



Variation in physical performance among basketball players

التباين في الأداء البدني بين لاعبي كرة السلة

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Abstract:

This study explores variations in physical performance between junior and senior basketball players in the Constantine regional league, focusing on 14 junior and 30 senior athletes. The objective was to compare key physical performance metrics across these groups and identify notable differences. A series of standardized tests were conducted to assess various attributes, including endurance, power, agility, speed, and technical skills. The tests included the Cooper test (aerobic endurance), Sargent test (vertical jump power), standing long jump (explosive power), passing accuracy, dribbling skills, dribbling combined with shooting, 40-meter sprint (speed), and 4x10-meter shuttle run (agility and speed).

The data collected were analyzed using SPSS software to determine statistical significance. The results revealed significant differences between the two groups in several key areas. Senior players demonstrated superior performance in technical and experience-based skills, such as passing accuracy and dribbling combined with shooting. Conversely, junior players exhibited higher potential in explosive power and speed-oriented tasks, particularly in the standing long jump and 40-meter sprint. The Cooper test also showed that seniors had better aerobic endurance, reflected in superior pacing and stamina.

These findings underscore the distinct developmental needs of junior and senior basketball players. Tailored training programs, informed by these results, can help optimize performance, reduce injury risks, and foster long-term athletic development. The use of SPSS provided robust analysis, ensuring accurate interpretation of the results.

Keywords: Basketball, Physical performance, Junior players, Senior players, Cooper test, Standing long jump, Dribbling skills, Performance variation, Age differences, Training adaptation.

Introduction and Problematic:

Basketball, a team sport par excellence, demands exceptional physical and technical abilities from its players, is a court-based team sport that contains unique movements (Scanlan et al., 2014). Basketball is considered as a high-intensity intermittent sport which requires speed, agility, coordination and explosive efforts (Arede et al., 2019). Performance in this sport relies on a balance of motor skills, strategy, and physical qualities, such as endurance, strength, speed, and agility.

Consequently, in order to play successfully, basketball players must be physically well prepared by having optimally developed levels of explosive power, agility, anaerobic power and anaerobic capacities (Van Puyenbroeck et al., 2024). These attributes are all the more crucial as they directly influence match results and the players' ability to maintain a high level of competitiveness throughout the season.

The physical performance of junior and senior players evolves along distinct paths. Juniors, undergoing significant physical growth and technical refinement, often experience rapid fluctuations in performance. On the other hand, seniors, with more stable but sometimes diminishing physical capacities, must contend with challenges such as recovery and the effects of aging. These variations highlight the importance of tailoring training strategies to meet the specific needs of each group.

Performance measurement is now essential to improving performance and player progression, especially when done in a real-game context (Ahlinvi, 2019). Furthermore, the long-term development and achievements of elite athletes are mediated by their response to training and competition (Singer & Janelle, 1999) (Guimarães et al., 2021). Physical performance indicators, such as speed, power, endurance or strength, allow us to assess the effectiveness of players on the field. By analyzing these parameters, it is possible to identify performance patterns and compare players with each other, which is essential for effective programming of the preparation process (Mikołajec et al., 2013). Juniors may demonstrate greater short-term adaptability, while seniors benefit from increased stability due to their experience and physical maturity. However, it remains to be determined how these variations in physical performance can be leveraged to guide training strategies and maximize the potential of players in each category.

This brings us to the following **Problematic**:

How do variations in basketball players' physical performance differ between junior and senior categories, and how can these variations be taken into account to optimize training strategies adapted to each group?

1. Study hypotheses:

1.1. Main hypothesis:

- Variations in physical performance between junior and senior basketball players are influenced by differences in physical maturity, experience, and adaptability. By identifying these variations, it is possible to design age-specific training strategies that enhance juniors' adaptability while maintaining and optimizing the stability and efficiency of seniors' performance.

