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The effect of using the (TABATA) method on the anaerobic ability and fatigue index offootball players

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ABSTRACT

The research aims to reveal the effect of the method (TABATA) on the ability of the amateur and fatigue index of young football players, and the researcher used the experimental approach for its suitability and the nature of the research, and the experiment was carried out on a sample of Nineveh Youth Club players for the football season (2024-2025), numbering (20) players, selected deliberately and divided randomly into two groups (experimental and control) and by (10) players per group, and homogeneity was achieved in the variables (age, height, mass, training age) As well as conducting equivalence between the two research groups in anaerobic capacity and fatigue index, and the researcher used (arithmetic mean, standard deviation, torsion coefficient, test (T) for associated samples, test (T) for independent samples as statistical means, and the researcher concluded that he achieved the method (TABATA) implemented by the experimental group improved the level of anaerobic capacity and fatigue index, and the experimental group that used the SPB (TABATA) improved better than the control group in the variables under study.

1- Definition of research

1-1 Introduction and importance of research

Physical fitness is one of the main factors that affect the performance of football players, especially in enhancing physical ability, which is a pillar for the implementation of skill and tactical requirements on the field. Modern football has witnessed a great development in the pace of performance, as players are facing increasing physical pressure that requires repetitive, fast, and effective effort throughout the two halves of the match, which requires specialists in the field to search for methods, training methods and exercises capable of developing performance elements, such as ability. Anaerobic and muscle fatigue .

Among the training methods used to raise the level of fitness, specifically anaerobic ability, TABATA stands out as one of the effective methods. This method is part of the High-Intensity Interval Training (HIIT) system, and relies on short periods of intense exercise followed by short breaks, which contributes to improving physical and physiological performance within short periods of time, and simulates in terms of intensity and frequency the nature of actual performance in football.

This method is based on performing 8 consecutive rounds, each round includes 20 seconds of maximum effort, followed by 10 seconds of rest, so that the player completes a training session of only 4 minutes, but it has a profound impact on the muscular and respiratory circulatory system, due to the intensity of the effort exerted during short periods.

A player's ability to perform high-intensity physical activities over short periods is a crucial indicator in team games such as football, where situations that require sudden and repetitive physical effort are frequent. Several studies indicate that training in the TABATA style contributes to the development of this ability, by enhancing the body's ability to withstand effort without direct dependence on oxygen (Tabata et al.). 1996.

Research also confirms that high-intensity training, such as the TABATA **method,** has a positive effect in raising metabolic efficiency, increasing muscle oxygenation, and improving the body's handling of lactic acid accumulation, which is directly reflected in fatigue tolerance and improved performance during periods of intra-match stress (Burgomaster et al., 2008).

From this standpoint, the importance of the current research to highlight the impact of the use of (TABATA) exercises on anaerobic ability and fatigue index among young football players, and in an effort to provide a practical vision on the possibility of employing this method in preparing football players physically in line with the requirements of the contemporary game, which is a scientific attempt through which the researcher hopes to reach results that serve workers and researchers in the field of the game

1.2 Research problem

Through the researcher's follow-up of the nature of performance in football, he noticed that the performance is characterized by fast starts, repetition of performance under pressure, and keeping pace with the pattern of high-intensity intermittent play, as well as the lack of rest times between those performances, which makes the intensity of work very high, and the fatigue index is one of the physiological indicators associated with endurance to anaerobic performance, which in turn affects the continuity of physical efficiency during the match.Especially at critical times before the end of the match, so coaches are required to train players on high-intensity work so that players can carry out physical, skill and tactical duties with the same strength, speed and accuracy throughout the time of the match.

The high-intensity interval training method (TABATA) is one of the methods that has been shown to be effective in improving anaerobic indicators in multiple sports, but its application in football to the knowledge of the researcher has not yet been sufficiently studied.

Hence, the research problem stems from the need to use the (TABATA) method and its impact on the anaerobic ability and fatigue index of football players, and to know the feasibility of this method in developing physical performance within actual playing conditions.

