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THE EFFECT OF WEIGHTED TRAINING AND HIGH-INTENSITY EFFORT ON SELECTED SPECIFIC PHYSICAL ABILITIES AND PULMONARY EFFICIENCY (CPET) AMONG YOUTH BASKETBALL PLAYERS

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Abstract
Training with relative weights serves different important purposes which can be utilized by researchers in improving various components of sport-specific physical preparation. The main target objectives of training programs for practitioners in the sports field are the sustenance of optimum physical and technical performance in critical game situations and athletes' preparedness who can cope with the physical, technical, and physiological demands of each sport.
From this concept, the researcher carried out this experiment to determine the effect of weighted training and high-intensity exercises on selected specific physical abilities and pulmonary efficiency (CPET) for basketball players.
A structured training program was implemented using different relative weights for the limbs in addition to high-intensity exercises to test their effects on certain physical abilities and pulmonary efficiency (CPET). The problem of the research emerged from the clear decrease in the variables of physical abilities and pulmonary efficiency in the sample of the study. Therefore, an eight-week training program was applied by the researcher (two consecutive months), three weekly training sessions using different individual relative body weights to find out their effect on the studied sample.
To solve the problem, the researcher used the experimental method with its one-group design because of the appropriateness to achieve the purpose of research wherein an experimental variable is imposed on a sample and measurement of its effect on research variables. Relative weight training and high-intensity exercises were used during the experiment.
The results clearly improved all the studied variables of specific physical abilities and pulmonary efficiency (CPET). The researcher recommends conducting such experimental programs, using relative weight training to improve specific physical capacities, and applying high-intensity exercises for improvements of pulmonary efficiency in youth basketball players.
Understanding the Basics: Why This Research Matters
Modern sport has greatly advanced particularly basketball therefore there is a need to keep up with such advancements and attempt to achieve high levels of physical and physiological performances that include developing the players in ways that match the evolving demands of the sport. Based on this, the researcher conducted this study to find out if it is possible to develop certain specific physical abilities and discover the role of high-intensity exercises in improving pulmonary efficiency (CPET) for basketball players.

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Sports training is directly related to the health and physiological condition of the athlete. None deny its important aspect in developing and organizing training programs, which would eventually satisfy the specific physical and physiological demands of a certain sport. Thus, a training program was prepared by the researcher and submitted to specialists for their evaluation and proper adjustment.

Contemporary outlooks on sports training involve more than the provision of classical or traditional modes. They include various modern training methods aimed at total athletic development and the physical, as well as physiological challenges confronted during actual competition. The researcher noted that results oriented toward using an experimental method in developing certain specific physical abilities together with pulmonary efficiency (CPET) would register positive effects on performance and achievement.
Therefore, a program was applied for eight weeks-three sessions per week-using relative weights for the upper and lower limbs to determine their effects on some selected physical abilities and pulmonary efficiency among youth basketball players.
Keywords : Weighted training ,High-intensity exercise ,Specific physical abilities ,Pulmonary efficiency CPET ,Youth basketball players

1-2 Research Problem

By constant monitoring of basketball training programs, the researcher noted that there was inadequate application of relative weight training for both the upper and lower limbs together with lack o f emphasis on improving the players' pulmonary efficiency which influences th e development of some specific physical abilities as well as CPET perform ance.
Therefore, the researcher conducted this experiment to determine the effect of such training in enhancing the variables under study to attain higher levels of physical and physiological performance among players during competition.

1-3 Research Objectives

• To design a training program using relative weighted resistance (loading) for youth basketball players.
• To develop high-intensity exercises aimed at improving pulmonary efficiency (CPET) for youth basketball players.
• Determining the impact of the training program on certain chosen specific physical abilities and pulmonary efficiency (CPET) among youth basketball players.

1-4 Research Hypotheses

• There are statistically significant differences because a training program uses relative weights (loading) in developing specific physical abilities among youth basketball players.
• There are statistically significant differences because high-intensity exercises develop pulmonary efficiency (CPET) among youth basketball players.
• There are statistically significant differences between the pre and post-tests of the experimental group in favor of the post-test due to the combined effect of relative weights and high-intensity training.

1-5 Fields of Research

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• Spatial Field: Sports hall, National Center for Sports Talent Care, Al-Diwaniyah.
• Temporal Field: 1/8/2025 – 13/8/2025.
• Human Field: Youth basketball players, National Center for Sports Talent Care, Al-Diwaniyah.

2-2 Sample of the research

The researcher selected his sample purposively: 12 players from the National Center for Sports Talent Care in Al-Diwaniyah. The training program was implemented regularly with them. Homogeneity of the sample was verified as follows:

No.	Variable	Unit	Mean	SD	Skewness	CV	Homogeneity
1	Height	cm	179.533	3.783	0.168	2.146	Homogeneous
2	Weight	kg	71.002	4.325	1.424	5.784	Homogeneous
3	Training age	years	7.679	0.896	0.779	10.985	Homogeneous

2-3 Studied Research Variables

Explosive leg power, speed-strength of the arms, speed-strength of the legs, and pulmonary efficiency as determined through a CPET test were identified as variables in this study.

