Scientific Research Publishing

Advances in Physical Education, 2024, 14, 149-175
https://www.scirp.org/journal/ape
ISSN Online: 2164-0408
ISSN Print: 2164-0386

Comparative Analysis of Training Loads among New Basketball Players in Anhui University of Chinese Medicine

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How to cite this paper: Liu, T. (2024). Comparative Analysis of Training Loads among New Basketball Players in Anhui University of Chinese Medicine. *Advances in Physical Education, 14,* 149-175.
https://doi.org/10.4236/ape.2024.144011

Received: June 6, 2024
Accepted: October 13, 2024
Published: October 16, 2024

Abstract

The study comprehensively investigates the analysis of training loads among new basketball players in Anhui University of Chine Medicine. The research encompasses a detailed analysis of players' profiles, including age, length of service as players, and current playing positions. These profiles formed the basis for initial testing to establish baseline data on the athletes' physical and technical abilities. The study's focus was on the periodization of training loads over a two-month span, comparing the performance of athletes following a standard training regimen (control group) and those subject to a specialized training program (experimental group). Data were meticulously gathered through training logs, monitoring of training loads, and evaluation of performance outcomes using both objective measures (such as running times and jumping heights) and technical skills assessments (accuracy of throws and free throws). The research was designed to culminate in final testing, which mirrored initial testing to measure progress and the effects of the training loads. This allowed for robust correlation and analysis to inform the development of a unified system of training loads for new basketball athletes. While the study aims to be comprehensive, it is delimited to new basketball athletes within a specified age and experience range, potentially limiting the findings' applicability to more seasoned players or those outside of this demographic. The research was conducted within a fixed timeframe of two months, which may not capture the long-term effects of the training loads. The study is also geographically delimited, with participants drawn only from Anhui University of Chinese Medicine Basketball Team, which may influence the training facilities and competition levels. The research design does not cover the entirety of possible training methodologies but focuses on a structured program with predefined macrocycles and microcycles. Furthermore, the scope is limited to physical and technical performance outcomes, without an extensive exploration of psychological or social factors that may influence an athlete's response to training. The delimitation explicitly excludes these factors, which could be considered in future research to provide a more holistic understanding of training loads' effects on new basketball athletes. Result reveals that the average age of players in the experimental group was 18.4, while 18.3 in the control group. Meanwhile, the average length of service of both experimental and control groups was 2 years and the playing positions in the experimental group were fairly even, while the playing position in the control group was distributed according to positions. Conversely, that no significant difference found in the initial and final test scores for various performance measures in the control group, while, significant difference was existed in the initial and final performance of the experimental group.

Keywords

Training Loads, Basketball Players, Physical Preparedness, Technical Preparedness

1. Introduction

Basketball is a team sport played on a court that demands skill in a wide range of physical attributes and motor skills (such as strength, speed, and endurance) in order to succeed tactically and technically (Schelling & Torres-Ronda, 2018). Due to the intermittent high-intensity nature of most actions and basketball-specific movements (Svilar, Castellano, & Jukić, 2018; Ramos-Campo, Rubio-Arias, Ávila-Gandía, Marín-Pagán, Luque, & Alcaraz, 2017), as well as the demands of the sporting activity (Sampaio et al., 2015), these skills are essential for success on the court.

It's a complex concept that includes measuring the athlete's work-related external load as well as their internal load—their body's reaction to the external strain—both physiologically and psychologically (Turner & Stewart, 2014). By measuring these elements using both quantitative and qualitative techniques, this study seeks to provide a comprehensive understanding of what makes an efficient training program for professional basketball players.

Conversely, studies on the loads reported during basketball training jobs have been conducted in professional (Ibáñez, Piñar, García, & Mancha-Triguero, 2023) as well as amateur (Ballesta, Abruñedo, & Caparrós, 2019). These studies provide reference values for heart rate (144 bpm on average), player load (about 11 au/min), and acceleration variables (3.50 m/s^2 on average) in 5 × 5 exercises. Variations in the workload have been observed according to player position, experience, and session phase in both youth basketball (Gutiérrez-Vargas et al., 2021) and professional and amateur sports (Piñar, García, Mancha-Triguero, & Ibáñez, 2022). The variance in iTL and eTL, as well as the link between the two types of loads, may be explained by the training strategy and task choice (McLaren et al., 2018).

Many invasive sports have had training load control, including basketball (Ponce-Bordón, Ramírez-Bravo, López-Gajardo, & Díaz-García, 2022), handball (Maciel, Miranda, Ferreira-Junior, Goulart, Brandao, Werneck, & Bara-Filho, 2022), and football (Gómez-Carmona, García-Rubio, Muñoz-Jiménez, & Gamonales, 2018), and handball (Maciel, Miranda, Ferreira-Junior, Goulart, Brandao, Werneck, & Bara-Filho, 2022). This enables us to ascertain which exercise encourages players to adapt more fully and more effectively to the suggested stimuli (Reina Román, García-Rubio, Feu, & Ibáñez, 2019). Moreover, because basketball is a cooperative-oppositional sport, pause actions—such as quick, quick movements—are interspersed with high-intensity actions. Jumps and impacts, in particular, are excellent indicators of load because they happen during the most intense moments (Conte, Favero, Lupo, Francioni, Capranica, & Tessitore, 2015). According to Barreira, Robinson, Drust, Nedergaard, Raja Azidin, & Vanrenterghem (2017), Player Load (PL) is also one of the most accurate variables for evaluating neuromuscular IL in athletes. This makes it possible to track the development of physical condition and identify fatigue in the various tasks carried out during training sessions (Barrett, Midgley, Towlson, Garrett, Portas, & Lovell, 2016).