1-3 Research Objectives

1-3-1 Detection of the effect of the (TABATA) method on the anaerobic ability and fatigue index of the experimental group players.

1-3-2 Significance of statistical differences in anaerobic ability and fatigue index between experimental and control groups in the post-test

1-4 Research hypotheses

1-4-1 There were statistically significant differences in the anaerobic ability and fatigue index of the experimental group players between the pre- and post-tests and in favor of the post-test.

1-4-2 There were statistically significant differences in anaerobic ability and fatigue index in post-tests between experimental and control groups.

1-5 Research Areas

1-5-1 Human field: Nineveh Sports Club football players season (2024-2025)

1-5-2 Time Range: 9/12/2024 to 20/2/2025

1-5-3 Spatial Area: Nineveh Sports Club Stadium

3- Research Procedures

3.1 Research Methodology:

The experimental approach was used for its suitability and the nature of the research.

3 – 2 Research sample

The main research sample was determined in a deliberate way from the players of the Nineveh Youth Football Club for the sports season (2024-2025) and its strength was (30) players, and (20) players were selected from them representing the research sample, and the sample was divided into two groups (experimental and control) through the followers of the random selection method using the draw by (10) players for each group, and the injured players were excluded and their number was (6) as well as the exclusion of goalkeepers and their number (4) and table (1) shows that.

Table (1) Research sample, excluded players and their percentages

Percentage	Number	Variables
100%	30	Main research sample
66,66%	20	Experimental Research Sample
33,33%	10	Excluded players

3-3 Means of collecting information and data: The researcher used the following research tools (content analysis, tests and measurements).

3.3.2 Measurements and tests used

3.3.2.1 Physical measurements

3.3.2.1.1 Body length measurement: **A** graduated wall was used to measure the length of the body, and when measuring the player stands barefoot with his back adjacent to the wall, provided that the wall touches the back of the feet, hips and

shoulder plates, and the look is directed forward and the length of the body is measured from the ground and to the highest point in the skull.

3.3.2.1.2 Body mass measurement: To measure mass, the player stands on the scale wearing pants only, and his body weight is measured to the nearest hundred grams.

3.3.2.2 Anaerobic ability test and fatigue index (RAST)

Repetitive Anaerobic Running (RAST) Test

Test Description:

It is a field test used to assess the anaerobic ability of athletes, especially in games that require frequent short and fast starts. It has been developed as a practical alternative to the Wingate test performed in-vitro.

Method of performance:

- Number of starts 6 Sprints
- Distance: 35 meters per start
- Rest between each start of only 10 seconds
- Required measurements: time of each start in seconds, body weight (kg)

Power calculation formula:

Capacity = (weight × distance²) ÷ time

The following indicators are extracted:

- Peak power
- Average power
- Minimum power
- Fatigue index

This test is a reliable and easy-to-apply method of measuring anaerobic ability and has been shown to predict the performance of athletes over short distances. (Zagatto & others 2009)

3-4 homogeneity of the research sample: homogeneity was carried out in variables (age, height, mass, training age) and table (2) shows the arithmetic means and standard deviations and the value of the coefficient of variation and torsion of the variables adopted in homogeneity

Table (2) Arithmetic means, standard deviations, coefficient of variation and torsion values of homogeneity

Values of the torsion coefficient	Coefficient of variation values	Sample		Unit of measurement	Variables
		+ p	Going to		
0, 812	5,321%	0, 894	16,800	**year**	**lifetime**
0,971	10,757%	3,838	168,000	**poison**	**Length**
-0,645	2,284%	7,903	54,450	**kg**	**Mass**
0, 201	24,166 %	0,725	3,000	**year**	**Training age**

Table (2) shows that the values of the coefficient of variation for the variables (age, height, mass, training age) were less than (30%) and this indicates that the sample is homogeneous in these variables and the values of the torsion coefficient were confined between (+- 1) and this indicates that the sample is homogeneous in these variables, as the torsion coefficient whenever it is between (+- 1) indicates the moderation of the distribution of the sample normally.