2-4 Tests Used in the Research

1- Standing Long Jump Test

The standing long jump is used to measure explosive leg power. The subject jumps for maximum distance from a standing position with no preliminary steps or run allowed.
Requirements: A measuring tape and floor surface that will not cause injury if an athlete falls must be provided.

2- The participant takes a starting position, flexes the knees and places the arms backward to get the largest possible push-off force, then jumps forward.

The distance achieved is recorded by the researcher.
Purpose of the Test:
To measure explosive leg power.

Standing Long Jump Test Assessment of Explosive Leg Power (image)

Modified Push-Up Test (Arms Speed-Strength)

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This test measures the speed-strength of the arms by recording the maximum number of fast push-ups completed from a deep inclined prone position with feet on a chair.
Performance Method:
The participant gets into a deep inclined prone position, places hands on the ground while keeping feet supported on a chair, and completes as many correct repetitions as possible.
Record and count the repetitions.

3- Leg Hopping Test

This test measures speed-strength of the legs.
Performance Method:
The participant performs the maximum number of hops in 10 seconds for each leg.
The researcher records the number of correct hops.

(Application of single-leg hopping test to measure lower limb speed strength)

4- Pulmonary Efficiency Test (CPET)

Also known as a Cardiopulmonary Exercise Test, this is basically a test that checks how efficient your lungs are by checking their functions. This will also help you know why you have shortness of breath or cannot tolerate high-intensity physical exertion.
Test Method:
The CPET is conducted on acomputerbased system which calculates the efficiency of lungs during any physical activity like walking or cycling (cycle ergometer). It gives an exact detail about how much capacity the lungs can take air inside while exercising. The participant has to wear proper shoes and clothes, with no eating or smoking few hours before the test. He performs exercises starting from low intensity to high intensity until he reaches the point where he cannot continue anymore.
The researcher applied the following tools and equipment to extract the needed data:

- Whistle
- Measuring tape
- Stadiometer (height measuring device)
- Pulmonary efficiency testing device (CPET)
- Hurdles
- Computer
- Digital scale (player body weight measuring)

2-6 Field Procedures of the Research 2-6-1 Pre-Measurements

The pre-measurements of the research variables were conducted on Monday, 4/8/2025, in the sports hall of the National Center for Talent Development in Al-Diwaniyah.

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The researcher explained the main important points about the tests and their procedures, besides the effort to be exerted in performing them. The height and weight measurements of the sample have been taken by an assistant team.

2-6-2 Implementation of Research Training Program

The training program has been applied to the sample group by the researcher for two continuous months (8 weeks) starting from Thursday 7/8/2025 until Monday 6/10/2025.

Three sessions per week were conducted with each session ranging between 45-and 60 minutes.

The training also involved relative-weight exercises (loading) and high-intensity exercises to determine their effect on pulmonary efficiency (CPET).

2-6-3 Post Measurements

All the tests applied in pre-measurements were again applied after the completion of the training program, under similar conditions and procedures.

2-7 Statistical Methods

Statistical Package for Social Sciences (SPSS) has been used by the researcher to obtain statistical data and process results.

3-1 Presentation, Discussion, and Analysis of Results

After the researcher had implemented the training program, he organized and analyzed statistically the results in order to facilitate their interpretation . He presented them mainly as shown in Table (2) below.

Table (2)

The arithmetic means , standard deviations , differences between means , standard error and calculated t value for physical abilities and CPET of experimental group

No.	Physical Ability	Mean Difference (س)	SE (ع)	t-value	Error Level	Significance
1	Explosive leg power	0.258	0.078	7.456	0.008	Significant
2	Speed-strength (legs)	1.803	0.335	10.465	0.001	Significant
3	Speed-strength (arms)	1.423	0.426	6.850	0.005	Significant
4	CPET (Pulmonary efficiency)	0.219	0.025	9.988	0.002	Significant

According to the table above and after processing the data obtained, there proved to be significant differences between pre-and post-tests of the experimental group in favor of the post-test regarding explosive leg power. This shows the effectiveness of the training program applied by the researcher and also in a way, it reflects through the type of exercises used by him for developing physical abilities inclusive of that pertaining to power manifested as an explosion within legs.

Scientifically sequenced and well-regulated exercises contributed to improving the studied variables. Among these was leg explosive power. This type of power is very influential in many sporting activities. It is regarded as a composite ability between strength and speed. Thus, it expresses high effectiveness of technical execution under demand and specific conditions set by the sport.

