



Original Article

Effect of Reverse Periodization on Some Physical Variables and Record Level for Freestyle Sprint Swimmers

Dr. Mostafa SamirMohamed

Lecturer, Sports Training Department, Faculty of Physical Education, Damietta University, Egypt

E-mail address: riddik.mostafa7@gmail.com

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Abstract

This study investigates the impact of reverse periodization (RP) on specific physical variables and the record levels of short-distance freestyle swimmers. A total of 20 junior swimmers aged 17-18 years participated in the study, divided into an experimental group (trained using RP) and a control group (trained traditionally); participants were selected intentionally from the swimmers of Al-Hawar Sports Club who registered with the Egyptian Swimming Federation for the training season 2023/2024. The training program was implemented during the special preparation period from 15 \ 12 \ 2023 to 10 \ 2 \ 2024 under the supervision of the researcher and team coaches at Al-Hawar Club. The results verified that the proposed program had a positive effect on developing specific physical variables for free style swimmers. in addition, the training program significantly improved the record level in 50m and 100m swimming events. finally, the experimental group, which underwent reverse periodization, outperformed the control group, which followed traditional training methods, in both specific physical abilities and personal records. It is recommended to apply the proposed program to other age groups, extend this study with its variables to other distances or swimming styles, and ensure the selection of scientifically calibrated training programs using reverse periodization that suit the swimmers' abilities to achieve the highest training levels and enable swimmers to break their records.

Keywords: *Reverse Periodization, Sprint Swimmers , freestyle*

Introduction

Planning is an approach followed in various fields to ensure achieving the goal in this field. It is the ideal means and the common approach used now in the sports sector in most advanced countries in sports. It is the one that draws the picture of work in various fields and determines its path. Without planning, things become fate or random, aimless work. One of the most important advantages of planning is that it works to follow the scientific method for discovering problems and determining clear goals for work. It determines the different stages of work and the steps that are followed, as well as the path taken by the trainer. In doing so, it helps achieve goals and is interested in providing work capabilities and ways to obtain them.



Thus, it facilitates follow-up and identifying the problems that are exposed to it, and intervening immediately to solve them and achieves psychological security for individuals and groups. In light of planning, everyone is reassured that the matters that concern them have been calculated and prepared. Planning is considered the most important stage, and it is even the basis on which the training stages carried out by the trainer are based.

A traditional program of periodization usually starts by building the aerobic training in a preparatory period and gradually altering the preparation by reducing volume and increasing intensity to a competitive period. This program often concludes with a tapering period of reduction volume previously to main competition as explained by Mujika, (2010). In some sports training, different models of periodization have been suggested in which training loads are concentrated in short periods of time in an attempt to increase the number of peak performances per year by following the same progression – first an aerobic training period, followed by a period of intensity. Examples of this training include the Block Training System of Verkhosansky, (1999) and Block Periodization (BP) of Issurin, (2010). Because the three periods are designated Accumulation-Transformation-Realization; this program of periodization is referred to as ATR. (Mujika,2010:32)

In a base of Periodization, there are several forms of periodization models including linear (traditional) and nonlinear (non-traditional) periodization, but all periodization models have the same principle consisting of three phases, including the preparation phase, the competition phase, and the transition or recovery phase(Bompa, T.O. 1999:189)

Non-traditional/non-linear periodization models include Reverse periodization and block periodization models , Non-linear periodization is based on the concept that volume and load changes are more frequent (daily and weekly) to allow for a longer recovery period because lighter loads are carried out more often. The linear periodization model works starting from low-intensity and high volume with gradual changes in volume and intensity so In the reverse periodization model, the training program starts with high intensity and the volume is low, and gradually the intensity decreases and the volume increases, or au intensity is maintained and volume increased depending on the sport The reverse periodization is based on a low training volume combined with high intensity, initiating high-intensity application from the start of the macro cycle.(Fleck, S. J.2011:92)

Reverse periodization is a training approach often used by performance sports. Unlike traditional periodization, which begins with a base phase of high volume and low intensity and progresses toward lower volume and higher intensity closer to competition, reverse periodization starts with high-intensity, low-volume training and transitions to higher-volume, lower-intensity work as the competition approaches.

