic Championship to fulfill the general goal of the program and achieve the best possible digital record for participants.

<u>Pilot study:</u>

The researcher performed a pilot study on a pilot sample (n=10) from the same research community and outside the main sample on 3-5-2022 to train assistants on performing tests and taking measurements in addition to identifying the suitable timeframe for the main study. The study also aimed to identify the best locations for cameras and validating the cameras.

Main study:

- The technical training program for junior 100m front crawl swimmers (less than 14 years). According to Maglscho (2003) (general preparation – specific preparation – heavy training – taper) for three months. The Major taper program was performed during the last (2) weeks of the competition preparation phase.
- Assistants were trained on taking all measurements for each swimmer.
- All assistants were trained to collect swimming data for 100m front crawl as follows:

1. Four assistants were recruited to measure the digital records of 100m front crawl.
2. Kinematic measurements for start and turn were taken by cameras (surface and underwater).
3. A WhatsApp group was established for participants to notify them with research aims, measurement results, weaknesses and strengths of tests and improvements along the program progression (pre-measurements – pre-taper – post-taper).

Pre-measurements:

Pre-measurements were taken on 8/9-5-2022

Main application:

The program was applied from 12-5-2022 to 11-8-2022.

Post-measurements:

Post-measurements were taken on 12/13-8-2022 at the end og major taper and following the same protocol of pre-measurements.

Statistical Treatment:

The researcher used SPSS software to calculate the following: Mean – Median – Standard Deviation – Squewness – Kurtosis – (t) test – improvement percentages (%).

Results:

Table (2): Differences significance between means of pre- and post-measurements of participants on Start variables of 100m front crawl (n=10)

s	Variable	Measurement	Pre-		Post-		Difference	(t)	Improvement percentage
			Mean	SD (±)	Mean	SD (±)			
1	15m duration	Sec	9.42	2.10	8.28	2.33	1.14	6.11	12.15
2	Duration between in-water and exit	Sec	2.75	0.74	3.42	0.93	-0.67	-3.50	24.24
3	Distance between in-water and exit	M	3.66	0.77	5.30	1.86	-1.64	-4.77	44.93

(t) table value on P ≤0.05 = 1.83

Table (2) indicated that (t) values for 100m front crawl start ranged from 3.50 to 6.11 on P ≤0.05. in addition, the tables showed improvement percentages between pre- and post-measurements of 100m front crawl start.

Table (3): Differences significance between means of pre- and post-measurements of participants on Turn variables of 100m front crawl (n=10)

S	Variable	Measurement	Pre-		Post-		Difference	(t)	Improvement percentage
			Mean	SD (±)	Mean	SD (±)			
1	Turn duration	Sec	14.12	2.34	11.98	2.93	2.15	7.46	15.20
2	Push to exit duration	Sec	2.79	1.08	3.43	1.18	-0.64	-2.78	22.98
3	Push to exit distance	M	2.87	0.80	4.18	1.55	-1.31	-4.94	45.72

(t) table value on P ≤0.05 = 1.83

Table (3) indicated that (t) values for 100m front crawl turn ranged from 2.78 to 7.46 on P ≤0.05. In addition, the table showed improvement percentages between pre- and post-measurements of 100m front crawl turn.

Table (4): Differences significance between means of pre- and post-measurements of participants on Half-Race variables of 100m front crawl (n=10)

S	Variable	Measurement	Pre-		Post-		Difference	(t)	Improvement percentage
			Mean	SD (±)	Mean	SD (±)			
1	First 50m	Sec	42.76	7.13	41.35	7.58	1.41	7.88	3.30
2	Second 50m	Sec	49.07	8.13	46.42	8.21	2.65	5.71	5.40

(t) table value on P ≤0.05 = 1.83

Table (4) indicated that (t) values for half-race variables of 100m front crawl ranged from 7.88 to 5.71 on P ≤0.05. In addition, the table showed improvement percentages between pre- and post-measurements of half-race variables of 100m front crawl.

Table (5): Differences significance between means of pre- and post-measurements of participants on Fatigue Resistance in 100m front crawl (n=10)

S	Variable	Measurement	Pre-		Post-		Difference	(t)
			Mean	SD (±)	Mean	SD (±)		
1	Fatigue resistance	%	6.37	3.18	6.09	3.03	0.29	1.08

(t) table value on P ≤0.05 = 1.83

Table (5) indicated that (t) values for fatigue resistance in 100m front crawl was 1.08 on P ≤0.05.