1.2. Partial hypotheses:

- Senior players are expected to exhibit significantly higher levels of aerobic endurance compared to junior players, a difference attributed to their prolonged exposure to systematic training and enhanced physiological adaptations over time.
- Junior players are anticipated to achieve higher performance levels in tests assessing explosive power, such as the standing long jump, owing to their ongoing physical development and growth-related physiological adaptations.
- Senior players will outperform juniors in tasks requiring precision and technique, such as passing accuracy and dribbling with shooting, because of their developed skill set and game Skill.

2. Objectives of the study:

The goal of this study is to evaluate how physical performance varies among basketball players (speed, endurance, strength, agility) by comparing the junior and senior categories, in order to identify the key factors that influence these variations and their impacts on match efficiency.

2.1. Research Significance

This research aims to:

- Analyze and compare the physical performance attributes (speed, endurance, strength, and agility) of junior and senior basketball players.
- Identify the key factors driving performance variations in each group, including physical growth in juniors and the effects of recovery and aging in seniors.
- Assess how these performance variations influence players' effectiveness during matches by examining metrics such as game statistics, fatigue levels, and injury susceptibility
- Develop recommendations to tailor training and recovery programs to the unique requirements of both junior and senior players.

3. Previous studies:

3.1. First study:

The research conducted by Sergio J. Ibáñez (2018) focused on examining the relative age effect in elite under-18 basketball players, with particular attention to their playing positions. The study analyzed variables such as date of birth, playing position, and technical-tactical performance indicators (TTPI) in basketball. A descriptive analysis was first conducted to characterize the sample, followed by a linear regression to assess the impact of birth date on basketball performance. Additionally, ANOVA and discriminant analysis were employed to identify differences across various playing positions. The findings of this study can provide valuable insights for coaches and clubs in the recruitment and selection of players for specific positions

3.2. Second study:

The study of (Michael Barth, 2022), "**The Relative Age Effect in under-18 basketball**" This study examines the progression of performance in both junior and senior athletes, emphasizing factors like the age at which they began their primary sport and the extent of specialized training they have undergone.

3.3. Third study:

The study of (Jack Ransone, PhD, ATC, 2017), "**Predictors of Junior Versus Senior Elite Performance are Opposite**" This article explores the physiological characteristics of basketball players, including strength, power, and agility, and how these attributes differ between age categories.

3.4. Fourth study :

The research by Jorge Arede (2018), titled 'Maturation Development as a Key Aspect in Physiological Performance and National-Team Selection in Elite Male Basketball Players,' had two main objectives: first, to identify the key variables that distinguish players selected for the under-16 (U-16) national team, and second, to explore how biological age influences physical and technical performance in young basketball players. The study found that post-pubertal players demonstrated significantly superior performance in power-related tasks such as jumping, sprinting, throwing, and blocking. In contrast, pre-pubertal players excelled in aerobic fitness and assists. These findings highlight the role of maturation in shaping performance and provide valuable insights for talent selection processes.

4. Research means and methods:

4.1. Sample: Stratified sampling:

Our study examines a sample of 30 senior players and 15 junior players from the Constantine regional league during the 2022-2023 season, spanning from November 18 to March 16. The seniors have an average age of 28.6 years (± 7.90), with an average weight of 83.10 kg (± 12.38) and a height of 184.30 cm (± 8.58). In comparison, the juniors have an average age of 17.2 years (± 0.54), an average weight of 78.93 kg (± 7.84), and a height of 182.93 cm (± 5.84). While both groups share relatively similar morphological profiles, the

seniors tend to be slightly heavier and taller, likely reflecting their physical maturity and more developed musculature. These differences, though subtle, may impact their physical performance and ability to adapt to the demands of basketball, particularly in terms of strength, power, and endurance during high-intensity gameplay. Observing these two categories over the course of a full season enables a comprehensive analysis of physical performance variations in a competitive context, considering age- and experience-related factors.

4.2. The method used in the study:

Due to the nature of the investigation, a descriptive analytical method was adopted. This method involves analyzing precise and comprehensive information about a specific phenomenon to derive practical results, interpret them objectively, and provide an informed evaluation.