3.5 Equivalence of the two research groups

Equivalence was performed between the research groups in anaerobic capacity and fatigue index as shown in tables (3**)**

Table (3) Arithmetic means, standard deviations, calculated (T) and Sig values for equivalence in physical characteristics between the two research groups

Sig[1]	(C) Calculated	Tribal Officer		Tribal Experimental		Unit of measure ment	Statistical Features / Anaerobic capacity
		± p	Going to	± p	Going to		
0,083	1,838	38,309	332,90	52,995	370,90	She came	**Medium Capability**
0,613	0,515	0,888	4,590	1,167	4,829	FI	**Fatigue indicator**

Through Table (3), it was found that the calculated values of (T) were between (1,838 and 0.515) and by noting the values of the probability level, which were between (0.613, 0.083), all of which are greater than the approved significance level (0.05), i.e. there are no significant differences between the two research groups, and this indicates the equivalence of the two research groups in anaerobic ability and fatigue index.

3.6 Devices and tools used in research

Electronic scale, stopwatch (2), signs, Burke, tape measure (1).

3 – 7 Experimental design : The experimental design was used, which was called the random control group design with pre- and post-testing.

3 – 8 Identify research variables

3 - 8 - 1 Independent variable: - The independent variable in the current research is represented by: - Exercises (TABATA).

3 **– 8 – 2 Dependent variable: -** The current research dealt with anaerobic capacity fatigue index.

4 – 9 Field procedures used in research:

4.9.1 Exploratory experiments

- **The first exploratory experiment** was on (9/12/2024) in which the exercises

(1 The researcher adopted a probability level≤ (0.05)

were approved after identifying how to apply the exercises and detecting errors that may occur.

- The second exploratory experiment was on (11/12/2024) that showed the possibility of adopting the test, as well as the knowledge of the assistant work team and the extent of their understanding of how to work and the method of registration.

- The third exploratory experiment on (12/12/2024) aimed to identify the time of intervals between repetitions and totals, as well as the appropriate repetitions for the exercises used by measuring the pulse index.

4.9.2 Design of TABATA **exercises used in research**

After analyzing the content of the sources and scientific studies, (6) exercises used in the (TABATA) method shown in (Appendix 1) were selected to be implemented by the experimental group in the research.

4.9.3 Anaerobic Ability Test and Pre-Fatigue Index

The anaerobic capacity test was conducted for the period on (14/12/2024)

4 – 9 – 4 Implementation of exercises in the style of Tabata special used in the research

After the completion of the application of the pre-test for anaerobic ability fatigue index, the exercises were carried out using the (TABATA) method on the experimental group, while the control group implemented the trainer's curriculum on (15/12/2024) until (6/2/2025), and the following points were taken into account when implementing the exercises, namely:

- The exercises were applied in the TABATA method for scientific research purposes.
- All training units start with a general warm-up in order to prepare all the muscles of the body, followed by a special warm-up.
- The method of high-intensity interval training was used in the implementation of the exercises used.
- The exercises were carried out during (8) minor (weekly) courses and by two intermediate sessions.
- Each intermediate course consists of four minor courses and each minor course consists of (3) training units (i.e. the implementation of "24" training units) and the training units were conducted on the days (Sunday, Tuesday and Thursday).
- The ripple of the load movement in each cycle is intermediate (3:1).
- Load control by changing in size by increasing only frequencies.
- Rest periods between repetitions and totals were determined based on the theoretical frameworks of TABATA-style exercises.

- The number of iterations and totals was determined according to the level of the research sample
- The time for the exercises used was determined based on what is used by previous scientific research that fits the level of the research sample.
- The training units were completed with calming and relaxation exercises to return the body to a semi-normal state

4- 9 - 5 Anaerobic capacity test and dimensional fatigue index: The post-test was conducted on (13/2/2025) in the same way as the pre-test.