Discussion:

According to Table (2), there are statistically significant differences between the pre- and post-measurements of the research sample in the 100m front crawl start variables. The tabulated T-value (1.83) is less than the calculated T-value, which ranged between (3.50: 6.11) in favor of the post-test measurement. The improvement rates for start variables ranged between (12.15%: 44.93%), indicating that the implementation of the major taper program had a positive impact on the start variables of the 100m front crawl swim. The improvement rates for the 100m front crawl start variables were ranked according to their improvement rates (the distance between in-water and exit, the duration between in-water and exit, and the 15-m time).

From these positive results in the start of the 100-m front crawl swim according to their improvement rates the researcher confirmed the positive impact of the major taper program on the start variables.

According to Table (3), there are statistically significant differences between the pre- and post-measurements of the research sample in the 100-m front crawl turn variables. The tabulated T-value (1.83) is less than the calculated T-value, which ranged between (2.78: 7.46) in favor of the post-test measurement. The improvement rates for the 100-m front crawl turn variables ranged between (15.20%: 45.72%), indicating that the implementation of the major taper program had a positive impact on the turn variables of the 100-m front crawl swim. The improvement rates for the 100-m front crawl turn variables were ranked according to their improvement rates (the push to exit distance, push to exit duration, and the turn duration).

From these positive results in the turn level of the 100-m front crawl swim according to their improvement rates the researcher confirmed the positive impact of the major taper program on the turn variables.

Based on the results of Table (4), there are statistically significant differences between the pre- and post-measurements of the research sample in the half-race variables of the 100-m front swim. The tabulated T-value (1.83) is less than the calculated T-value, which ranged between (7.88: 5.71) in favor of the post-test measurement. The improvement rates for the half-race variables of the 100-m front crawl swim ranged between (3.30%: 5.40%), indicating that the implementation of the major taper program had a positive impact on the half-race variables of the 100-m front crawl swim. The improvement rates for the half-race variables of the 100-meter swim were ranked according to their improvement rates (the first 50 m and the second 50 m).

From these positive results in the half-race level of the 100-m front crawl swim according to their improvement rates (the first 50 m and the second 50 m), the researcher confirmed the positive impact of the major taper program on the half-race variables of the race.

From the above discussion of the first hypothesis variables, the researcher concluded that the variables that improved and were mastered, along with the swimmers' understanding of their weaknesses and addressing them during the major taper period by focusing on the components of the race and recovery processes, enabled the swimmers to perform the first 50 meters at the highest speed and the second 50 meters without exhaustion, feeling the progress. This was evident in the swimmers' different times compared to the initial measurement, providing a significant motivation for achieving better results by reducing the gap between the first and second 50 meters. This resulted from mastering each component and addressing deficiencies to achieve the minimum time at each stage, benefiting from the push-off in the start, turn, and race completion without the exhaustion seen in many national and international competitions.

In this context, it is clear that the start performance of freestyle swimming is one of the most critical components for improving the swimmer's performance. Swimming performance is divided into four main phases: start, free swimming, turn, and finish (**Chakravorti, et al., 2012**). To achieve the best performance, the swimmer must have a fast start with a quick and strong reaction to respond rapidly to the starting signal (**Vilars-Boas, et al., 2000**).

Therefore, coaches should emphasize training swimmers on race starts throughout the season, not just a week before competitions. The swimmer must perform correct starts and turns during training (**Meglischo, 2003**). The researcher attributes this to the impact of the major taper program, aligning with studies such as **Neville, et al**. (2008); **Karimi et al.** (2013); **Fukuda et al**. (2013); **Papacosta et al**. (2013); **Baioumy & Ghazy** (2015); **Ghazy et al.** (2016). These studies indicate that reducing training load in preparation for a significant competitive event at the end of the season over two weeks while maintaining intensity improves swimming performance.

The researcher found statistically significant differences between the pre-test and post- measurements, in favor of the post-measurements after implementing the major taper program. From these results, the researcher confirmed the validity of the first research hypothesis.

According to Table (5), there are no statistically significant differences between the pre- and post- measurements of the research sample in the fatigue resistance variables for the half-race of the 100-m front crawl swim. The tabulated T-value (1.83) is higher than the calculated T-value (1.08), indicating no impact of the major taper program on the research sample after its application, allowing the sample to recover from fatigue in preparation for competition.

The two-week major taper program did not result in differences between the pre- and post- averages for neuromuscular fatigue in the 100-meter swim (**Ribeiro, et al., 2023**). The researcher attributes this to the fact that the sample consisted of juniors who require a longer period than the two-week major taper program under investigation for gradual physical and technical load preparation for competition. Junior athletes typically have a short training age, weak physical abilities, and low technical level.