Reverse Periodization (RP) introduced a paradigm that is completely opposite to the tendency of the training load programmed by traditional periodization programs. Both



programs (BP and RP) often concludes with a tapering period of reduction in volume prior to the main competition as RP starts with high-intensity/low-volume and gradually increasing volume and reducing intensity.(Bosquet et al. 2007:67)

Sideraviciūte (2006) explains that according to the (RP) model, athletes can start their preparation period by training with high-intensity, low-volume patterns, gradually reducing intensity, increasing volume in accordance with the type of sport, or by maintaining intensity and increasing volume during the following training periods within the season. The (RP) model has already been studied in training (fitness, strength training, swimming, rowing) with the aim of obtaining increases in (muscular endurance, maximum strength, and endurance performance).(Sideraviciūte 2006:664)

The idea of (RP) revolves around doing high intensity periods without much building of other systems, and this model is used extensively for the following reasons:

- Overcoming the boredom and depression of the winter season in terms of bad weather and different physiological adaptations.
- Adapting to cases of extending the season when determining a strong championship or experiences after the official championship.
- Building the ideal reverse plan to adapt to some cases of stress from aerobic training.
- Finding a plan with a new model that may benefit the player in the event that his numbers are locked in more than one championship. (Sperlich, B.,2010:1031)

Arroyo Toledo et al (2016) compared the effects of training using traditional and reverse periodization methods on the strength rate, body components, performance rates, and record level of the 100-meter freestyle race. The researchers used the experimental method for (14) weeks on a sample of (26) swimmers aged 15-16 years. He found that the reverse periodization has positive effects on improving the record level, body weight, and resistance ability compared to traditional periodization, and reverse periodization is considered a better strategy from a specialized point of view and has better effects on speed swimmers.

Clemente, et. al (2019) tested the effect of reverse and traditional line training on triathletes, they used the experimental method for (10) weeks on a sample of (32) swimmers. The study emphasizes the effectiveness of reverse periodization in improving some physical abilities and the record level of swimmers, while traditional periodization improves the technical performance of aerobic and anaerobic swimming.

Due to the difficult training conditions facing coaches and swimmers due to the beginning of the first semester in September and its exams, which are accompanied by volatile weather conditions, which makes it difficult for coaches to form the general preparation period for the winter season in the traditional form of planning due to the small number of training periods due to study, exams, and the cancellation of many training sessions due to weather



conditions, which often causes a noticeable decrease in the level of young swimmers, and from this came the idea of implementing reverse periodization during the winter training season.

The research aims to identify the effect of (RP) for the training season on the record level of short-distance swimmers through designing a training program using the Reverse periodization model for short-distance swimmers. And test the effect of Reverse periodization on the physical variables and record level of speed swimmers.

Study Hypotheses

1. There are statistically significant differences between the pre- and post-measurements (experimental group) in the variables under study in favor of the post-measurement for the physical variables and record level of speed swimmers.
2. There are statistically significant differences between the post-measurement (for the experimental group) and the post-measurement of the group (for the control group) in the variables under study in favor of the post-measurement of the experimental group.

Materials and Method

The author used the experimental method due to its suitability for the research application and using the experimental design with pre- and post-measurement for two groups, one experimental and the other control.

Participants

The research community represents the junior swimmers of the public swimming team at Al-Hawar Club for the age group (17-18) years and registered with the Egyptian Swimming Federation.

The participant was selected intentionally from the swimmers of Al-Hawar Sports Club under 18 years old registered with the Egyptian Swimming Federation for the training season 2023/2024. The sample consisted of 29 swimmers. The pilot study was conducted on (5) swimmers, then (4) swimmers were excluded for not committing to training; So the participant became (20) swimmers, who were randomly divided into two equal groups, one experimental and the other control, each sample consisted of (10) juniors. The author conducted homogeneity in height, weight, and age (Table 1)

Table 1 Description of the groups of participants

no	Sample			Program
	Sample type	Number	Percentage	
1.	Control group	10	40.00	Traditional periodization reverse periodization
2.	Experimental group	10	40.00	
3.	Pilot study group	5	20.00	
4.	Total sample	25	100%	

