



## Effect of phosphorous training according to pulse intensity to develop speed endurance and Achievement of 400-meter run for women

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### Abstract

**Objectives.** The primary objective of this research was to identify the effect of phosphagen (phosphorous) training, regulated according to pulse intensity, on improving speed endurance and the performance in the 400-meter run for women. The study aimed to enhance the athletes' ability to tolerate high-intensity exertion and adapt to fatigue, thereby improving their endurance and achieving better results in the 400-meter sprint event.

**Materials and Methods.** This study employed an experimental approach to investigate the impact of phosphagen training on female runners. The research sample consisted of women athletes specializing in the 400-meter event from the North Gas Sports Club. The training program focused on high-intensity phosphorous energy system exercises, with careful regulation of training loads based on pulse measurements to ensure optimal intensity levels. Pre- and post-tests were administered to assess speed endurance and performance in the 400-meter run. The exercise intensities were rationed using heart rate (pulse) as an indicator to monitor and adjust training loads accurately.

**Results.** The findings of the study indicated that phosphorous training, when properly rationed according to pulse intensity, had a significant positive impact on improving speed endurance in female 400-meter runners. The athletes showed notable improvements in their ability to tolerate high-speed efforts over longer durations, which translated into better performance and completion times in the 400-meter sprint event.

**Conclusion.** The study concluded that phosphorous training, regulated through pulse intensity measurements, is an effective method for enhancing speed endurance and improving the performance of female athletes in the 400-meter run. Based on these findings, the researcher recommends adopting this training method for women sprinters, emphasizing its importance in developing endurance capabilities and achieving competitive performance outcomes.

**Keywords:** Phosphorous Training, Pulse Intensity, Speed Endurance, Achievement of 400-Meter Run.

## **Introduction**

Scientific creativity made researchers in the search and investigation of scientific facts in various fields for the purpose of development and progress and address the problems that hinder the achievement of advanced results, including the sports field. In this field, the achievement of results, numbers and championships depends on discovering the appropriate training, choosing exercises and style, and dealing with other sciences for the purpose of making changes and adaptations to the player's ability for the purpose of winning.

The most sports games in need of qualitative and specialized training are arena and field games, especially the effectiveness of running 400 meters, being one of the strong events and needs a high-level physical aspect such as bearing speed for the purpose of maintaining speed, completing the race distance and achieving record times. Therefore, the use of appropriate training for this effectiveness of phosphorous training that is seen by (Wajdi Mustafa Al-Fateh, Mohamed Lotfi Al-Sayed, 2002) "is to intensify the increase in training loads and raise the intensity of training to a high degree for a short period, which leads to the achievement of sports form as soon as possible but without ensuring continuity throughout the sports season" (Wagdy, Mohamed, 2002: 57).

This training is considered the effective element in the development of speed endurance, which is considered the most necessary physical ability in achieving the achievement of the 400-meter running event, and for this reason (Qusai Muhammad Ali, and others, 2018): The 400-meter sprint race is one of the fiercest athletics races and is one of the fast and strong events that require a huge amount of speed, endurance and strength, in addition to the requirements of willpower, determination and strength to continue the struggle and endure extreme fatigue" (Qusai, 2018: 291) .

With regard to bearing the speed in running 400 meters, he sees (Mohamed Osman, 1990) "This stage begins in the last 80 m of the race almost and is the most important stages of the race, where the level, the time of the race, and the order of the racers are determined based on the level of performance at this stage, especially if the specifications of the previous stages are equal, and this stage shows individual competencies, and the player's ability to continue to perform in case of lack of oxygen as well as prove the ability of high-level players to get rid of acid Electric is more sufficient in the blood than their peer players" (Muhammad, 1990: 231).

Hence, the importance of searching for the role of phosphoric training, which deals with high stresses and raising the level of load intensity for the purpose of adapting to fatigue

and achieving a high level of endurance, including speed tolerance for the purpose of raising the level of the players' ability to achieve the achievement of running 400 meters, and the use of correct rationing to calculate the intensity of the exercises used, including the pulse, is a correct and successful indicator in discovering the real level of the ability of runners and this is seen (Muhammad Hassan Allawi, Abu Al-Ala Ahmed Abdel Fattah , 2000) "Heart rate is one of the most important factors for regulating the volume of cardiac pulse both during the performance of a physical load of low intensity and high intensity" (Mohammed, Albu Al-Ula, 2000: 226).

Each event in the arena and field games has a special training because it contains specialized physical abilities that help achieve the required times, as in running 400 meters for women, it is considered one of the events in which the element of speed endurance is necessary to achieve the sports achievement and the required crisis, which needs high-level training and specialized in the development of the level and ability of the players to gain speed endurance.

Through the experience of the researcher in arena games and convict, being a former player, coach and academic, she noticed that the times achieved in running 400 meters for women are not at the required level and fixed times as a result of using training according to methods and methods that may not achieve the desired goal, which requires the use of more advanced training in raising the level of intensity required and dealing with high load intensity and for periods suitable for the 400-meter race, such as phosphoric training, and this in turn proved its ability to achieve a high level of speed tolerance for some sports His turn came in a 400-meter run for female runners.