3- 10 Statistical means: The statistical means were extracted by relying on the statistical bag (SPSS), which are: (arithmetic mean, standard deviation, coefficient of variation, torsion coefficient, test (T) for related samples, test (T) for independent samples, percentage).

4- Presentation, analysis and discussion of results

4.1 Presentation and analysis of results

4.1.1 Presentation of the results of the anaerobic ability test and the fatigue index before and after the experimental group

Table (4) Arithmetic Means, Standard Deviation, Calculated (T) Values, Sig for Anaerobic Power Test and Pre- and Post-Fatigue Index for the Experimental Group

Sig	(C) Calculated	Experimental after me		Tribal Experimental		Unit of measurement	Statist / Anaerobic capacity and fa
		± p	Going to	± p	Going to		
0,000*	7,249	56,714	471,400	52,995	370,90	She came	Medium Capabi
0,003*	4,015	0,532	3,767	1,167	4,829	FI	Fatigue indicat

* Significant at the probability level of ≤ (0.05)

Through Table (4) we can see the following:

- There were significant differences between the averages of the pre- and post-tests in the anaerobic ability and fatigue index addressed by the research in the experimental group if the sig values are less than (0.05).

4.1.2 Presentation of the results of the anaerobic ability test and the pre- and post-fatigue index of the control group

Table (5) Arithmetic means, standard deviation, calculated (T) values, Sig for anaerobic ability test and pre- and post-fatigue index for the control group

Sig	(C) Calculated	The officer after me.		Tribal Officer		Unit of measurement	Statist / Anaerobic capacity and fatigu
		± p	Going to	± p	Going to		
0,000*	8,405	33,153	392,700	38,309	332,90	She came	Medium Capabili
0,047*	2,296	0,167	4,227	0,888	4,590	FI	Fatigue indicator

* Significant at the probability level of ≤ (0.05)

Table (5) shows us the following:

- There were significant differences between the averages of the pre- and post-tests in the anaerobic ability and the fatigue index addressed by the research in the control group if the SIG values were less than (0.05).

4.1.3 Presentation of the results of the anaerobic power test and the dimensional fatigue index for the experimental and control groups

Table 6 Arithmetic means, standard deviation, calculated T values, Sig for anaerobic power test and dimensional fatigue index for experimental and control groups

Sig	(C) Calculated	Dimensional Officer		Experimental dimension		Unit of measurement	Statistic / Anaerobic capacity and fatigu
		± p	Going to	± p	Going to		
0,001	3,788	33,153	392,700	56,714	471,400	She came	Medium Capability
0,017	-2,609	0,167	4,227	0,532	3,767	FI	Fatigue indicator

* Significant at the probability level of ≤ (0.05)

Table (6) shows us the following:

- There were significant differences between the averages of the post-test in anaerobic ability and fatigue index between the two research groups and in favor of the experimental group, as the values of Sig were less than (0.05).

4.2 Discussion of the results:

The results of Tables (4) and (5) showed a clear improvement in the indicators of anaerobic capacity and fatigue resistance in both the experimental group and the control group, but to varying degrees. While the experimental group experienced significant development in both variables after the application of the TABATA method, the control group showed less improvement in terms of value and effect.

The researcher attributes this improvement in both groups to the continuity of training and effort during the application period, but the significant change that appeared in the experimental group is directly related to the type of method applied, which relied on the high-intensity and frequent (TABATA) method . This method alternates between short periods of maximum effort and short rest periods, which efficiently stimulates anaerobic energy systems, especially in sports activities that rely on explosiveness and speed of repetition, such as football. This is consistent with studies Saha et al. (2025) andAnsori et al. (2024), where they showed that the TABATA protocol improves anaerobic capacity and endurance by raising the efficiency of anaerobic systems and enhancing muscle performance under pressure.