5. Protocol:

5.1. Experimental protocol

To assess the physical qualities of the players, a rigorous experimental protocol was implemented. The athletes were informed in advance about the research objectives, the tests to be conducted, and the conditions under which they would take place. The physical tests were carried out in a multi-sports hall, providing a suitable and standardized environment to ensure the reliability of the results. The necessary equipment for each test was carefully prepared, including precise measuring tools to evaluate parameters such as speed, power, endurance, and strength. Optimal conditions (temperature, lighting, playing surface) were maintained to minimize external factors that could affect performance. This protocol enabled the collection of reliable and comparable data between junior and senior players, while ensuring their safety and comfort during the testing process.

6. Physical tests:

6.1. Physical tests performed:

To assess the physical abilities of the players, a series of standardized tests was conducted. These tests were specifically selected to evaluate the key physical and technical attributes essential for basketball, including explosiveness, speed, endurance, agility, accuracy, and coordination. The following tests were performed:

6.1.1. Sergeant Jump Test: the vertical jump has been a commonly used method of assessing muscular power in the lower limbs (Bui et al., 2015). This method is simple to use, requiring only a wall or board and chalk powder to make marks with your fingers. Johnson and Nelson (1974) reported a reliability of .93 and an objectivity of .93 for this test (Aragón, 2000). the vertical jump test is considered suitable for assessing lower limb power (Castillo et al., 2018)

The test involves two measurements:

Measurement 1: The participant stands sideways to the wall with feet flat on the ground. The arm closest to the wall is fully extended upward, and the height reached by the fingertips is recorded.

Measurement 2 (Sargent test): The participant stands with feet slightly apart, positioning the foot nearest to the wall about 30 centimeters away. Without any prior rebound, the participant prepares for the jump by lowering their arms and bending their legs. They then jump as high as possible, marking the wall with their fingertips at the peak of the jump.

6.1.2. The standing long jump test: The test is conducted from a stationary position, meaning no running start is permitted. Participants are only allowed to use a simultaneous swing of their arms to prepare for the leg push-off. This assessment is designed to measure explosive strength, which refers to the capacity to produce maximal muscle force in the shortest possible time. Specifically, it evaluates the explosive power generated by the leg extensor muscles, including the glutes, thighs, and calves. A line marked on a hard surface was used as the starting point. The jump distance was recorded using a tape measure securely fixed to the ground. Each participant performed three attempts, and the longest jump was measured to the nearest centimeter, from the starting line to the heel closest to the line upon landing. If a participant fell backward, the measurement was taken from the starting line to the body part nearest to it that touched the ground. All three jumps were counted, regardless of whether a participant fell during any attempt. The longest jump was used as the test score. (Almuzaini & Fleck, 2008)

6.1.3. Basketball throw for accuracy test: Accuracy pass was evaluated through push pass for accuracy test (as described by Johanson, and Nelson, 1988) (Boroujeni & Shahbazi, 2011)

The participant stands behind a line drawn on the floor. The player, positioned 40 feet from the wall, throws the ball at the wall with the goal of hitting the rectangles drawn on it. The participant can pass the ball using both hands or one hand (hook pass). The task involves performing ten passes. Points are awarded as follows:

Scoring includes three points for the smallest rectangle or its lines, two points for the medium rectangle or its lines, and one point for the largest rectangle or its lines..

From the above, it is clear that the maximum possible score (if all ten passes hit the smallest rectangle) is 30 points.

6.1.4. Dribbling test : To measure control and agility while dribbling.

The player stands behind the starting line, ball in hand, ready to start when the signal is given, they run while dribbling the ball around obstacles arranged in a figure-eight (zigzag) pattern. The participant continues this movement until they hear the word "stop" from the evaluator,

signaling the end of the 30-second test duration. The participant should aim to avoid touching the obstacles or losing control of the ball during the zigzag run.

One point is awarded for each marked zone passed (zones are numbered from 1 to 10).

6.1.5. wall bounce test: To measure passing speed.

The participant positions themselves behind a line, facing the wall with the ball in hand. When the start signal is given, they throw the ball toward the wall and proceed to execute 15 consecutive chest passes using both hands as quickly as possible. The ball should be passed and received without stepping forward, and the participant must remain behind the line drawn on the ground.