The research aims at the following:

1. Identify the effect of phosphorous training according to the rationing of the intensity of the pulse to raise the level of speed endurance and the completion of 400 meters running for women.
2. Identifying the results of the differences in the tests of speed endurance and achievement in running 400 meters for women between the pre- and post-tests and for the control and experimental groups.
3. Identifying the results of the differences in the tests of speed endurance and achievement in running 400 meters for women in the post-tests between the control and experimental groups.

The researchers assume the following:

1. The existence of a positive effect of phosphorous training according to the rationing of the intensity of the pulse to raise the level of speed endurance and the completion of the 400-meter run for women.
2. The existence of statistically significant differences between the pre- and post-tests and in favor of the post-tests and for the control and experimental groups in the tests of speed endurance and achievement in running 400 meters for women.
3. The existence of statistically significant differences in the post-tests between the control and experimental groups and in favor of the experimental group in the tests of speed endurance and achievement in running 400 meters for women.

## **Materials and Methods**

### **Study participant**

The research population consisted of female athletes specializing in the 400-meter run from the North Gas Sports Club. A total of nine athletes were identified as the research population through a purposive sampling technique. From this population, a sample of eight runners was randomly selected and divided equally into two groups: the experimental group ( $n = 4$ ) and the control group ( $n = 4$ ). Homogeneity within each group was ensured through the calculation of the coefficient of variation for key variables, including height, mass, speed endurance (300 m), and 400-meter run achievement. Additionally, equivalence between the two groups was confirmed using an independent samples t-test. The statistical analysis showed no significant differences between the groups in any of the pre-test variables, confirming the comparability of the two groups before the intervention. Table 1 presents the results of homogeneity and equivalence testing.

**Table 1. Homogeneity within each group and equivalence between the control and experimental groups**

Variables	Control Group	Experimental Group	Calculated T Values	Significance Level
	Mean	Std. Dev.	Coefficient of Variation	Mean
Height (cm)	160.2	1.452	0.906	160.4
Mass (kg)	60.412	0.964	1.595	60.552
Speed Endurance (300 m/s)	48.64	0.754	1.550	48.57
Achievement Run (400 m/s)	64.42	0.678	1.052	64.43

\*Tabular T value at degrees of freedom ( $df = 6$ ) and probability level ( $p = 0.05$ ) = 2.447

### ***Study Organization***

The study employed an experimental approach using a two-group design (experimental and control groups) with equivalent groups. An exploratory experiment was conducted on October 14, 2024, to test the suitability of the exercises and training load for the research sample. Pre-tests were carried out before the training program implementation to measure the baseline levels of speed endurance (300-meter test) and 400-meter run achievement.

The intervention for the experimental group consisted of a phosphorous (phosphagen) training program specifically designed to enhance strength and speed. The program emphasized high-intensity workloads regulated through pulse measurements. The training lasted for eight weeks, from October 21, 2024, to December 23, 2024, with a total of 24 training sessions conducted three times per week (Sunday, Tuesday, and Thursday).

The training intensity was maintained at maximum levels ranging between 95-100%, and the pulse rate was used to control and adjust the training loads. The following formula was applied to calculate the target pulse during training:

$$\text{Maximum Heart Rate (MHR)} = 220 - \text{Age}$$

$$\text{Target Pulse} = (\text{Training Intensity \%}) \times (\text{MHR} - \text{Resting Pulse}) + \text{Resting Pulse}$$

Rest periods were determined based on the pulse returning to the ranges of 110-120 beats per minute or 120-130 beats per minute, depending on the training objective and load.

After completing the eight-week training program, post-tests were conducted to evaluate improvements in speed endurance and 400-meter run performance.

### ***Statistical Analysis***

The data collected from the pre-tests and post-tests were processed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including means, standard deviations, and coefficients of variation, were calculated to assess homogeneity and group equivalence prior to the intervention. An independent samples t-test was used to confirm equivalence between the experimental and control groups.

To analyze the effect of the phosphorous training program, paired t-tests were conducted within each group to compare pre- and post-test results, while independent samples t-tests were applied to compare post-test outcomes between the two groups. The level of statistical significance was set at  $p \leq 0.05$ .

## Results

**Table 2.** shows the means for pre and post-tests, standard error and calculated and tabular values of the control group in physical tests

Variables	Mean of pre-test	Mean of post-test	Standard error	Calculated (T)	Significance level
speed endurance running 300 m/s	48.64	46.14	0.678	3.687	Sig.
Achievement Run 400 m/s	64.42	62.21	0.741	2.982	Sig.

Tabular value of (T) at degree of freedom (3) and under probability of error (0.05) = 3.182.