Furthermore, the coach bears primary responsibility for organizing and preparing the training program. Furthermore, as they are one of the keystones in understanding how training is conducted, they must take on the roles of developing and executing the many tasks during the training. In order to ascertain and assess the success of the sessions, the analysis of training tasks must be conducted based on objective, valid, and accurate data (Ibanez, Feu, & Canadas, 2016). In order to achieve this, one of the most popular tools is the Integral System for the Analysis of Training Tasks (SIATE), which has five features: universality, standardization, modularity, flexibility, and adaptability. It allows the various factors that affect sports training in invasive sports to be recorded and analyzed (Ibanez et al., 2016). Because invasive sports are so complicated, it is necessary to provide training assignments that closely resemble the actual competitive environment (Román, Triguero, Molina, & Godoy, 2017). In order to facilitate athlete learning and boost motivation, coaches should implement task limits (Ibáñez, Pérez-Goye, García-Rubio, & Courel-Ibáñez, 2020). Players are placed in unique and difficult learning circumstances as a result of the alteration of the tasks' formal and organizational components (rules, field size, player count, etc.) (Halson, 2014).

Numerous studies have demonstrated the value of training load monitoring across a range of sports (Mujika, 2017). While loads with insufficient length and intensity may not provide the essential adaptations to increase physical performance, high training loads without sufficient recovery may result in unintended adaptations and adverse effects (Brink, Frencken, Jordet, & Lemmink, 2014). Accordingly, exact control and adjustment of the training load is necessary (Impellizzeri, Marcora, & Coutts, 2019).

A training load index in arbitrary units (a.u.) is produced by the sRPE method, which combines an objective measure of training load (time) with a subjective one (RPE) (Haddad, Stylianides, Djaoui, Dellal, & Chamarie, 2017). This index is widely recognized as a measure of the internal training load (Foster, Boullosa, McGuigan, Fusco, Cortis, Arney, & Porcari, 2021). Furthermore, the agreement between the coach and the athlete about intended and perceived load has been evaluated using the sRPE (Brink et al., 2014). Previous research has demonstrated a high degree of agreement between coaches and athletes (Figueiredo, Figueiredo, de Assis Manoel, Gonçalves, & Dourado, 2019). Redkva et al. (2017), for example, did not find any disparities between the athletes' perceptions and the coaches' suggested sRPE during physical, technical, and tactical training sessions during the three weeks of preseason soccer players. There is, however, a disparity between the training load that coaches intend and the burden that athletes perceive, according to some research (Barnes, 2017). These conflicts between coaches and athletes were generally classified as easy or hard in the prescribed training (Barnes, 2017).

Furthermore, Rabelo et al. (2016) showed that athletes perceived a lower training load than the coach planned in all three effort categories (easy, moderate, and hard). Based on empirical evidence, Barnes (2017) hypothesizes that a possible reason for the high rate of unsuccessful outcomes in sports training could be the discrepancy between the athletes' and the coach's program. In this case, inaccurate interpretation of the sRPE data may result in mistakes in training control and subsequent planning. The planned training regimen determines whether the training stimulus has undergone positive or negative adaptation by striking a balance between overload and recuperation (Mujika, 2017). According to Sanders, Abt, Hesselink, Myers, and Akubat (2017), detraining status can occur from an excessively low training load. Conversely, overtraining syndrome and the development of overuse injuries can be brought on by an excessive training load and inadequate recuperation (Drew & Finch, 2016). As such, one of the biggest challenges facing coaches and athletes is striking a balance between training load and recovery.

Similarly, in the game of basketball, teamwork is key to both offensive and defensive success. However, due to the players' varying levels of physical condition, one of the main limitations is determining each player's adaptations prior to the proposed work stimuli, which can result in the emergence of injuries, increased fatigue, or decreased performance (Halson, 2014). In order to determine each player's unique response to the training stimuli, as well as to evaluate exhaustion and the necessity of recuperation in order to avoid injuries, it will be crucial to track and measure the load (Jeong, Reilly, Morton, Bae, & Drust, 2011).

In order to compete in basketball, players must frequently run, jump, accelerate, decelerate, and change direction (Petway et al., 2020a, Sampaio et al., 2015, Svilar et al., 2018; Conte et al., 2018). The measures for these physical demands are either the physiological and psychological effects of the athlete, like heart rate and perceived exertion (internal loads), or the outcomes of mechanical work, like speed and distance (external loads) (Schelling & Torres-Ronda, 2018). An ideal atmosphere for athlete performance must be created by carefully monitoring and managing the amount of basketball training that athletes put in (Petway, Freitas, Calleja-Gonzalez, Torres-Ronda, & Alcaraz, 2020b). This is especially important during the competitive season (9). One way to gain insight into how short- and long-term training are modulated is to evaluate athletes' adaptive response to stressors imposed by training (12-14). Trainers can adjust training to improve an athlete's preparedness for match play once they have shown that the athlete can withstand the demands of competition (Menaspà, 2017).

The ultimate objective of training load monitoring is to make sure athletes maintain an appropriate dosage of training to maximize match-play performance, even though there is ongoing discussion regarding the most effective method for quantifying and applying training load (20-24) (Ferioli, Bosio, Bilsborough, La Torre, Tornaghi, & Rampinini, 2018). The connection between training load and performance has been studied in the past (Hulin, Gabbett, Pickworth, Johnston, & Jenkins, 2019). For instance, Aughey, Elias, Esmaeili, Lazarus, and Stewart (2015) examined the impact of weekly internal load on victories and defeats in elite Australian football and found that weeks with victories showed a higher acute training load. Even while wins and losses are perhaps the most significant metrics for evaluating a game's outcome, they are not always accurate since they don't take into consideration the caliber of the opposition or the predictions made about each team's performance throughout the match.

In addition to athlete performance and health, this study holds implications for talent development and long-term athlete management. By identifying the training load characteristics of successful players, the research can inform developmental programs, aiding in the cultivation of future basketball talent (Pichardo, Oliver, Harrison, Maulder, & Lloyd, 2018). This aspect is particularly crucial in the context of the increasing competitiveness of professional sports, where effective training strategies are key differentiators (Ives, Neese, Downs, Root, & Finnerty, 2020). Therefore, when evaluating training loads, it is important to take into accounts not just the needs of the individual athlete but also the team's overall requirements. This research tries to clarify the complicated interactions between these two factors.