The duration is tracked from the start signal to the point when the ball touches the wall on the fifteenth and final pass, measured in seconds.

6.1.6. Dribble-Shoot Test: The test starts with the participant positioned at the starting line, holding the ball. Once the start signal is given, the participant dribbles the ball in a zigzag motion through the cones, continuing until they arrive at the target area. They then attempt to score (using any method they prefer) to hit the target. After scoring, they retrieve the ball and return in the same manner (zigzag running while dribbling) until they cross the starting line. It is important to note that the participant must successfully score before beginning their return. According to experts (based on practical experience), the best type of shot to use in this test is the layup.

The participant's time is recorded from the moment the start signal is given until they cross the starting line after completing the steps outlined in the performance specifications.

6.1.7. 40 m speed test: To measure the player's maximum sprinting speed over a 40-meter distance.

The participant starts in a standing position behind the starting line. When the start signal is given, they sprint at maximum speed over a 40-meter distance. The time is measured using a stopwatch or electronic timing system, beginning as the participant starts running and ending when they cross the finish line.

The performance is scored based on the time taken to complete the sprint, measured in seconds, with faster times indicating better sprinting speed.

6.1.8. 4x10m speed test: is a widely used agility and speed assessment in sports and fitness. This test evaluates **speed, agility, and acceleration**, as well as the ability to change direction quickly.

Two parallel lines are drawn 10 meters apart. The participant begins behind the first line (starting line). At the 'Go' signal, they sprint 10 meters to the opposite line, touch it with either

their hand or foot, and then turn and sprint back to the starting line. The timing begins with the 'Go' signal and ends when the participant crosses the starting line after completing the fourth 10-meter sprint.

6.1.9. Cooper Test: The Cooper Test (Cooper 1968) is used to monitor the athlete's aerobic endurance and to obtain an estimate of their VO_2 max. (*Cooper Test - 12 minutes pour évaluer votre vo_{2max} , s. d.*)

A flat, measured track (typically 400 meters) or a marked area where distance can be accurately tracked, The participant aims to run the greatest distance possible within a 12-minute timeframe. The objective is to maximize the distance covered during this period, and the total distance achieved, measured in meters or kilometers, is recorded.

The result is often used to estimate VO_2 max (maximal oxygen uptake), a key indicator of aerobic fitness.

7.Descriptive analysis of the performances realized in the different tests of physical qualities:

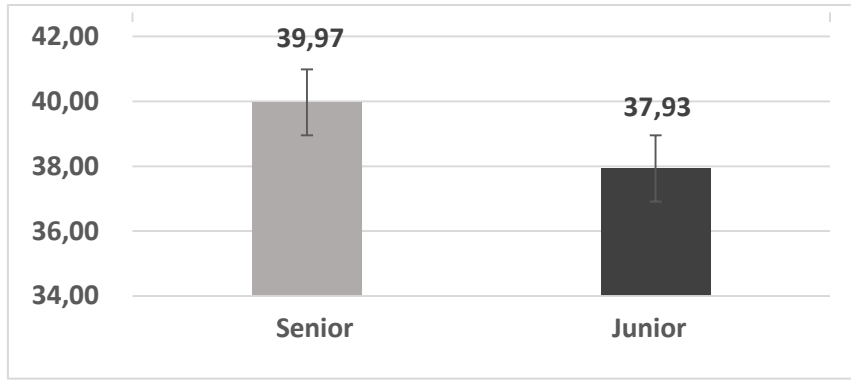
7.1. Descriptive analysis and interpretation of the results from the Sergeant Jump Test

The average Sergeant Jump Test values are shown in Table 7.1

	Seniors	Juniors	t(U)	P	Sig
Sergeant Jump Test	39,97±4,76	37,93 ± 4,53	1,290	0,207	NS

The Sergeant's Jump Test results show a comparison between senior and junior basketball players. Seniors scored a mean of 39.97 ± 4.76 cm, while juniors scored a mean of 37.93 ± 4.53 cm. Although seniors showed a slight superiority in explosive power, the difference between the two groups was not statistically significant, as indicated by the t(U) value of 1.290 and the p-value of 0.207 ($p > 0.05$).