**Table 3.** shows the pre- and post means, standard error, calculated and tabular values of the experimental group in physical tests

Variables	Mean of pre-test	Mean of post-test	Standard error	Calculated (T)	Significance level
speed endurance running 300 m/s	48.57	44.51	0.997	4.072	Sig.
Achievement Run 400 m/s	64.43	60.33	0.979	4.187	Sig.

Tabular value of (T) at degree of freedom (3) and under probability of error (0.05) = 3.182.

**Table 4.** Shows The Means Of Post-Tests, Standard Deviations, And Calculated And Tabular Values (T) Between The Control And Experimental Groups In Physical Variables

Tests	Control group		Experimental group		Calculated (T) values	Significance level
	Mean	St.d	Mean	St.d		
speed endurance running 300 m/s	46.14	0.667	44.51	0.497	3.395	Sig.
Achievement Run 400 m/s	62.21	0.564	60.33	0.695	3.643	Sig.

Tabular value (T) at degree of freedom (6) and under probability of error (0.05) = 2.447

## Discussion

After presenting the results of the pre- and post-tests and for the control and experimental groups in tables (2) and (3) show us there is an improvement at the required level and the achievement of good times and this is evidence of the improvement of runners in the training used and their continuation of training and this is an indicator that training gives progress and achievement according to its quality and method of performance and for this (Owais Ali Al-Jabali, 2000) "that sports training aims to raise the player's physical abilities according to the sports activity practiced, so workers in the sports field need to

develop the level of The player is physically in addition to the need to know the information related to the methods and means of training because of their impact on the development of public and private physical abilities" (Owais, 2000: 17).

Macardle (1981) points out that regular athletic training has a special specificity as "the latest special adaptations generated by the special effects of the training process" (Macardle, 1981, 268).

In Table (4), we found the superiority of the experimental group over the control as a result of the use of correct and purposeful training, which is phosphorous training, which controlled the intensity and achieved progress in the level as a result of raising the intensity of the load through the exercises placed and thus we can judge the achievement of the training goal and for this he sees (Sidqi Ahmed Salam, 2014) "The upgrading of the level of sports performance is one of the indicators of the success of the training process in order to reach the highest levels of sports, the great development that has occurred in the methods of training is the result of the increasing interest in searching for New methods in training players and relying on scientific foundations in planning and developing training programs that make them able to improve digital levels." (Sidqi, 2014:83).

Also, phosphorous training is a training method that controls only the intensity and achieves the sports form, i.e. achievement in the race, as in the women's 400-meter run, sees (Mohammed, Abu Ela 1984) "The training load is the main means of bringing about the physiological effects of the body, which achieves improved responses and then adapt the body's systems and raise the level, so it is one of the most important factors for the success of the training program and then improve performance" (Mohammed, Abu Al-Ela, 1984: 22).

Therefore, the use of appropriate and purposeful training achieves advanced results when it is fully specialized, as he believes (Marwan Abdul Majeed, Mohammed Jassim Al-Yasiri, 2010) "The goal of the sports training process is to reach the individual athlete to the highest level of athletic achievement in the event or activity in which the player specialized" (Marwan, Mohammed, 2010: 22).

As for the role of endurance, especially speed endurance, it is an important and basic physical requirement for 400-meter runners, considering that the race distance requires this physical ability and its development helps to achieve the required achievement, and for this reason (Qasim Hassan Hussein, 1998) "The player who has the characteristic of stretching can perform races with technical abilities and efficiency without falling the level or without showing signs of fatigue that affect the continuation of performance as required" (Qasim, 1998: 265).

While he believes (Mohamed Abdel Hagami, 1995) "that special endurance is a basis in the construction of every sports training, as this trait supports the achievement of the intensity of ideal training through the required time determined by the competition, as well as it leads to correct solutions to psychological and tactical problems and facilitates the process of mastering many duties and difficult work during training" (Mohammed, 1995: 22).

### **Conclusion**

Based on the findings of this study, it can be concluded that phosphorous training, when applied according to the rationing of intensity using pulse measurements, plays a significant role in enhancing speed endurance and improving the performance of female athletes in the 400-meter run. This method of training ensures that the intensity of the exercise is appropriately adjusted to match the physiological capacity of the runners, allowing them to achieve optimal adaptation and improve their endurance. Additionally, the use of specialized training programs that scientifically ration the training load through pulse monitoring has proven effective in obtaining accurate and reliable results regarding the exercise intensity required for 400-meter runners. This approach contributes to better management of the physical load and maximizes the performance outcomes of the athletes.

### **Recommendations**

In light of the conclusions reached, it is recommended to adopt phosphorous training methods that utilize pulse-based intensity rationing, given their proven effectiveness in enhancing speed endurance and improving the completion time of the 400-meter run for female athletes. Furthermore, coaches and trainers are advised to emphasize the use of scientifically designed training programs that incorporate precise load management through pulse monitoring. This practice ensures the accuracy of intensity control during exercises, thereby supporting athletes in achieving the desired performance levels in the 400-meter sprint.

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