The researcher believes that the intense nature of the exercise used in this technique (TABATA) activates anaerobic metabolic pathways such as phosphate and glucose breakdown, leading to increased energy production without direct dependence on oxygen. Voltage intensity during short periods also contributes to raising the anaerobic threshold, which is the athlete's ability to continue performing before fatigue actually appears. The study of Narayanan et al. (2025) has confirmedHigh-intensity frequent training, especially when combined with plyometric exercise, leads to significant improvements in cardiomuscular ability and increased activity of anaerobic enzymes.

The researcher confirms that the remarkable improvement in the indicators of anaerobic capacity and fatigue index in the experimental group was not only due to the high intensity that characterizes the TABATA protocol, but also due to the dynamics of performance that requires the repetition of effort under short time pressure, which stimulates physiological adaptation in a concentrated and rapid manner at the muscular and energy levels. This is what Boutcher (2011) has previously pointed out, and has been confirmed by the results of recent studies, such as Saha et al. (2025), which explained that short and high-intensity programs lead to significant improvements in the ability of muscles to deal with repetitive stress, which reflects positively on anaerobic performance and endurance.

The results of Table (6) in the post-test also showed a clear superiority of the experimental group over the control group in both anaerobic ability and fatigue index. While the control group continued on a traditional training program of a general nature, the experimental group relied on (TABATA) exercises, which are

highly effective in stimulating anaerobic energy systems and raising the level of physiological stimulation in a short time.

Traditional exercises may contribute to improving overall fitness and achieving limited physical development in physical indicators, but they do not have the same intense and direct effect as the TABATA method, especially in the development of anaerobic ability. High voltage in short intervals and frequently makes the Tabata protocol an ideal choice for stimulating rapid adaptations in systems responsible for short-term and explosive performance, increases tolerance to repetitive exertion and supports neuromuscular responses in the face of fatigue.

The researcher stresses that traditional exercises may be useful for building a general physical base, but they lack the intensity and physiological diversity provided by the TABATA protocol, which is characterized by intensity integration and precise time regulation. This method not only increases the efficiency of physical performance, but also enhances the efficiency of anaerobic metabolism and pushes the muscles to work to their limits, resulting in a stronger musculoskephysiological adaptation compared to regular exercises. This has been confirmed by studies such as Zelt et al. (2014) andAnsori et al. (2024), which showed that high-intensity training (TABATA), causes rapid physiological effects including improved energy production and increased activity of anaerobic enzymes, which enhances the athlete's ability to perform vigorous repeats and reduces the speed of fatigue onset.

5. Conclusions and recommendations

5.1 Conclusions

- The experimental group's TABATA exercises made progress in the post-test of anaerobic ability and fatigue index.
- The control group made progress in the post-test of anaerobic ability and fatigue index.
- The experimental group that performed TABATA exercises achieved better improvement than the control group in the anaerobic ability test and fatigue index.

5.2 Recommendations

In light of the findings and conclusions of the research, the researcher recommends the following:

- Adopting the (TABATA) method in physical preparation programs for football players, especially in the preparatory stages of the season, because of its positive impact on the development of anaerobic ability and reduce the speed of the onset of fatigue.
- Integrate the TABATA method into the training modules of youth teams, either separately or supplementally along with skill exercises, in order to enhance the effectiveness of physical performance under actual playing conditions.
- Conducting similar studies on different age groups (juniors, youth, adults) and on players from multiple competitive levels for team games and individual events, to verify the effectiveness of the TABATA method on a larger scale and determine the optimal training doses for each category.

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Appendix (1)

The method of performing exercises in the Tabata method and a model of a training unit

How to perform TABTA exercises used by the experimental group:

1. Squats

How to perform:

- Stand upright, feet open shoulder-width apart.
- Direct the metatarsals slightly outward to provide greater balance during movement.
- Interlace the hands in front of the chest to stabilize the upper body and help maintain balance.
- The torso is bent by lowering the hips back and down, as if sitting on an invisible chair.
- The knees are gradually bent while keeping the back straight and tightening the abdominal muscles.
- The body descends until the thighs are at a level approximately parallel to the ground or depending on physical ability.
- The body is returned to a standing position by slowly and tightly stretching the knees and thighs.
- Repeat the movement while maintaining balance and regular breathing during performance.

