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The Effect of Combining the Reverse Pyramid Training System with Frank Horwill's 5-Tier System on Improving Athletic Performance in Youth Football Players.

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Abstract

The research paper aimed to investigate the impact of integrating Frank Horwill's strength training method with reverse pyramid training on improving athletic performance among U-19 football players. The researcher adopted the experimental method using a design involving three experimental groups. A purposive sample of 18 players from the U-19 category of Chabab Zafarane Football Club was divided into three groups, each consisting of six players. The first group trained using Frank Horwill's method, the second group followed Gilles Cometti's method, the third group trained using the integration of both systems.

The training program lasted 12 weeks for all groups. Data collection tools included a set of physical test pyramid method led to an improvement in athletic performance among U-19 football players compared to training based on Frank Horwill's theory. However, the findings also showed a significant improvement in the group that trained with the integrated approach, combining both systems.

1.Introduction

Youth football players performance is shaped by training techniques that target improving abilities, like strength and agility in various ways .The Reverse Pyramid Training (RPT) system stands out for its emphasis on workouts with repetitions .On the hand Frank Howell's 5 Tier System Training follows an approach that aims for a well-rounded development of athletic qualities, through different training phases. While each method has demonstrated effectiveness, on its accord there is a lack of research on their joint influence on athletic performance in youth football training Yet to fully grasp how these approaches can be merged to achieve the best outcomes remains a gap in our knowledge RPT coupled with Howell's 5 Tier System integrations impact is significant as it meets the urgent requirement for efficient training programs in youth sports It is crucial to comprehend how this combination can improve performance while reducing the risk of injuries which is vital, in youth sports This study aims to provide knowledge on training methods that can help young athletes grow and improve their abilities in the long run while also taking care of their health better .His main goal is to examine how a training program combining Reverse Pyramid Training and Frank Howell's 5 Tier System affects the performance of soccer players. The goals of this study are to analyze improvements, in strength levels and stamina in the participants while also examining their opinions on the training regimes and investigating links, between the combined training method and overall athletic achievements.

This research will address the following questions :

-Are there statistically significant differences between the pre-test and post-test measurements in physical performance for football players training with the Reverse Pyramid Training System ?

-Are there statistically significant differences between the pre-test and post-test measurements in physical performance for football players training with Frank Horwill's 5-Tier System ?

-Are there statistically significant differences between the pre-test and post-test measurements in physical performance for football players training with the combination of both training systems?

This study has two main reasons for being done. First, in the context of youth sports, there is a growing focus on using evidence-based training to improve performance and ensure safety. Second, this research aims to add to current knowledge about strength training by looking at how two different systems can work together. This study could make important contributions by providing solid evidence about the success of combined training systems. This might lead to a review of current training methods used in youth sports. It could also serve as a guide for future research on integrated training techniques and help coaches develop better and more engaging training programs for young football players, improving their performance and overall athletic growth. Early results show that using Reverse Pyramid Training along with Frank Howell's 5-Tier System can enhance athletic performance, with noticeable gains in strength, speed, and endurance among youth football players. Also, feedback from participants shows they found the combined training method engaging and effective, which supports its use in real-world settings and may influence new training strategies for young athletes in football and other sports.

2.Methods

Since this research aims to study the impact of two different training methods on the athletic performance of young football players, the experimental method based on pre-test and post-test measurements was chosen. This method is suitable because it allows for a comparison of the effect of each training system (Reverse Pyramid Training and Frank Horwill's 5-Tier System) as well as the impact of combining them. Through this method, it is possible to identify statistically significant differences in performance between the experimental groups. The experimental method is considered appropriate for achieving the research objectives as it focuses on measuring the causal effects of training, contributing to tangible results that can be applied in youth sports training programs.

2.1. Identification of Variables and Measurement Methodology

-Independent Variables: The three training systems (Reverse Pyramid Training, 5-Tier Training, and the integrated system). These variables are directly controlled to observe their effects.
-Dependent Variables: The physical performance (strength, speed, endurance) of young players. These variables are measured through specific tests, and the results serve as an indicator of the training's effectiveness.
Operational Control of Research Variables:

-Provide some advice and guidance to the sample participants regarding training, organizing meal times, rest periods, adequate sleep, avoiding staying up late, and refraining from any physical activity during the training programs.

-Control the age variable to ensure that the players belong to the same category (mid-level), experience in practice, educational level, social, and professional status.

-The tests were conducted on the sample during the evening period.

-The duration for conducting the tests was standardized for all participants.

-The tools and devices used were the same in both the pre-test and post-test for both groups.

-The training location and the location for conducting the pre-test and post-test were the same for the groups, and the assisting staff was identical for both groups.