*Homogeneity of the participants groups:*

To ensure the homogeneity of the total sample of the research (25) swimmers (the experimental group, the control group, and the pilot study group); the author made some measurements, to ensure the homogeneity of the data distribution among the sample members in the variables under study, as shown in Table (2)

**Table 2 Homogeneity test of basic variables of the research groups
(pilot- experimental - control)**

no	Variables	Units	Mean	Median	St.Dv.	Skewness
1)	Age	Year	17.5	17.3	0.8	0.75
2)	Training age	Year	8.4	8.5	1.32	1.06
3)	Weight	kg	77	77.45	3.25	-0.42
4)	Grip Strength Test (Favorite Hand)	kg	38	38.08	2.18	0.10
1.	Back Strength Test	kg	137.13	137.5	2.02	-0.70
2.	Leg Strength Test	kg	140	139.03	1.67	-0.40
3.	Sit-up Test	number	50	49	2.54	1
4.	Push - up Test	number	40.05	39.6	1.43	0.10
5.	Vertical Jump test	cm	68	67.5	1.64	0.09
6.	Broad Jump test	meter	1.98	2.11	0.12	-0.28
7.	Medicine Ball Throw	meter	7.60	7.03	0.78	-0.44
8.	burpee test	number	31	29	3.62	1.07
9.	50 m Swimming (free style)	Second	28.09	28.56	1.37	0.60
10.	100m Swimming (free style)	minute	1.18	1.20	0.35	0.40

It is clear from Table (2) that the values of the skewness coefficients were between (-3) and (+3), which indicates that the measurements of the total sample of the research in the variables under study fell under the normal curve, which indicates the homogeneity of the individuals of the total groups of participants in these variables

Equivalence of the two research groups

The author conducted equivalence between (the experimental group and the control group) according to the variables under study that may affect the research. Table (3) shows the equivalence of the two groups in the variables under study.

It is clear from Table (3) that there are no statistically significant differences between the measurements under study for the two experimental groups, as the calculated (t) value was less than its tabular value at a significance level of (0.05), which indicates that there are no statistically significant differences between the measurements in all tests, which indicates the equivalence of the two groups in the variables under study.



Table 3. Equivalence of the two research groups (experimental and control) in the studied tests

no	Variables	Units	experimental group		control group		(T) value
			Mean	St.Dv.	Mean	St.Dv.	
1.	Grip Strength Test (Favorite Hand)	kg	38	2.45	37.8	1.64	1.66
2.	Back Strength Test	kg	138	1.79	138.26	2.31	0.28
3.	Leg Strength Test	kg	140.15	2.21	138.9	0.84	1
4.	Sit-up Test	number	50	2.73	51	2.35	0.97
5.	Push - up Test	number	41	1.49	40	1.4	0.77
6.	Vertical Jump test	cm	69.5	1.45	68	1.89	0.13
7.	Broad Jump test	meter	2	0.13	1.95	0.12	0.8
8.	Medicine Ball Throw	meter	7.83	0.82	7.32	0.77	0.56
9.	burpee test	number	31	2.13	29	3.36	0.31
10.	50 m Swimming (free style)	Second	28.16	0.05	28.9	0.11	0.52
11.	100m Swimming (free style)	minute	1.10	0.17	1.23	0.08	0.34

Data collection tools

Through the researcher's reference survey of many Arab and foreign research and references, he reached the most appropriate tests and measurements that achieve the research objective.

- Basic measurements, physical tests and record level measurements for sprint swimmers.
- Basic and specific measurements to describe and homogeneously the groups of participants are:
 - Age (to the nearest half year)
 - Weight (to the nearest kilogram)
 - Height (to the nearest centimeter).
 - Training age (to the nearest half year)

Procedures

As preparatory steps, the author obtained approval from Al-Hiwar Sports Club in Mansoura to apply the study to the club's swimmers. The author from the club's swimming coaching staff and met with the swimmers and parents, to clarify the importance of the research, and obtain the parents' approval to conduct measurements on the swimmers.