The lack of statistical significance (NS) indicates that although seniors may have a slight advantage in vertical jump performance, this difference could be attributed to random variation rather than a true distinction in physical abilities. This result highlights the rather similar explosive capacity of the two groups, despite their differences in age and experience.



Graph n°1: Shows the mean and standard deviation of the values obtained in the Sergeant Jump Test

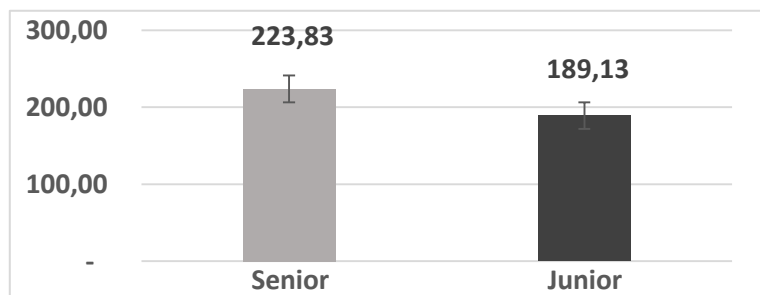
7.2. Descriptive analysis and interpretation of the results from The standing long jump test

The average the standing long jump test values are shown in Table 7.2

	Seniors	Juniors	t(U)	P	Sig
The standing long jump test	223,8±20,85	189,13±24,09	4,880	0,000105***	S

The results of the Standing Long Jump Test revealed a clear difference between senior and junior basketball players. Seniors recorded a mean jump distance of 223.8 ± 20.85 cm, significantly outperforming juniors, whose mean was 189.13 ± 24.09 cm. Statistical analysis revealed a t(U) value of 4.880 and a highly significant p-value of 0.000105 ($p < 0.001$), indicating a statistically significant difference between the two groups (S).

Seniors exhibit superior explosive leg power compared to juniors due to physical maturity, muscular development, and basketball-specific training experience, emphasizing the need for targeted training programs.



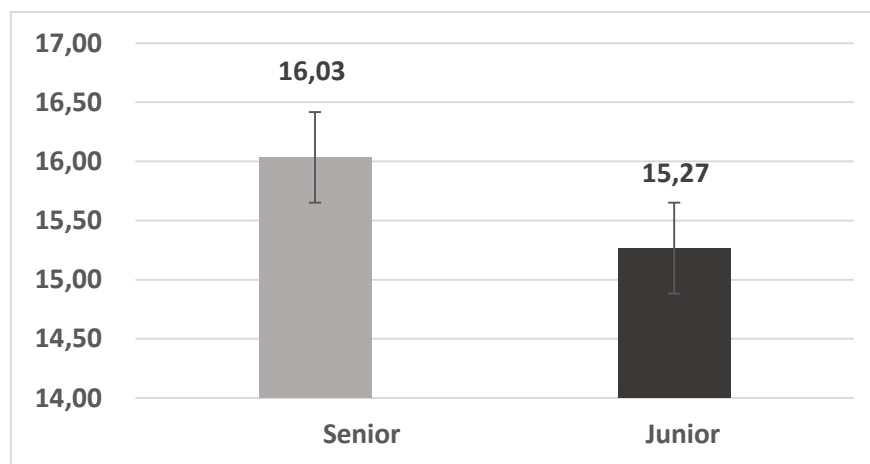
Graph n°2: Shows the mean and standard deviation of the values obtained in the Standing Long Jump Test

7.3. Descriptive analysis and interpretation of the results from the Basketball Throws for Accuracy Test

The average the Basketball Throws for Accuracy Test values are shown in Table 7.3

	Seniors	Juniors	t(U)	P	Sig
The Basketball Throws for Accuracy Test	16,03±3,48	15,27±4,27	0,585	0,564	NS

The results of the Basketball Throws for Accuracy Test indicate relatively similar performance levels between senior and junior basketball players. Seniors achieved an average score of **16.03 ± 3.48**, while juniors recorded an average score of **15.27 ± 4.27**. The statistical analysis yielded a **t(U) value of 0.585** and a **p-value of 0.564** ($p > 0.05$), demonstrating no statistically significant difference between the two groups (**NS**). Both juniors and seniors show comparable passing accuracy in basketball throws, with slightly higher scores in seniors due to random variation, suggesting skill development is not strongly influenced by age or experience.