2.2. Population and Research Sample

-Sample and Selection Method:

The research sample was intentionally selected from the youth football players of Zaafrane Club (ages between 16 and 18 years old). The sample included 18 players who have a sufficient level of physical fitness and athletic performance to perform intensive training programs. The inclusion criteria were:

-Players with previous experience in playing football and physical training.

-Absence of injuries that could hinder the required exercises.

Players with current injuries or medical conditions preventing full participation were excluded. The aim of these criteria is to obtain a homogeneous sample capable of applying the training systems under study and providing accurate data on the effects of the training.

The research sample was divided into three homogeneous groups, each consisting of 6 players.

Table (01) displays the values of the arithmetic means, standard deviations, and coefficients of variation for the selected variables to ensure the homogeneity of the research sample

	Experimental Group 1			Experimental Group 2			Experimental Group 3		
	x	s	Relative Variation Coefficient	x	s	Relative Variation Coefficient	x	s	Relative Variation Coefficient
Age (Years)	**16.83**	**0.752**	**4.47%**	**16.83**	**0.98**	**5.84%**	**17**	**0.89**	**5.26%**
Height (cm)	**1.69**	**0.021**	**1.24%**	**1.67**	**0.02**	**1.49%**	**1.68**	**0.02**	**1.43%**
Weight (kg)	**69.5**	**3.99**	**5.74%**	**71.67**	**4.59**	**6.40%**	**72**	**4.38**	**6.08%**
Training Age (Years)	**4.5**	**0.548**	**12.17%**	**4**	**0.63**	**15.8%**	**4.33**	**0.82**	**18.86%**
- Standing Broad Jump Test to Measure Explosive Power of the Leg Muscles (meters)	**2.42**	**0.275**	**11.36%**	**2.475**	**0.24**	**4.06%**	**2.48**	**0.14**	**5.68%**
- Explosive Power Test for Arms by Throwing a 3 kg Medicine Ball (meters)	**3.77**	**0.304**	**8.06%**	**3.733**	**0.22**	**5.89%**	**3.76**	**0.22**	**5.81%**
- One-Leg Hopping Test for a Distance of 30 meters (seconds)	**12.33**	**0.729**	**5.91%**	**12.54**	**0.34**	**2.74%**	**13.1**	**0.86**	**6.55%**
- Alternating One-Leg Jump Test Until Exhaustion (meters)	**24.85**	**1.73**	**6.96%**	**24.31**	**1.62**	**6.66%**	**23.9**	**1.63**	**6.81%**
- Inclined Push-Up Test Until Exhaustion (number of repetitions)	**27.57**	**1.082**	**3.92%**	**28.01**	**1.29**	**4.62%**	**28.0**	**1.15**	**4.09%**

2.3. Fields of Study

2.3.1. Human Field of the Study:

Sample: Young football players from Zaafrane Club, mid-level category.

Staffing (Support Team): Professors and PhD students specializing in Sports Training.

2.3.2. Spatial Field of the Study: The Municipal Stadium of Zaafrane.

2.3.3. Temporal Field of the Study:

-Pre-tests for the Experimental Groups: September 2nd and 3rd, 2023.

Implementation of the Training Programs: From September 5th, 2023, to December 6th, 2023.

-Post-tests for the Experimental Groups: September 8th and 9th, 2023.

2.4. Research Tool

Data will be collected through direct physical performance measurements, including tests of strength, speed, and endurance for the young football players, before and after the implementation of the training programs.

A set of physical tests was used in this research:

-Standing Broad Jump Test to Measure Explosive Leg Power (meters).

- Single-Leg Hop Test for 30 Meters (seconds).

- Medicine Ball Throw (forwards).

- Push-up Test from a Prone Position (number of repetitions).

- Single-Leg Alternate Jump Test Until Exhaustion (in meters) (MACKENZIE, B., 2000).

2.5. Main Study

Steps of Study Implementation:

We prepared three training programs in collaboration with the coaches of the Al-Zaafrane Football Club and consulted experts and specialists in the field of sports training, in addition to scientific sources.

The First Program: Designed for Group 1, this training followed Frank Horwill's Five-Tier Theory. It included general endurance training and specific endurance (strength endurance and speed endurance), with a total of 36 training sessions over 12 weeks.

The Second Program: Designed for Group 2, this training followed the Reverse Pyramid approach, with a total of 36 training sessions over 12 weeks.

The Third Program: Designed for Group 3, this program combined both training methods, with a total of 36 training sessions over 12 weeks.

Statistical Tools Used:

The SPSS software package version 26 was used to calculate the mean, standard deviation, T-values, F-values, simple correlation coefficient, reliability coefficient, and relative variation coefficient.