Pilot Studies

This study was conducted during the period from 1/11/2023 to 1/12/2023 on a group of (5) swimmers from outside the basic sample, from Al-Hawar Club. the purpose of the pilot study was to:

1. Design a form to record data and measurements for each swimmer.



2. Discover difficulties while conducting measurements to determine the best measurement methods.
3. Speed up the adjustment and preparation of devices and tools used in conducting measurements.
4. Ensure the validity of the devices and tools used in the measurement.
5. Ensure the suitability of the tests for the participant group members.
6. Training assistants on the measurement methods used and how to conduct and arrange those measurements.
7. Ensure that the physical loads used in the program are appropriate for the age group

Main Study

Pre- measurements

Pre-measurements of the research groups were conducted during 12/12/2023 to 15/12/2023 as the following:

1. First day Grip M-Strength Test (Favorite Hand)
 Back M-Strength Test
 burpee test
2. Second day 50 m Swimming (free style)
 Sit-up Test
 Broad Jump test
3. Third day Push - up Test
 100m Swimming (free style)
4. Fourth day Vertical Jump test
 Medicine Ball Throw
 Leg Strength Test

Training Program

The training program was implemented during the special preparation period, where the experimental group performed the revers periodization proposed training program, the control group performed traditional priodization freely. The duration of the program was (8 weeks) with three training units for week during the period 15 \ 12 \2023 to 10\2\2024 under the supervision of the author and team coaches at Al-Hawar Club

The author surveyed the scientific references specialized swimming training and used many modern references in designing special training groups using reverse periodization. The implementation of the proposed training program took (8 weeks) during the training season (special preparation period).

The author set the aims of his proposed training program in an attempt to develop some physical variables and the record level of swimmers by performing the proposed exercises using high intensity exercises passed on revers periodization



1. *Designing the training program*

- Determine the program aims.
- Determine the start and end of the program period.
- Conduct tests and measurements to determine the players' level.
- Determine the total training time and distribute the time to the different settings.
- Divide the times of each period according to the technical content of the program according to what the coach sees

2. *Scientific basics of the program*

- The program should achieve the objectives set for developing the specific physical fitness elements and the record level of the swimmers.
- The program contents should be in line with the swimmers' abilities without conflicting with the training load.
- The proposed exercises should be as similar as possible to the motor performance and muscular work for all parts of the body (training on the nature of competitive performance).
- Diversify the program contents and make it flexible.
- Take into account the undulation of the training load principle.
- Speed exercises should be combined with stretching and relaxation exercises
- Take into account the appropriate formation of the training load in terms of intensity, volume and rest periods as the following:

Speed level	Target Heart Rate	Set distance	Rest
Sp1:	85%-90%	200-600	1-2m
Sp2:	90%-100%	50 -200	30-60sec
Sp3:	90%-100%	25-100	10-30sec

Post measurements

The post-measurements of the research groups were conducted after completing the training program, in the same way that the pre-measurements were applied, and under the same conditions, during the period from 11\2\2024 to 15 \ 2 \ 2024.

Statistical Analysis

The author used the Statistical Package for the Social Sciences (SPSS) program in the statistical processing of the data in this study Version (23) using the following transactions: Mean, Standard Deviation, Paired Sample t-Test, Independent Samples t-Test, Effect Size, Change Ratio.

Results

The first hypothesis states that: *"There are statistically significant differences between the pre & post-measurements (the experimental group) in the variables under study in favor of the post-measurement in both the physical variables and the record level"*. To verify the validity



of the first hypothesis, the author used a paired sample t-test for two related samples of data, to measure the differences between the average scores in the pre-measurement and the post-measurement (for the experimental group), in the variables under study. The effect size was also calculated using (Cohen's d) and interpreted according to Cohen's criteria, in addition to the change/improvement ratio, as in table (4).