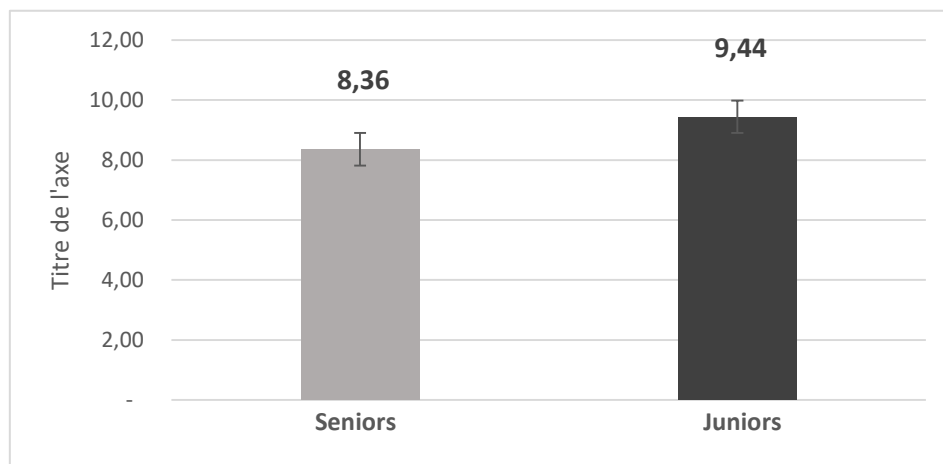
Graph n°3: Shows the mean and standard deviation of the values obtained in the Basketball Throws for Accuracy Test

7.4. Descriptive analysis and interpretation of the results from the Dribbling Test

The average the Dribbling Test values are shown in Table 7.4

	Seniors	Juniors	t(U)	P	Sig
Dribbling Test	8,36 ± 0,80	9,44 ± 0,83	-3,529	0,00252	S

The results of the Dribbling Test reveal a notable performance gap between senior and junior basketball players. Seniors recorded an average time of 8.36 ± 0.80 seconds, while juniors had a slower average time of 9.44 ± 0.83 seconds. The statistical analysis produced a t(U) value of -3.529 and a p-value of 0.00252 ($p < 0.01$), indicating a statistically significant difference between the two groups (S). Senior players excel in dribbling efficiency due to experience, ball-handling skills, and coordination, while juniors may be refining their technical abilities, emphasizing the need for targeted training programs.



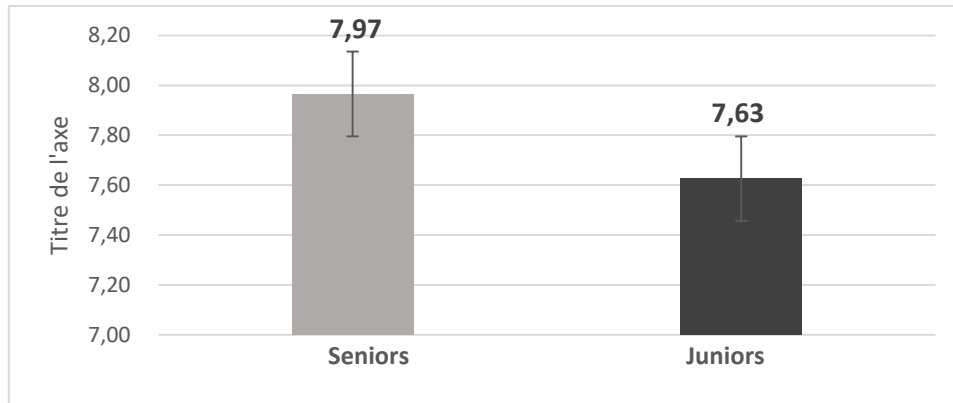
Graph n°4: Shows the mean and standard deviation of the values obtained in the Dribbling Test