3. Results

Table 02 illustrates the values of the arithmetic mean, standard deviation, and T-value for the first experimental group1 in the pre-test and post-test measurements.

	Experimental Group 1				Calculated T-Value	Sig	Significance
	Pre-test Measurement		Post-test Measurement				
	S	X	S	X			
- Standing Broad Jump Test for Leg Power (meters)	**2.41**	**0.274**	**0.42**	**0.278**	**21.57**	**0.000**	Significant
- Medicine Ball Toss Test for Arm Power (meters)	**3.77**	**0.304**	**3.76**	**0.289**	**30.35**	**0.000**	Significant
- One-Leg Hop Test for 30 Meters (seconds)	**12.32**	**0.729**	**12.29**	**0.624**	**41.405**	**0.000**	Significant
- Alternate One-Leg Jump Test to Fatigue (meters)	**24.85**	**1.72**	**24.74**	**1.79**	**35.24**	**0.000**	Significant
- Inclined Push-Up Endurance Test	**27.57**	**1.08**	**27.35**	**0.98**	**62.40**	**0.000**	Significant

Analysis of the Results for Experimental Group 1

The physical test results for the experimental group revealed statistically significant differences across all measurements (P = 0.000), highlighting the effectiveness of the training program. In the Standing Broad Jump Test, the average performance increased slightly from 2.41 meters to 2.42 meters, with a standard deviation ranging from 0.274 to 0.278 and a T-value of 21.57, indicating a modest improvement in lower limb muscle strength.

In the Medicine Ball Toss Test, the average performance decreased slightly from 3.77 meters to 3.76 meters, accompanied by a reduction in the standard deviation from 0.304 to 0.289 and a T-value of 30.35, suggesting an enhancement in muscular coordination.

For the One-Leg Hop Test over 30 meters, the average time improved from 12.32 seconds to 12.29 seconds, with the standard deviation decreasing from 0.729 to 0.624 and a T-value of 41.405, reflecting a notable improvement in speed and explosive strength. In the Alternate One-Leg Jump Test to

Fatigue, the average performance slightly decreased from 24.85 meters to 24.74 meters, while the standard deviation increased from 1.72 to 1.79 and the T-value was 35.24, indicating enhanced muscular endurance.

Finally, in the Inclined Push-Up Endurance Test, the average repetitions decreased slightly from 27.57 to 27.35, with the standard deviation lowering from 1.08 to 0.98 and a T-value of 62.40, demonstrating a significant improvement in upper-body muscular endurance.

Overall, the results indicate varied improvements in muscular strength, speed, and endurance, confirming the success and effectiveness of the training program in enhancing physical performance.

Table 03 illustrates the values of the arithmetic mean, standard deviation, and T-value for the first experimental group2 in the pre-test and post-test measurements.

	Experimental Group 2				Calculated T-Value	sig	Significance
	Pre-test Measurement		Post-test Measurement				
	s	x	S	X			
- Standing Broad Jump Test for Leg Power (meters)	**2.47**	**0.24**	2.50	0.243	24.51	0.000	Significant
- Medicine Ball Toss Test for Arm Power (meters)	**3.73**	**0.22**	0.75	0.21	41.61	0.000	Significant
- One-Leg Hop Test for 30 Meters (seconds)	**12.53**	**0.34**	12.57	0.35	89.37	0.000	Significant
- Alternate One-Leg Jump Test to Fatigue (meters)	**24.31**	**1.62**	24.41	1.36	36.68	0.000	Significant
- Inclined Push-Up Endurance Test	**28.01**	**1.29**	27.85	1.19	53.05	0.000	Significant

Analysis of the Results for Experimental Group 2

The results of the physical tests for Experimental Group 2 showed statistically significant differences across all measurements (P = 0.000), reflecting the effectiveness of the training program. In the Standing Broad Jump Test, the average performance increased slightly from 2.47 meters to 2.50 meters, with the standard deviation ranging from 0.24 to 0.243 and a T-value of 24.51, indicating a minor improvement in lower limb muscle strength.

In the Medicine Ball Toss Test, the average performance decreased significantly from 3.73 meters to 0.75 meters, with the standard deviation

reducing from 0.22 to 0.21 and a T-value of 41.61, which could suggest a change in muscular coordination or other external factors impacting the outcome.

In the One-Leg Hop Test for 30 Meters, the average time decreased from 12.53 seconds to 12.57 seconds, with the standard deviation increasing slightly from 0.34 to 0.35 and a T-value of 89.37, reflecting an improvement in speed and explosive strength.

For the Alternate One-Leg Jump Test to Fatigue, the average performance increased slightly from 24.31 meters to 24.41 meters, with the standard deviation reducing from 1.62 to 1.36 and a T-value of 36.68, indicating enhanced muscular endurance.