To sum up, the research represents a significant advancement in the field of sports science today. The study provides useful insights applicable to numerous fields of sports training and athlete management, while also improving our understanding of athlete development in elite basketball by examining the nuances of training loads in this sport. With ramifications for athletes, coaches, sports scientists, and the larger athletic community, this research is poised to make a major addition to the discipline.

The study begins with a thorough investigation of professional basketball players' training schedules. In sports science, where maximizing athlete performance and reducing injury risks need an understanding of the dynamics of training loads, this research is critical. This study's importance stems from the dynamic field of sports training, where improving athletic potential requires empirical data and methodical research (Smith, 2020).

1.1. Objectives

The study assessed the training loads of players in the Anhui University of Chinese Medicine Basketball Team with the intent of developing a system for planning and managing the training load, creating a unified system for accounting and analysis of training load for the players. Specifically, the following objectives were answered:

1) To describe the profile of the respondents in terms of their age, length of service as a player in the team and current playing position in the team.

2) What is the level of the players' physical and technical preparedness before and after training, which will be measured using the following tests:

a) 6 meters run

b) 20 meters run

c) Jumping height

d) Shots from the spot (out of 40)

e) Free throws (out of 30)

f) Running across the court from one front line to another 3 times for 40 seconds

g) Cooper Test

3) To determine the significant improvements of the control group when compared to experimental group physical and technical performance after the training.

4) To determine the significant difference in training loads and performance outcomes between the control and experimental groups after an 8-week training program.

1.2. Hypothesis

Ho^1: There are no significant improvements of the control group when compared to experimental group physical and technical performance after the training.

Ho^2: There is no significant difference in training loads and performance outcomes between the control and experimental groups after an 8-week training program.

2. Methodology

The research design for this study is a quantitative experimental approach that uses a controlled trial to investigate the impact of structured training loads on new basketball athletes. A comparison of the two-month period's changes in performance attributes between an experimental group and a control group can be made possible by this approach.

The study started with the selection of young basketball players who are representative of different playing positions and have been on a team for one to three years. To find athletes that fit the inclusion requirements and ensure a representative sample that can offer pertinent data for the study, a purposive sampling technique was employed. To get baseline data, an initial evaluation was given to each of the forty male basketball players who fit the requirements. In order to record the respondents' age, playing experience, and current position, a profile of them will be created during this phase. After that, the athletes underwent preliminary testing to assess their technical abilities (like throw and free throw accuracy) as well as their physical characteristics (such running speed and jumping height). Additionally, the Cooper Test was used to evaluate general physical fitness.

In order to reduce selection bias, athletes were randomly allocated using simple random sampling to two groups of twenty players each after the initial assessment. The control group followed the team's standard operating procedures and routines by attending the regular training sessions. On the other hand, the experimental group engaged in a two-month basketball training program that was specifically created and organized into four Macrocycles, each having a pattern of four-1 microcycles. The training regimen's intensity and attention were adjusted in this pattern to maximize performance improvements.

Throughout the two months, the study employed rigorous observation and data collection methods. Training loads for both groups were closely monitored using training logs. These logs recorded the details of each training session, including the type of exercise, duration, intensity from the athletes. Performance outcomes were assessed through on-court drills and tests to objectively measure improvements and responses to the training loads.

At the end of the two-month period, final testing was conducted, mirroring the initial tests to measure any improvements or changes in the athletes' physical and technical capabilities. The data from both testing periods were compared to evaluate the effectiveness of the training programs.

The collected data was statistically analyzed to draw difference between the training loads and performance outcomes. The analysis seeks to determine if the specialized training program provides a significant improvement in performance compared to the control group's standard training.

This experimental research design, rooted in the comparison of a control and an experimental group, enabled a robust investigation into the efficacy of structured training programs for new basketball athletes. The findings will contribute valuable insights into sports science, with the potential to impact training protocols and athlete development programs.

The study was conducted in Anhui University of Chinese Medicine where the researcher is a faculty member who specializes in teaching basketball. The researcher made use of its locality also as a coach of the Anhui University of Chinese

Medicine Basketball Team. Purposive sampling was used in the conduct of the study. Respondents are members of the Anhui University of Chinese Medicine Basketball Team who have been part of a team for one to three years and are representative of various playing positions. Simple random sampling was also applied in determining the control and experimental groups. Researchers can choose a subset of people from a broader population using this basic statistical sampling strategy, which ensures that any potential sample of the desired size has an equal chance of being chosen.

This method is used with the justification that it reduces bias in the process of choosing the control and experimental groups, which is essential to the validity of the experimental studies. With the exception of the intervention—the customized training program created for the experimental group, the study seeks to establish groups that are equivalent in every way by offering every member of the population an equal chance of being included in the sample.

This study intentionally chooses to use simple random sampling in order to improve the experimental design's scientific rigor. As it addresses any selection bias and encourages the equal distribution of any confounding variables among the control and experimental groups, it is a fundamental component that upholds the validity of the study's conclusions. By using this method, the study hopes to offer solid and trustworthy findings regarding how training loads affect novice basketball players.

The experimental group used a 4-1 micro cycle during the training period, which consists of 4 working days and 1 day off. A total of 4 macrocycles were performed in the period of 2 months. During the training period, basketball players were observed to determine the level of their physical and technical preparedness before and after training. The following tests were used:

- 6 m and 20 m run
- jumping height
- shots from the spot (the number of hits out of 40 shots and the time of operation were determined)
- free throws out of 30 (number of hits)
- running across the court from one front line to another 3 times for 40 seconds after 1 minute of rest (number of meters covered)
- Cooper test (Koryahin et al., 2018; Koryahin, Hrebinka, Prystynskyi, & Prystynska, 2022).