7.5. Descriptive analysis and interpretation of the results from the Wall Bounce test

The average the wall bounce test values are shown in Table 7.5

	Seniors	Juniors	t(U)	P	Sig
Wall Bounce Test	7,97±0,59	7,63±1,19	1,012	0,325	NS

The Wall Bounce Test results indicate that junior and senior basketball players perform similarly in passing speed and coordination. The average scores for juniors were 7.63 ± 1.19 , while for seniors it was 7.97 ± 0.59 . The slight variation in averages could be due to chance, suggesting consistent training could benefit both groups.



Graph n°5: Shows the mean and standard deviation of the values obtained in the wall bounce test

7.6. Descriptive analysis and interpretation of the results from the Dribble-Shoot Test

The average the Dribble-Shoot Test values are shown in Table 7.6

	Seniors	Juniors	T(U)	P	Sig
Dribble-Shoot Test	$8,87 \pm 0,75$	$8,98 \pm 0,85$	-0,447	0,659	NS

The Dribble-Shoot Test results show that junior and senior basketball players perform similarly, with seniors averaging 8.87 ± 0.75 seconds and juniors averaging 8.98 ± 0.85 seconds. The slight difference in times was not statistically significant ($T(U) = -0.447$, $p = 0.659$, $p > 0.05$), indicating that both groups are equally proficient in combining dribbling and shooting during the test. This suggests that age and experience do not significantly influence performance in this specific skill, and both juniors and seniors could benefit equally from targeted training.

7.7. Descriptive analysis and interpretation of the results from the 40 m speed test

The average the 40 m speed test values are shown in Table 7.7

	Seniors	Juniors	t(U)	P	Sig
40 m speed test	6,95 ± 0,98	7,37 ± 0,93	410,000	0,120	NS

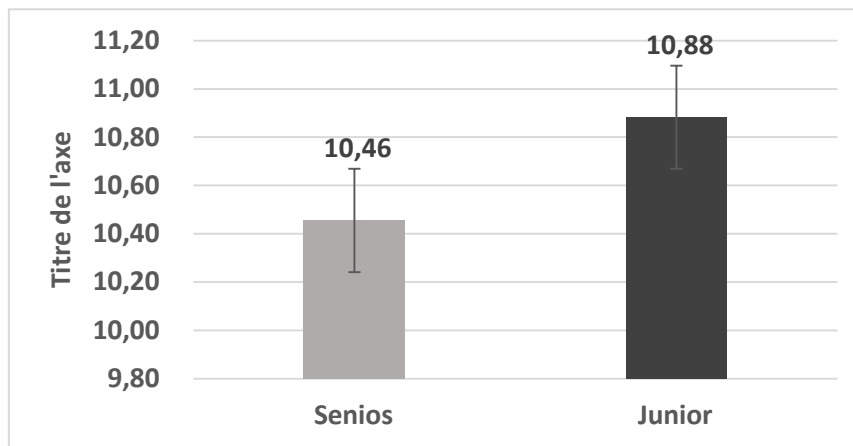
The 40m Speed Test results revealed no statistically significant difference between senior and junior basketball players, with seniors averaging 6.95 ± 0.98 seconds and juniors averaging 7.37 ± 0.93 seconds ($t(U) = 410.000$, $p = 0.120$, $p > 0.05$). This suggests that short-distance sprinting ability is comparable between the two groups, despite slight variations. The findings indicate that age and experience may not significantly impact speed over this distance, though further research could explore factors like training, muscular maturity, and technique. Both groups could benefit from targeted speed training to enhance performance.