Explosive leg power assumes a key role in actions of jumping, leaping, or even throwing.

According to Mahir Ahmed Assi et al. (2020) among the components which play a major role in success of sports is explosive strength. Abu Al-Ela Abd Al-Fattah (2012) also narrated that an athlete can show his

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capability by displaying a maximal voluntary muscular contraction within a short period, hence relating it to explosive strength.

Speed-strength of the Legs

The statistical analysis revealed significant differences between pre and post-tests within the experimental group, in favor of the post-test.

The researcher attributes this to the efficiency of the prepared training program and the good implementation of exercises.

Speed strength is one of the important abilities that should always be focused on by coaches, researchers, or any sports practitioner because it is a combined ability between muscular strength and speed needed in most games-sports like basketball, football (soccer), handball, volleyball among others.

According to Qasim Hassan Hussein (1998), an athlete with high speed strength demonstrates better integration between power and speed.

Mohammad Hassan Allawi (1995) defines speed-strength as the ability to produce submaximal force for a certain number of repetitions within a limited time.

Mufti Ibrahim (1998) describes it as the muscles' ability to overcome resistance with high contraction speed.

Issam Abdel Khaleq (1994) notes that it represents the rapid manifestation of muscular force combining both speed and strength in movement.

Speed-Strength of the Arms

The results show significant differences between the pre-and post-tests of the experimental group. The researcher attributes this improvement to the effectiveness of the training program applied to the sample.

Speed-strength of arms is very important for basketball players because scoring and passing under pressure, shooting accuracy all require a quick and forceful movement of arms especially in defensive blocks and limited time situations.<eop>

Speed-strength of the arms represents the most prominent physical ability in many sports actions because it combines precise coordination between force and speed to produce efficient motor output.

According to Mohammad Abdul Hassan (2010), speed-strength reflects an athlete's ability to overcome resistance through rapid muscle contractions.

Ahmad Arabi Ouda (2011) views it as the capability of the neuromuscular system to overcome resistance requiring high contraction velocity.

Pulmonary Efficiency (CPET)

Results clearly show significant improvements of CPET between pre and posttest for the experimental group. The improvements are attributed to the high-intensity exercises applied regularly throughout the training program.

Such exercises increase the physiological load on players, enhancing pulmonary capacity and improving optimal performance during competition.

Pulmonary efficiency indicates how well the lungs perform during physical exertion through monitoring oxygen consumption, carbon dioxide production, and ventilation.

The CPET test helps in the detection of reasons behind exercise intolerance and assessment of cardiovascular as well as respiratory conditions.

4-1 Conclusions

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Based on the training program prepared by the researcher and applied to the sample of the study, it is clear that exercises have a great positive effect on physical performance for players.
The following variables were studied: Explosive power of the legs, speed-strength of the leg muscles, speed-strength of the arm muscles, and pulmonary efficiency (CPET). The results allow us to make the following conclusions:

There was a significant improvement in all the physical variables studied.
The improvements were due to relative strength (load) exercises.
Weighted training created a positive interactive environment between the researcher and players because individual loads were applied according to each athlete's body weight.
• A structured program incorporating high-intensity exercise was recorded as substantially improving pulmonary efficiency (CPET).

4-2 Recommendations

• Conduct other studies using similar research approaches of simple weight training with variably relative loads to determine the effectiveness.
• One cannot leave functional muscle development to chance. It should be well-structured programs targeting particular muscle groups and channeling them toward regulated sports training.
• Training loads used in weighted exercises must be carefully regulated according to the age group of the athletes.
• High-intensity exercises appropriate for the target age group should be used to improve pulmonary efficiency (CPET).

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Appendix No. (1)
Training Program and Sample Training Sessions
I will now translate the appendix tables as they appear.

Session	Exercise	Intensity	Reps	Sets	Rest (Exercises)	Rest (Sets)
1	Sitting jump	85%	3	3	2 min	5 min
	Incline chest press	80%	12	3	3 sec	3 min
	Wall squat	85%	12	2	4 sec	3 min

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	30 m run	90%	2	2	1 min	2 min
2	Knee lift forward to hip level	85%	10	2	3 sec	1 min
	Sitting jump	90%	2	2	2 min	3 min
	Heel-to-hip kicks	80%	5	3	2 sec	2 min
	20 m run	95%	4	3	1–5 sec	2 min
	Front-support leg raises	95%	20	3	3 sec	2 min
	Squat with overhead arm push	85%	8	3	2 sec	3 min
	Running with jumps (30 m)	90%	4	2	2 sec	3 min
	Front plank (1 min)	90%	—	2	2 min	3 min
4	40 m run	95%	3	2	1 min	2 min
	Side plank	85%	—	3	1 min	1 min
	Incline chest press	90%	20	2	2 sec	2 min
	Front-support leg raises	85%	25	3	2 sec	1 min