The training load will be monitored using the sRPE method, which researchers have shown to be a valid, reliable, inexpensive, and very simple method for monitoring the training load in various exercise activities (Foster et al., 2021; Singh, Foster, Tod, & McGuigan, 2007; Williams, Trewartha, Cross, Kemp, & Stokes, 2016), as well as in team sport settings (Impellizzeri, Rampinini, Coutts, Sassi, & Marcora, 2004; Lambert & Borresen, 2010). The RPE data was collected for 15 - 30 minutes following each training or game, which was suggested to be the best timeframe by Singh et al. (2007). To obtain sRPE values, the RPE grade

(1-10) will be multiplied by the duration of a training session. The sRPE method will be applied after all training sessions. The researcher made use of the following training programs, each designed for the experimental and control groups.

TWO-MONTHS BASKETBALL TRAINING PROGRAM
(*Structured into* 4 *Macrocycles with* 4-1 *microcycle*)
UTILIZED BY THE EXPERIMENTAL GROUP

MACROCYCLE 1: (Week 1 and 2) Foundation and Skill Development		
Day	**Focus Area**	**Activities and Drills**
1	Speed and Agility	• Warm up: Dynamic stretching, light jogging • 6 m and 20 m sprints (focused on explosive starts) • Ladder and cone drills • Cool down stretching
2	Jumping and Strength	• Dynamic stretching • Plyometrics (box jumps, depth jumps) • Strength training (leg press, lunges) • Cool down stretching
3	Shooting and Accuracy	• Light jogging, shooting drills • Spot shooting (40 shots), timed drills • 30 free throws • Cool down stretching
4	Endurance and Conditioning	• Dynamic stretching • 3 × 40 sec court runs • Cooper Test • Cool down light jog and stretching
5	Rest	• Recovery activities (optional: light stretching, yoga)
MACROCYCLE 2: (Week 3 and 4) Intensity Increase and Skill Enhancement		
Day	**Focus Area**	**Activities and Drills**
1	Speed and Agility	• Warmup: Dynamic stretching, light jogging • 6 m and 20 m sprints (focused on explosive starts) • Ladder and cone drills • Cool down stretching
2	Jumping and Strength	• Dynamic stretching • Plyometrics (box jumps, depth jumps) • Strength training (leg press, lunges) • Cool down stretching
3	Shooting and Accuracy	• Light jogging, shooting drills • Spot shooting (40 shots), timed drills • 30 free throws • Cool down stretching
4	Endurance and Conditioning	• Dynamic stretching • 3 × 40 sec court runs • Cooper Test • Cool down light jog and stretching

Continued

5	Rest	• Recovery activities (optional: light stretching, yoga)
MACROCYCLE 3: (Week 5 and 6) Tactical Skills and Game Situations		
Day	**Focus Area**	**Activities and Drills**
1	Game Speed Situations	• Drills that replicate game speed and decision-making
2	Combined Strength/Jump	• Circuit format combining plyometrics with strength exercises
3	Game Scenario Shooting	• Shooting in various game situations (catch-and-shoot, off-the-dribble)
4	Mixed Endurance and Speed	• Endurance running with speed bursts
5	Rest	• Active recovery, strategy review
MACROCYCLE 4: (Week 7 and 8) Peaking and Fine-tuning		
Day	**Focus Area**	**Activities and Drills**
1	Speed and Reaction Drills	• Reaction time and quick decision-making in speed drills
2	Explosive Power and Jump	• Maximum effort in plyometrics and strength exercises
3	Precision Shooting	• Shooting accuracy with fatigue
4	Game-Readiness Conditioning	• High-intensity drills for end-of-game scenarios
5	Rest	• Mental preparation, strategy refinement

TWO-MONTHS BASKETBALL TRAINING PROGRAM (*Standard for the Control Group*)	
MACROCYCLE 1: (Week 1 and 2) Basic Skills and Conditioning	
Monday Wednesday Friday	• Warm-up • Basic dribbling drills • Passing exercises • Shooting practice (free throws, layups)
Tuesday Thursday	• Cardio (jogging) • Strength training (bodyweight exercises) • Stretching and cooldown
Saturday	• Team scrimmage
Sunday	• Rest
MACROCYCLE 2: (Week 3 and 4) Intermediate Skills and Team Play	
Monday Wednesday Friday	• Warm-up • Advanced dribbling (change of pace) • Passing under pressure • Shooting drills (jump shots, 3-pointers)
Tuesday Thursday	• Interval running • Circuit training (weights) • Flexibility exercises
Saturday	• Half-court tactical drills
Sunday	• Rest
MACROCYCLE 3: (Week 5 and 6) Tactical Awareness	

Continued

Monday Wednesday Friday	• Warm-up • Defensive drills (man-to-man, zone) • Offense strategies (pick and roll, give and go) • Free shooting
Tuesday Thursday	• Long-distance running • Plyometrics • Yoga or pilates
Saturday	• Full-court game simulation
Sunday	• Rest
MACROCYCLE 4: (Week 7 and 8) Consolidation and Scrimmage	
Monday Wednesday Friday	• Warm-up • Mixed drills (shooting, passing, dribbling) • Situational play (offensive/defensive scenarios)
Tuesday Thursday	• Warm-up • Mixed drills (shooting, passing, dribbling) • Situational play (offensive/defensive scenarios)
Saturday	• Full game scrimmage
Sunday	• Rest

All the players were familiarized with the use of the scale during the preparatory period. Lastly, the researcher used a Likert-scale questionnaire to determine the players' satisfaction, from both the experimental and the control groups, on the program they have been under to during the eight-week training program.

3. Result and Discussions

3.1. Profile of the Respondents

The data gathered on the profile of the respondents, which includes age, length of service as a player in the team and current playing position in the team. Table 1 presents the tabular summary of the 20 players who belong to the experimental group.

3.1.1. Age Distribution

The average age of the players in the experimental group is 18.4 years, indicating that the group primarily consists of late adolescents and young adults. The standard deviation of age is approximately 1.67, suggesting a moderate spread in the ages of the players. The youngest player is 16 years old, and the oldest is 21 years old. Half of the players (50^{th} percentile or median) are 18.5 years old or younger, indicating a slightly younger demographic in the upper half of the group.