Table 4. Significance of differences between the pre-measurement and the post-measurement (for the experimental group)

no	Variables	Units	pre-measurement		post-measurement		(T) value	Effect Size
			Mean	St.Dv	Mean	St.Dv		
1.	Grip Strength Test (Favorite Hand)	kg	38	2.45	44	3.37	12.72	1.7
2.	Back Strength Test	kg	138	1.79	148	2.16	14.12	3.8
3.	Leg Strength Test	kg	140.15	2.21	151.72	4.02	16	2.4
4.	Sit-up Test	Rep	50	2.73	58	1.52	13.42	3.1
5.	Push - up Test	Rep	Rep	1.49	53	2.39	31.14	4.7
6.	Vertical Jump test	cm	69.5	1.45	76.5	1.73	10.11	4.9
7.	Broad Jump test	m	2	0.13	2.58	0.09	11.37	5.1
8.	Medicine Ball Throw	m	7.83	0.82	9.63	0.32	8.30	2.4
9.	burpee test	Rep	31	2.13	46	1.89	7.43	3.5
10.	50 m (free style)	Sec	28.16	0.05	26.7	0.24	3.2	2.7
11.	100m (free style)	min	1.10	0.17	1.02	0.58	1.9	1.4

To determine the applied significance of the independent variable on the dependent variable, the effect size was calculated using (Cohen's d), and the values of (Cohen's d) ranged between (1.4) and (5.1), which indicates a (huge) effect size.

It is clear from Table (4) that the calculated (t) values ranged between (3.04) and (11.83). To determine the applied significance of the independent variable on the dependent variable, the effect size was calculated using (Cohen's d). The values of (Cohen's d) ranged between (1.4) and (5.6). This indicates an effect size of (Very Large) to (Huge)

The second hypothesis states that: *"There are statistically significant differences between the post-measurement of experimental group and the post-measurement of control group in the variables under study in favor of the post-measurement of the experimental group."* The same statistical coefficients were used.



Table 5. Improvement percentage between scores of experimental group in the studied variables

no	Tests	Units	pre-measurement Mean	post-measurement Mean	Differences	Improvement percentage
1.	Grip Strength	kg	38	44	6	15.7
2.	Back Strength	kg	138	148	10	7.2
3.	Leg Strength	kg	140.15	151.72	11.57	7.8
4.	Sit-up	Rep	50	58	8	10
5.	Push - up	Rep	41	53	12	29.2
6.	Vertical Jump	cm	69.5	76.5	7.80	11.2
7.	Broad Jump	m	2	2.58	0.58	29
8.	Medicine Ball Throw	m	7.83	9.63	1.8	22.9
9.	burpee	Rep	31	46	15	48.3
10.	50 m (free style)	Sec	28.16	26.7	1.46	8.11
11.	100m (free style)	min	1.10	1.02	0.08	7.27

Table 6. Differences Significance between the post-measurement (experimental group) and the post-measurement (control group) in the studied variables

no	Tests	Units	experimental group		control group		(T) value	Effect Size
			Mean	St.Dv	Mean	St.Dv		
1.	Grip Strength (Favorite Hand)	kg	44	3.37	40	2.10	3.11	1.5
2.	Back Strength	kg	148	2.16	142.5	2.89	4.70	2.2
3.	Leg Strength	kg	151.72	4.02	146.3	2.45	3.09	1.5
4.	Sit-up	Rep	58	1.52	54	2.11	4.18	2
5.	Push - up	Rep	53	2.39	44	1.41	6.6	3.1
6.	Vertical Jump	cm	76.5	1.73	71.2	1.81	6.44	3
7.	Broad Jump	m	2.58	0.09	2.09	0.1	11.83	5.6
8.	Medicine Ball Throw	m	9.63	0.32	8.64	0.61	3.80	1.8
9.	burpee	Rep	46	1.89	38	1.66	3.90	1.4
10.	50 m (free style)	Sec	26.7	0.24	27.5	0.05	3.04	1.9
11.	100m (free style)	min	1.02	0.58	1.06	0.68	4.09	2.1