In this context, studies such as **Neville et al**. (2008); **Karimi et al**. (2013); **Fukuda et al.** (2013); **Papacosta et al.** (2013); **Baioumy & Ghazy** (2015); **Ghazy et al.** (2016) indicate that planning the major taper period should consider the athlete's training age. The major taper plan should align with the athlete's training and chronological age, as each level requires a taper period suitable for physical and technical levels. Using a taper program is crucial for the success of the training program, reducing training load by more than 50%, allowing the recovery of physiological capacities decreased by previous training phases. This enables athletes to regain their training tolerance, achieve recovery, and improve physical, skill, and technical performance and competitive performance (**Mujika & Padilla**, 2003).

The researcher believes that the major taper program should positively affect recovery processes, enabling swimmers to perform race components, including start, underwater gliding, surfacing, and turn, effectively. From these results, the researcher confirmed the validity of the second research hypothesis.

Conclusions:

According to this research aim, hypotheses, methods and results, the researcher concluded the following:

1. The results for the 100-m front crawl swimming start variables showed statistically significant differences at a significance level of (0.05) between the pre- and post- measurements of the research sample, in favor of the post-measurements, with improvement rates ranging between (12.15% to 44.93%).
2. The results for the 100-m front crawl swimming turn variables showed statistically significant differences at a significance level of (0.05) between the pre- and post-measurements of the research sample, in favor of the post-measurements, with improvement rates ranging between (15.20% to 45.72%).
3. The results for the half-race variables of the 100-m front crawl swim showed statistically significant differences at a significance level of (0.05) between the pre- and post- measurements of the research sample, in favor of the post-test, with improvement rates ranging between (3.30% to 5.40%).

4. The effectiveness of applying the two-week major taper program was demonstrated in the competition period, impacting the start, turn, and half-race variables for junior 100-m front crawl swimmers.
5. The results for the fatigue resistance variables in the half-race of the 100-m front crawl swim showed no statistically significant differences at a significance level of (0.05) between the pre- and post- measurements of the research sample.
6. The two-week major taper program was not effective in the competition period for improving the fatigue resistance variables in junior 100-m front crawl swimmers.

Recommendations:

According to these conclusions, the researcher recommends the following:

- Using a two-week major taper program during the competition period to improve the start, turn, and half-race performance for junior 100-m front crawl swimmers.
- Utilizing the fatigue resistance indicator as a physiological measure specific to swimming to understand adaptation processes from training loads, especially during the taper phase.
- Focusing on the taper period, particularly its duration, and its suitability for the swimmers' age group.
- If fatigue resistance improves after the taper period, there will be an enhancement in the swimmers' technical levels in the start, turn, and half-time performances, thereby improving the overall 100-m front crawl performance.
- It is necessary to study extending the duration of the taper program for juniors to effectively impact fatigue accumulation, body resistance, recovery, and competition readiness.

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Abstract:

The current research aims to identify the effects of a Major Taper program on race duration components (start – turn) and fatigue resistance in junior swimmers of 100m front crawl. The researcher used the experimental approach (one-group design) with pre- and post-measurements. Research community included (20) swimmers of short distance front crawl from Toshki Sporting Club (less than 14 years) who were registered in Alexandria Zone for Swimming. After acquiring the approval of technical system and consents of parents, (10) swimmers were selected for the main sample while the other (10) were selected for the pilot sample. Results indicated that:

1. The results for the 100-m front crawl swimming start variables showed statistically significant differences at a significance level of (0.05) between the pre- and post- measurements of the research sample, in favor of the post-measurements, with improvement rates ranging between (12.15% to 44.93%).
2. The results for the 100-m front crawl swimming turn variables showed statistically significant differences at a significance level of (0.05) between the pre- and post-measurements of the research sample, in favor of the post-measurements, with improvement rates ranging between (15.20% to 45.72%).
3. The results for the half-race variables of the 100-m front crawl swim showed statistically significant differences at a significance level of (0.05) between the pre- and post- measurements of the research sample, in favor of the post-test, with improvement rates ranging between (3.30% to 5.40%).
4. The effectiveness of applying the two-week major taper program was demonstrated in the competition period, impacting the start, turn, and half-race variables for junior 100-m front crawl swimmers.
5. The results for the fatigue resistance variables in the half-race of the 100-m front crawl swim showed no statistically significant differences at a significance level of (0.05) between the pre- and post- measurements of the research sample.
6. The two-week major taper program was not effective in the competition period for improving the fatigue resistance variables in junior 100-m front crawl swimmers.

Key words: Tapering Period – Race Time Components – Fatigue Resistance – 100m Front Crawl