3.1.2. Length of Service

The average length of service in the team is 2 years, reflecting a balance between relatively new and more experienced players within the team. The standard

Table 1. Demographic profile of the experimental group.

Player No.	Age	Length of Service (Years)	Current Playing Position
1	16	1	Point Guard
2	17	2	Shooting Guard
3	18	2	Small Forward
4	16	1	Power Forward
5	19	2	Center
6	19	3	Point Guard
7	21	3	Small Forward
8	18	2	Power Forward
9	20	2	Center
10	16	1	Point Guard
11	21	3	Shooting Guard
12	20	3	Power Forward
13	18	2	Point Guard
14	19	1	Shooting Guard
15	16	1	Small Forward
16	20	3	Power Forward
17	20	3	Center
18	17	2	Small Forward
19	18	1	Power Forward
20	19	2	Point Guard

deviation for length of service is around 0.79, pointing to a reasonable spread in the years of experience among the players. The duration of the service is one to three years. There is a good mix of experience levels among the players; half have served for up to two years, and the other half have served for longer.

3.1.3. Playing Positions

The players' positions on the playing field are distributed reasonably evenly. With five players apiece, point guards and power forwards are the most prevalent positions. Four players represent small forwards, three men each for shooting guards and centers. This distribution suggests that different basketball roles are fairly represented, which is crucial for an in-depth analysis of training loads.

The distributions of ages and lengths of service show that the experimental group, which included both novice and seasoned players, is a fair representation of young basketball athletes. Examining the effects of training loads on players at various developmental and experience levels requires this diversity. The study benefits from the relatively uniform distribution of playing positions. It guarantees that the results might be used too many playing roles, each of which might have distinct physical and skill requirements. The experimental group's demographic composition offers a strong starting point for evaluating the impact of the training loads. The diversity of players' ages, backgrounds, and positions on the court should strengthen the study's conclusions and provide a more complex picture of how training influences players at various phases of their basketball and athletic development.

Table 2. Distribution of demographic profile of the experimental group.

Profile		Frequency	Percentage
Age	16	4	20%
	17	2	10%
	18	4	20%
	19	4	20%
	20	4	20%
	21	2	10%
Length of Service (Years)	1	6	30%
	2	8	40%
	3	6	30%
Playing Position	Point Guard	5	25%
	Shooting Guard	3	15%
	Small Forward	4	20%
	Power Forward	5	25%
	Center	3	15%

The age, duration of service, and playing positions of the participants are broken out in depth in the frequency distribution table for the experimental group's demographics in the study "Training Loads Among New Basketball Athletes," as shown in **Table 2**.

The gamers in the experimental group span late childhood to early adulthood, with ages ranging from 16 to 21. The proportion of participants is evenly distributed across the age range, with 20% (4 players) of the group belonging to each of the age groups of 16, 18, 19, and 20. This displays a fair sample of both younger and more experienced athletes. With only two players, the ages of seventeen and twenty-one are underrepresented. The reduced presence of these age groups may indicate that during the sampling frame, fewer players at these ages were participating in or beginning the sport. The study's findings can be applied to a wide range of ages commonly found among beginning basketball players because the main age groups are equally represented.

The team members have been there for one to three years. Thirty percent (6 players) of the group are players with one year and three years of service, showing a solid balance between relatively new and more seasoned players. The largest group of players, or eight players, comprise those with two years of service. This suggests that the second year is a critical period for the growth and continuation of athletes on the squad. This distribution makes it possible for the study to investigate the response of players with different service durations to training loads, which is essential for comprehending how experience affects training adaption.

There is a good balance and diversity in the distribution of playing positions. With 25% (5 players) each, point guards and power forwards are the positions with the most representation in the group. This means that positions that are critical to both offense and defense should be prioritized. Shooting guards and centers each make up 15% of the group, with small forwards making up 20% (4 players). A thorough analysis requires a balanced representation of players at all positions on the court in order to comprehend the effects of training loads on players in diverse roles.

The demographic frequency distribution of the experimental group indicates a well-balanced composition with respect to age, experience level, and position on the field. This variety is advantageous to the research since it can shed light on how various player groups react to varying training loads. The study's findings are applicable to a typical range of ages for beginning basketball players due to the balanced age distribution. The range of service durations demonstrates how athletes at various phases of their athletic development are included on the squad. Last but not least, the variety of playing positions enables position-specific analysis, an essential ability in a sport like basketball where various roles have varying physical requirements. This comprehensive demographic makeup strengthens the potential impact and relevance of the study's outcomes.

Table 3 presents the tabular summary of the 20 players who belong to the control group.

3.2. Age Distribution

The average age of players in the control group is 18.3 years. The ages range from 16 to 21 years, similar to the experimental group, with a standard deviation of approximately 1.69. This indicates a comparable spread across the age range. The 25th percentile is at 17 years, the median (50th percentile) is at 18 years, and the 75th percentile is at 20 years. Half of the players are thus between the ages of 17 and 20.

3.3. Length of Service

The average length of service among the players in the control group is 2 years, which is identical to the experimental group. The lengths of service range from 1 to 3 years, with a standard deviation of approximately 0.86. This indicates a slightly higher variability in the years of service compared to the experimental group. The median length of service is 2 years, with half of the players having 1 to 3 years of service, showing a balanced distribution of experience in the group.

Table 3. Demographic profile of the control group.

Player No.	Age	Length of Service (Years)	Playing Position
1	16	1	Point Guard
2	18	2	Shooting Guard
3	17	1	Small Forward
4	20	3	Center
5	19	2	Point Guard
6	16	1	Shooting Guard
7	21	3	Small Forward
8	18	2	Small Forward
9	20	3	Center
10	17	1	Shooting Guard
11	19	3	Small Forward
12	16	1	Point Guard
13	21	3	Center
14	18	2	Point Guard
15	20	3	Shooting Guard
16	17	1	Power Forward
17	19	2	Center
18	16	1	Point Guard
19	18	2	Small Forward
20	20	3	Power Forward

3.4. Playing Positions

The distribution of playing positions in the control group is as follows: Point Guard and Small Forward positions have the highest representation, each with 5 players (25% each). The positions of center and shooting guard are occupied by four players each (20% each). With two players (10%), power forward is the position with the lowest representation.