Table 7. Improvement percentage differences between the (experimental group) and the (control group) in the studied variables

no	Tests	experimental group		control group		Differences between measurements	
		post-measurement Mean	Improvement percentage	post-measurement Mean	Improvement percentage	Mean Differences	improvement percentage
1.	Grip Strength	44	15.7	40	5.8	4	9.9
2.	Back Strength	148	7.2	142.5	3.06	5.5	4.14
3.	Leg Strength	151.72	7.8	146.3	5.32	5.42	2.48
4.	Sit-up	58	10	54	5.88	4	4.12
5.	Push - up	53	29.2	44	10	9	19.2
6.	Vertical Jump	76.5	11.2	71.2	4.7	5.3	6.5
7.	Broad Jump	2.58	29	2.09	7.1	0.49	21.9
8.	Medicine Ball Throw	9.63	22.9	8.64	18.03	0.99	4.87
9.	burpee	46	48.3	38	31.03	8	17.27
10.	50 m (free style)	26.7	8.11	27.5	4.8	-0.8	3.31
11.	100m (free style)	1.02	7.27	1.15	6.5	-0.13	0.77

Discussion

Table No. (4) shows that there are statistically significant differences between the pre- and post-measurements of the experimental group in the specific physical abilities and the record level of 100 m and 50 m freestyle in favor of the post-measurement. Table (5) also shows that the improvement rate ranged between (7.2% to 48.3%), where the highest improvement rate was for the burpee test and the record level was improved by 3.31% for the 50 m & by 0.77% for the 100 m free style so that author attributes this improvement to the training program designed using reverse periodization .

This is consistent with both Arroyo Toledo, et.al (2016)(3) and Clemente Issurin, V.(2010)(8) that the reverse periodization model contributes to improve the record level by developing physical variables and swimming technique this also agrees with what Muhammad Al-Qat(2004) said that standardized training programs in swimming aim to raise the level of swimmer's performance by developing physical abilities, as the swimmer moves through the water relying on the movements of the arms and legs to produce force to overcome the water's components that hinder the body's progress to complete the specified distances in the shortest possible time, and this can only be achieved through continuous, regular training and practice, with correction of any causes that may arise that hinder reaching the correct performance.



Through the previous presentation of the results and their discussion, the validity of the first hypothesis becomes clear.

It is clear from Table (6),(7) that there are statistically significant differences between the two post-measurements of the experimental and control groups in terms of specific physical abilities and record level In favor of the post-measurement of the experimental group, as is clear from Table(7), the experimental group obtained improvement rates ranging between(7.2) to(48.3), while the improvement rates for the control group ranged between (0.13)to(9). From here, we find that the experimental group improved more, and this superiority indicates that the training program designed using reverse planning is more effective than the traditional program, especially for 50-meter while it was less influential for the 100m freestyle swimmers.

This result is consistent with the results of the study of:, Clemente Suárez, et., al (2015) (6), Arroyo Toledo, et., al (2016) (3), Clemente Suárez, et., al (2019) (7),Prestes, J. etal(2009)(13) that training programs using reverse planning lead to an improvement in the record achievement level of swimmers.

This is consistent with what Abu Al-Ala Abdel Fattah (1994) mentioned, that the swimmer's speed, which is expressed by the record achievement in the type of competition, is considered the basic result of swimming performance and an objective measure of the swimmer's performance effectiveness. It indicates the extent of the swimmer's ability to generate motive forces through the strokes of the arms and legs, by looking at swimming as a system with inputs, the most important of which are the physical aspects, which include endurance and proper performance. According to the systems theory, any modifications or development in the inputs may lead to improving and developing the results and record achievement.(Abu Al-Ala Abdel Fattah 1994:92)

This is what Toledo et al (2013) indicate, that training using reverse periodization contributes positively to developing physical abilities represented in muscular endurance, strength, agility and flexibility, and also works to develop the components of technical performance and physiological aspects related to sports performance.

Through the previous presentation of the results and their discussion, the validity of the second hypothesis becomes clear.

Conclusion

1. The proposed program had a positive effect on developing specific physical variables for free style swimmers
2. The training program significantly improved the record level in 50m and 100m swimming events.



3. The experimental group, which underwent revers periodization, outperformed the control group, which followed traditional training methods, in both specific physical abilities and record level.

Recommendations

1. Apply the proposed program to other age groups.
2. Extend this study with its variables to other distances or swimming styles.
3. Ensure the selection of scientifically calibrated training programs using revers periodization that align with the swimmers' abilities to achieve the highest training levels and enable swimmers to break their records

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