2. Push-ups from the knees

Method of performance:

- From a kneeling position on the floor, the hands are placed on the floor along the shoulders.
- Stretch the torso in a straight line from head to knees, tightening the abdominal muscles.
- The body slowly lowers towards the floor until the chest is close to touching it.
- Take care to keep the elbows at an angle inclined outward (about 45 degrees).
- The body is pushed up using the arms until the starting position is reverted.

- Repeat the movement while maintaining stability and discipline in performance.

3. Dynamic Lunges

Method of performance:

- Stand upright, hands at the waist.
- Skip a long step forward with one leg.
- The knees are bent until the hind knee approaches the ground without touching it.
- Take care to keep the front knee above the heel level.
- The body is returned to a standing position by pushing the front foot back.
- He repeats the movement with the other leg and continues to switch at a regular pace.

4. High knees

Performance method

- Stand upright, feet pelvic-width apart.
- One knee is raised upwards until it reaches about hip level.
- The knee is lowered and then the other knee is raised in the same way, successively and quickly.
- Moves the arms in harmony with the movement of the legs, such as during a run.
- Keeps the torso straight and looking forward throughout the performance.
- The exercise is carried out at a continuous and fast pace during the specified period

5. Spider crawling (Spider Crawl).

Performance method

- Push-up position is taken, with the body straight from head to heels.
- Hands are placed on the floor shoulder-aligned, with the arms extended straight and firm.
- Pulls the right knee towards the right elbow, without touching the floor.
- The leg is moved backwards, then the movement is repeated with the left leg towards the left elbow.
- Continued movement interchangeably between the legs, keeping the body low and the torso stable.
- Ensures that the hip remains low without excessive height.
- The exercise is carried out at a regular pace throughout the specified period.

6. Plank Jack

Method of performance:

- Start with the plank position on the forearms, keeping the body in a straight line from head to heels.

- Keep your elbows just below the shoulders, and your forearms stable on the floor.
- Keep your feet bandaged at first, while tightening your abdominal muscles.
- Jump with your feet and open them to the sides quickly and lightly.
- Jump again and return the feet to the closed position.
- Keep your upper body steady throughout your workout without moving your forearms.
- Repeat the movement at a fast and regular pace during the specified period

Sample of the first week of Tabata exercises used in research

Total time for the main part of the training unit per minute	Total workout time in minute	Total workout time per second	Rest time between groups and exercises in the flush	Rest time between repetitions in seconds	Number of totals	Number of repetitions	Exercise time in seconds	Exercise used in the module	Training Module	today	The week
15.333	7.667	460	4	10	2	4	20	Criss Cross Squats	1	Sunday	The first
	7.667	460	5	10	2	3	20	Kneeling Push-ups			
15.333	7.667	460	4	10	2	4	20	Dynamic Lunges	2	Tuesday	
	7.667	460	5	10	2	3	20	High Knees			
15.333	7.667	460	4	10	2	4	20	Spider Crawl	3	Thursday	
	7.667	460	5	10	2	3	20	Plank Jack			

The training load was gradually increased by increasing the volume (number of repetitions), as the number of repetitions in the second week was raised to (5×2) for the first exercise and (4×2) for the second exercise, and the escalation continued in the third week to reach (6×2) and (5×2) respectively.

In the fourth week, a decrease in the training load was made, by reducing the number of repetitions by one repetition from the previous week, to become (5×2) for the first exercise and (4×2) for the second exercise, with the aim of reducing stress and providing an opportunity for recovery while maintaining the continuity of physical stimulation.

In the fifth week, the load was raised again to reach (6×2) for the first exercise and (5×2) for the second exercise, as a preparation for entering the highest stages of the training load. In the sixth week, the escalation continued to reach its maximum level in

the seventh week, by (7×2) for the first exercise and (6×2) for the second exercise, with the adoption of stabilization in the same week. As for the eighth week, the repetitions were reduced to (6×2) and (5×2), in preparation