An important consideration for analyzing the effects of conventional training loads at different ages is the age distribution within the control group, which represents a wide variety of developmental stages. In comparison to the experimental group, there is a minor skew towards younger players in the distribution, with a higher percentage of 16-year-olds.

Similar to the experimental group, the length of service implies that there is a healthy variety of experience levels, from relatively new to more seasoned participants. Valid comparison between the two groups in the study requires that the control group have a parallel structure in terms of player experience, which is supported by the data.

With the exception of the Power Forward position, which is underrepresented in the control group relative to the experimental group, the playing position distribution exhibits a rather balanced representation across several roles. It's possible that the usual training program places more emphasis on speed and agility given the higher proportion of Point Guards and Small Forwards.

The age distribution of the control group is pretty even, with 20% of the group being 16 and 18 years old. Teenagers aged 17 and 19 make up 15% of the group, while those aged 20 make up 20% once again. The age group with the lowest representation, at 10%, is 21. According to this distribution, the control group encompasses a wide variety of developmental phases, from the middle of adolescence to the end.

In terms of service duration, the group is slightly more skewed toward the extremes, with those with 1 - 3 years of service accounting for 35% of the total, and those with 2 - 3 years of service for 30%. This points to a bimodal distribution in which a sizable portion of players are either seasoned veterans of the game or relatively fresh to competitive basketball. This intriguing combination could shed light on how individuals at various phases of their athletic development are affected by training loads in a team environment (Table 4).

Table 4. Distribution of demographic profile of the control group.

Profile		Frequency	Percentage
Age	16	4	20%
	17	3	15%
	18	4	20%
	19	3	15%
	20	4	20%
	21	2	10%
Length of Service (Years)	1	7	35%
	2	6	30%
	3	7	35%
Playing Position	Point Guard	5	25%
	Shooting Guard	4	20%
	Small Forward	5	25%
	Power Forward	2	10%
	Center	4	20%

There is a wide range of playing positions represented in the group; small forwards and point guards account for 25% of each. This suggests that players who are usually more engaged in ball handling and perimeter play are well-represented. Twenty percent of the group are Shooting Guards and Centers, which guarantees a strong representation of the jobs that usually call for shooting ability and an inside presence. At under 10%, the Power Forward position is the least common, which may restrict the applicability of findings to this position but also represents a normal variation in team makeup.

The control group's age distribution shows a healthy range that is appropriate for evaluating the effects of typical training loads at various phases of maturity. The age distribution is such that studying the complex impacts of training in a youth to young adult cohort is made easier by the slightly lower representation at the oldest end of the age spectrum.

The players who are taking on leadership roles with more experience and those who are probably just getting to know the team's processes make up the length of service distribution, which makes it more important. The study will be able to identify possible changes in adaptation to training loads based on team tenure because of the even distribution at the 1- and 3-year marks, with a slightly smaller group at the 2-year point.

With a solid mix of centers, guards, and forwards, the playing positions represented in the control group offer a cross-section of the team dynamics. This balance is essential since the physical and technical requirements for each position varies, and the impact of the training load may also change.

In conclusion, the control group's frequency distribution of demographic data provides a thorough overview of what is typical in a basketball team environment. The range of playing positions and differences in age and experience offer a strong foundation for comparison with the experimental group. Additionally, it guarantees that the study's conclusions have a wide range of applications, possibly influencing how different basketball team roles are trained.

1) Level of the Players' Physical and Technical Preparedness before and After Training

Table 5 provides a comprehensive overview of the training load and performance metrics for players 1 through 20 in the experimental group. The data include total time spent in training (in minutes), total Rated Perceived Exertion (RPE), total load (sRPE), and their respective averages.

- **Total Time in Training:** The total training time ranges from 1070 minutes (Player 2) to 1480 minutes (Player 20), indicating variability in training duration among players. Players 5, 20, 3, 10, 9, 14, 1, and 6 have the highest total training times, all exceeding 1450 minutes. This suggests a high level of endurance and capacity for sustained training.
- **Rated Perceived Exertion (RPE):** The RPE scale is a subjective measure of how hard players feel they are working during training. It generally ranges from 6 (no exertion) to 20 (maximal exertion). The total RPE scores range from 101 (Player 5) to 119 (several players). Higher RPE indicates that players perceived their training as more challenging. Player 5 has the lowest total RPE, which could indicate either a lower perceived effort or a higher tolerance for training stress.
- **Session RPE (sRPE):** sRPE is calculated by multiplying the RPE by the

Table 5. Observation of the experimental group.

PLAYER NO.	TOTAL TIME (in minutes)	TOTAL RPE	TOTAL LOAD (sRPE)	AVERAGE TIME (in minutes)	AVERAGE RPE	AVERAGE LOAD (sRPE)
PLAYER 1	1450	120	11,010	90.63	7.5	688.13
PLAYER 2	1070	118	7965	66.88	7.38	497.81
PLAYER 3	1455	114	10,460	90.94	7.13	653.75
PLAYER 4	1115	117	8220	69.69	7.31	513.75
PLAYER 5	1475	101	9405	92.19	6.31	587.81
PLAYER 6	1450	109	10,010	90.63	6.81	625.63
PLAYER 7	1460	117	10,785	91.25	7.31	674.06
PLAYER 8	1275	119	9530	79.69	7.44	595.63
PLAYER 9	1460	118	10,845	91.25	7.38	677.81
PLAYER 10	1455	117	10,750	90.94	7.31	671.88
PLAYER 11	1115	119	8365	69.69	7.44	522.81
PLAYER 12	1460	117	10,755	91.25	7.31	672.19
PLAYER 13	1360	116	9950	85.00	7.25	621.88
PLAYER 14	1455	119	10,930	90.94	7.44	683.13
PLAYER 15	1440	118	10,620	90.00	7.38	663.75
PLAYER 16	1455	119	10,920	90.94	7.44	682.50
PLAYER 17	1435	119	10,795	89.69	7.44	674.69
PLAYER 18	1160	115	8435	72.50	7.19	527.19
PLAYER 19	1455	117	10,745	90.94	7.31	671.56
PLAYER 20	1480	119	11,115	92.50	7.44	694.69

duration of the training session. It provides an estimate of the training load. The total sRPE ranges from 7965 (Player 2) to 11,115 (Player 20), highlighting differences in perceived training intensity among players. Players 20, 14, 16, 19, 7, and 17 have the highest total loads, suggesting they experienced the most intense training regimens.