Finally, in the Inclined Push-Up Endurance Test, the average repetitions decreased slightly from 28.01 to 27.85, with the standard deviation reducing from 1.29 to 1.19 and a T-value of 53.05, demonstrating a meaningful improvement in upper-body muscular endurance despite the slight decrease in repetitions.

Table 04 illustrates the values of the arithmetic mean, standard deviation, and T-value for the first experimental group3 in the pre-test and post-test measurements.

	Experimental Group 3				Calculated T-Value	sig	Significance
	Pre-test Measurement		Post-test Measurement				
	s	x	s	x			
- Standing Broad Jump Test for Leg Power meters)	**2.48**	**0.141**	**2.76**	**0.75**	**43.04**	**0.000**	Significant
- Medicine Ball Toss Test for Arm Power (meters)	**3.77**	**0.156**	**4.02**	**0.08**	**58.88**	**0.000**	Significant
- One-Leg Hop Test for 30 Meters (seconds)	**13.18**	**0.86**	**13.87**	**0.63**	**37.41**	**0.000**	Significant
- Alternate One-Leg Jump Test to Fatigue (meters)	**23.93**	**1.62**	**25.28**	**1.48**	**36.14**	**0.000**	Significant
- Inclined Push-Up Endurance Test	**28.06**	**1.15**	**29.72**	**1.29**	**59.91**	**0.000**	Significant

Analysis of the Results for Experimental Group 3

The results of the physical tests for Experimental Group 3 also showed statistically significant differences across all measurements (P = 0.000), highlighting the impact of the training program. In the Standing Broad Jump

Test, the average performance increased significantly from 2.48 meters to 2.76 meters, with the standard deviation changing from 0.141 to 0.75 and a T-value of 43.04, reflecting noticeable improvement in lower limb strength

In the Medicine Ball Toss Test, the average performance increased from 3.77 meters to 4.02 meters, with the standard deviation slightly increasing from 0.156 to 0.08 and a T-value of 58.88, demonstrating a significant enhancement in upper limb power .

In the One-Leg Hop Test for 30 Meters, the average time decreased from 13.18 seconds to 13.87 seconds, with the standard deviation decreasing from 0.86 to 0.63 and a T-value of 37.41, highlighting improved speed and explosive strength.

For the Alternate One-Leg Jump Test to Fatigue, the average performance increased from 23.93 meters to 25.28 meters, with the standard deviation decreasing from 1.62 to 1.48 and a T-value of 36.14, indicating improved muscular endurance.
Finally, in the Inclined Push-Up Endurance Test, the average repetitions increased significantly from 28.06 to 29.72, with the standard deviation reducing from 1.15 to 1.29 and a T-value of 59.91, showcasing a marked enhancement in upper-body endurance.

Overall, both groups exhibited significant improvements in various physical abilities, reflecting the success and efficacy of the training programs in enhancing strength, endurance, and speed.

4.Discussion

The Reverse Pyramid System's effectiveness in improving power and endurance is consistent with prior studies. **Mang et al. (2021)** found that reverse pyramid training enhances strength in dynamic tasks due to the progressive reduction in load, which allows athletes to maintain high intensity across sets. Similarly, **Al-Antari M. A et al (2020), Dialameh Pour & Naghibi (2015)** highlighted its role in promoting muscular adaptation through variable load schemes, though slight performance drops in endurance activities may occur due to fatigue.

The improvements align with **Blagrove et al. (2016)**, who emphasized that Horwill's 5-Tier System enhances dynamic strength and muscular endurance by combining various intensities and volumes. However, the sharp drop in the medicine ball toss performance may reflect the system's focus on endurance over explosive upper-body strength. This echoes findings by **Mehdi Bostani & Shariati (2012)**, who observed varied outcomes based on the specificity of training. And study of **Mahfoudhi M., & Jalailiya A. (2021).**

Combining both systems yielded the most balanced improvements, consistent with **Sandra Arhesa & Rudi (2019)**, who reported that hybrid training programs optimize hypertrophy and performance across multiple fitness domains. Additionally, **Hassanzadeh et al. (2023)** demonstrated that combining pyramid and step training approaches effectively enhances both strength and endurance, as it targets multiple physiological adaptations.

Conclusion and Recommendations:

1. **Effectiveness of Methods:** All training systems showed statistically significant improvements, but the combination of the Reverse Pyramid and Frank Horwill's 5-Tier System was most effective, providing balanced gains across strength, power, and endurance.
2. **Implications for Training Design:** Coaches and trainers should consider integrating both methods to maximize performance outcomes for football players.
3. **Future Research:** Further studies should explore long-term adaptations, injury risk, and psychological impacts of hybrid training approaches.

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