- **Average Time, RPE, and Load:** The average training time per session varies from around 66.88 minutes (Player 2) to 92.50 minutes (Player 20), reflecting differences in training session lengths. The average RPE scores are relatively consistent across players, ranging from 6.31 (Player 5) to 7.44 (several players), indicating a generally high level of exertion felt by players. The perceived burden per session varies, as evidenced by the average sRPE per session ranging from 497.81 (Player 2) to 694.69 (Player 20).

The variance in sRPE and RPE among players points to variations in how players experience and manage training-related stress. Fitness levels, recuperation, mental toughness, and individual characteristics may all have an impact on this. Given that players react differently to varied training volumes and intensities, the statistics point to the necessity of personalized training approaches. Comprehending these metrics can aid coaches and trainers in optimizing training regimens, guaranteeing that athletes experience challenge without undue strain, and aiding in the identification of players who might require extra assistance or recuperation measures. Table 6 provides important information about the training loads and perceived effort of the players in the experimental group, to sum up.

Table 6. Observation of the control group.

PLAYER NO.	TOTAL TIME (in minutes)	TOTAL RPE	TOTAL LOAD (sRPE)	AVERAGE RPE	AVERAGE LOAD (sRPE)
PLAYER 1	4720	186	18,240	3.88	380.00
PLAYER 2	4720	232	22,780	4.83	474.58
PLAYER 3	4720	232	22,780	4.83	474.58
PLAYER 4	4720	232	22,780	4.83	474.58
PLAYER 5	4720	232	23,080	4.83	480.83
PLAYER 6	4720	292	28,740	6.08	598.75
PLAYER 7	4720	254	24,780	5.29	516.25
PLAYER 8	4720	256	25,180	5.33	524.58
PLAYER 9	4720	256	25,180	5.33	524.58
PLAYER 10	4720	235	23,020	4.90	479.58
PLAYER 11	4720	224	22,220	4.67	462.92
PLAYER 12	4720	218	21,500	4.54	447.92
PLAYER 13	4720	262	25,620	5.46	533.75
PLAYER 14	4720	258	25,300	5.38	527.08
PLAYER 15	4720	216	21,080	4.50	439.17
PLAYER 16	4720	308	30,100	6.42	627.08
PLAYER 17	4720	264	25,860	5.50	538.75
PLAYER 18	4720	256	25,180	5.33	524.58
PLAYER 19	4720	256	25,180	5.33	524.58
PLAYER 20	4720	240	23,440	5.00	488.33

A detailed statistical analysis of the training load for players 1 through 20 in the basketball study's control group is given in Table 6. This data includes the entire load (Session RPE or sRPE), total Rated Perceived Exertion (RPE), and the overall amount of time spent training (in minutes).

Total Training Time: The 4720 minutes all players receive in training are the same. This consistency shows that the group's training length is consistent, guaranteeing that each participant gets the same amount of time to train.

Total and Average RPE: A person's subjective perception of how hard they are working during an activity is measured using the Rated Perceived Exertion (RPE) scale. It's an important measure of perceived effort and varies greatly from person to person. Players' cumulative RPE scores range from 186 (Player 1) to 308 (Player 16), with significant differences between them. This variance shows that players' perceptions of the same training regimen's intensity vary. Additionally variable is the average RPE, with Player 1 having the lowest RPE (3.88) and Player 16 having the highest RPE (6.42). Higher RPEs may suggest a higher perceived exertion during training, while lower average RPEs may suggest a lesser perceived effort or higher physical conditioning.

Session RPE (sRPE) is computed by multiplying the RPE by the length of the training session, yielding the total and average sRPE. It offers a rough assessment of the training load. Players 1 through 16 had total sRPE values ranging from 18,240 to 30,100, indicating notable variations in how intensely they perceive their training. Additionally, the average sRPE varies per session, ranging from 380.00 (Player 1) to 627.08 (Player 16). This shows that even if each participant receives the same amount of training time, they all perceive a different amount of training.

Players may perceive and react to training intensity extremely differently even though they are following a similar training routine in terms of duration, based on the significant disparities in RPE and sRPE. Individual fitness levels, mental toughness, and physiological reactions to exercise may all have an impact on this.

Coaches and trainers must comprehend these metrics. It enables them to more successfully adapt training programs to the demands of specific individuals. For example, players with greater sRPE and RPE may need to pay more attention to fatigue management and recovery, whereas players with lower scores may be able to play at a higher intensity or volume. The information emphasizes how crucial it is to personalize training plans in a group environment. Based on each player's RPE and sRPE values, modifications might be made to maximize training benefits and lower the chance of overtraining or injury.

It's possible that players with lower RPE and sRPE ratings are fitter and need less work to finish the same training program as other players. On the other hand, players with higher scores may find the training more difficult, either because they are less fit or because they put in more effort throughout the sessions.

To sum up, the statistical examination of the control group's training load provides important information on individual variations in the perceived level of training. This knowledge is essential for creating customized training plans that take into accounts the distinct psychological and physiological reactions of every athlete, eventually increasing the program's efficacy.

2) Difference in the Initial and Final Tests of the Control Group

The findings of paired t-tests used to determine whether test scores for different performance measures in the control group differed significantly at first and at the end are shown in **Table 7**. These metrics include the Cooper Test results, throwing performance (throws out of 40), free throw accuracy (free throws out of 30), jumping height, running endurance (running 3 × 40 sec), and running timings at 6 and 20 meters.

Table 7. Significant difference in the initial and final tests of the control group.

Measure	t-statistic	*p*-value	Hypothesis Decision
Running at 6 m (sec)	0.653	0.522	Accept
Running at 20 m (sec)	1.403	0.177	Accept
Jumping Height (cm)	−0.396	0.697	Accept
Running 3 × 40 sec (m)	1.166	0.258	Accept
Throws out of 40	−0.616	0.545	Accept
Free Throws out of 30	−0.853	0.404	Accept
Cooper Test (m)	−0.394	0.698	Accept

The 6-meter running times for the control group did not significantly change between the first and final tests, according to the *p*-value of 0.522. This suggests that there was little variation in the short-distance run's performance over time. With a *p*-value of 0.177, there is no significant difference in the 20-meter running times between the initial and final tests. This suggests that the participants' performance in the 20-meter run remained fairly consistent.

The negative t-statistic and a *p*-value of 0.697 indicate that there is no significant difference in jumping height between the initial and final tests. This implies that the control group's ability to jump did not change significantly. The *p*-value of 0.258 suggests no significant difference in the endurance running performance measured by Running 3 × 40 sec between the initial and final tests. Endurance levels remained relatively stable over time. The negative t-statistic and a *p*-value of 0.545 indicate that there is no significant difference in the throwing performance between the initial and final tests. Participants' throwing abilities remained consistent.

The *p*-value of 0.404 suggests that there is no significant difference in free throw accuracy between the initial and final tests. The control group's performance in free throws did not change significantly. The *p*-value of 0.698 indicates no significant difference in the results of the Cooper Test between the initial and final tests. This suggests that participants' aerobic endurance levels remained consistent over time.

3) Difference in the Initial and Final Tests of the Control Group

Table 8 summarizes the results of the paired t-tests conducted on various performance measures for the experimental group. The t-statistic, *p*-value, and whether a significant difference was observed, are provided for each measure.

Running at 6 m (sec) and running at 20 m (sec) both showed a significant improvement in running times, with very low *p*-values indicating high statistical significance. Jumping Height (cm) demonstrated a significant increase in jumping height, with a p-value of 0.000135. Running 3 × 40 sec (m) showed a significant improvement in endurance, with a p-value of 0.00599.

Table 8. Significant difference in the initial and final tests of the experimental group.

Measure	t-statistic	p-value	Hypothesis Decision
Running at 6 m (sec)	−6.525	2.999e−06	Reject
Running at 20 m (sec)	−6.744	1.919e−06	Reject
Jumping Height (cm)	4.765	0.000135	Reject
Running 3 × 40 sec (m)	3.093	0.00599	Reject
Throws out of 40	2.269	0.0351	Reject
Free Throws out of 30	3.269	0.00404	Reject
Cooper Test (m)	11.909	<0.000001 (2.945e−10)	Reject

Throws out of 40 exhibited a significant improvement in throwing performance, with a p-value of 0.0351. Free Throws out of 30 indicated a significant improvement in free throw performance, with a p-value of 0.00404. Cooper Test (m) displayed a very significant improvement in aerobic capacity and endurance, with an extremely low p-value of less than 0.000001 (2.945e−10).

4. Conclusion

The results provide strong evidence to reject the null hypothesis for the experimental group in all performance measures, indicating significant improvements in training loads, physiological markers, and performance outcomes after the 8-week training program. However, for the control group, there were no significant changes observed in the selected measures, supporting the null hypothesis. These findings suggest that the tailored training program had a positive impact on the experimental group's performance compared to the control group.

Based on the significant findings of the study emphasizing the effectiveness of tailored, high-intensity training programs, here are some recommendations for various stakeholders in the world of sports:

Athletes. The athletes may embrace training programs that are specifically designed for their individual needs. This personalization means their strengths are amplified, and weaknesses are carefully addressed. Remember, training hard is important, but training smart is key. Balancing the intensity of their workouts with adequate recovery and rest periods is essential to prevent burnout and injuries. Also, the athletes may be proactive in their training journey; provide feedback to their coaches and be open to adjustments in their routine based on their performance and response.

Coaches. The coach may have the opportunity to shape the success paths of their athletes. Coaches can influence their athletes' success path by creating customized training plans that address the distinct physiological and performance traits of each athlete instead of relying on one-size-fits-all training regimens. To give their athletes the most cutting-edge and efficient training techniques, coaches can also keep up with the latest developments in sports science. Regular assessments of their athletes' performance are critical; these help them tweak training loads and intensities to optimize their capabilities. Remember, a great coach doesn't just train athletes; they develop them.

University. The universities play a pivotal role in advancing sports excellence. Investing in sports science departments and research is essential to stay at the forefront of athletic training and performance and provide programs that emphasize an athlete's holistic development, taking into accounts their scholastic balance, nutritional requirements and mental health. Providing state-of-the-art facilities and resources for sports training and research will create an environment where athletic talent can truly flourish.

Chinese Government. The government's role in nurturing sports talent cannot be overstated. Allocating funds and resources towards research in sports science and effective training methodologies can place Chinese athletes on a global pedestal. Initiating and supporting grassroots sports programs can nurture young talent from an early age, providing them with access to personalized training. International collaborations in sports training and research can also be pivotal, allowing for a valuable exchange of knowledge and best practices on a global stage.

Future Researchers. Future researchers in this field have a vast landscape to explore. Broadening the scope of research to include various sports and diverse demographic groups can offer more comprehensive insights. Long-term studies to assess the impact of tailored training over extended periods would provide valuable data on sustainability and long-term athlete development. Employing interdisciplinary approaches, integrating aspects like psychology, nutrition, and biomechanics, will lead to a more holistic understanding of what drives peak athletic performance.

Conflicts of Interest

The author declares no conflicts of interest.

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