7.8. Descriptive analysis and interpretation of the results from the 4x10m speed test

The average the 4x10m speed test values are shown in Table 7.8

	Seniors	Juniors	t(U)	P	Sig
4x10m speed test	10,46 ± 0,76	10,88 ± 0,66	-1,894	0,067	NS

The 4x10 Meters Speed Test results showed that senior basketball players were slightly faster (10.46 ± 0.76 seconds) compared to juniors (10.88 ± 0.66 seconds). However, statistical analysis ($t(U) = -1.894$, $p = 0.067$, $p > 0.05$) indicated no significant difference between the groups. While seniors may have a marginal advantage in agility and short-distance speed, the lack of statistical significance suggests the difference is not substantial. Both groups could benefit from agility drills and high-intensity interval training to further improve performance.



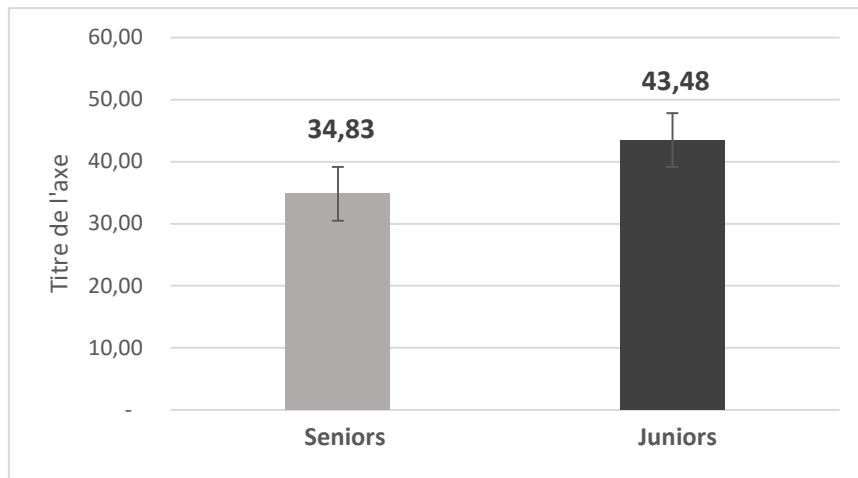
Graph n°6: Shows the mean and standard deviation of the values obtained in the 4x10m speed

7.9. Descriptive analysis and interpretation of the results from the Cooper Test

The average the Cooper Test values are shown in Table 7.9

	Seniors	Juniors	t(U)	P	Sig
Cooper Test	34,83 ± 4,99	43,48 ± 1,96	-6,328	0,000000000387	S

The Cooper Test results revealed a significant difference in aerobic endurance between senior and junior basketball players. Juniors completed an average of 43.48 ± 1.96 laps, significantly outperforming seniors, who averaged 34.83 ± 4.99 laps ($t(U) = -6.328$, $p < 0.001$). This suggests that juniors have superior aerobic endurance, likely due to their younger age, greater cardiovascular efficiency, and developmental advantages. In contrast, seniors may experience reduced endurance due to aging and accumulated fatigue. These findings highlight the need for age-specific training programs: juniors can focus on maintaining their endurance, while seniors may benefit from targeted endurance and recovery strategies to counteract age-related declines.



Graph n°7: Shows the mean and standard deviation of the values obtained in the Cooper Test

8. Discussion:

The objective of this study is to analyze the variations in physical performance of basketball players (speed, endurance, strength, agility) by comparing the junior and senior categories, in order to identify the key factors that influence these variations and their impacts on match efficiency.

8.1. Discussion of the first hypothesis which assumes Senior players are expected to exhibit significantly higher levels of aerobic endurance compared to junior players, a difference attributed to their prolonged exposure to systematic training and enhanced physiological adaptations over time:

The Cooper Test results challenge the initial hypothesis, revealing that junior players outperformed seniors in aerobic endurance. Juniors completed an average of 43.48 ± 1.96 laps, significantly more than the seniors' 34.83 ± 4.99 laps. This notable difference ($t(U) = -6.328$, $p < 0.001$) underscores the influence of age-related physiological changes. While seniors have accumulated years of systematic training and likely reached peak aerobic capacity earlier in their careers, their decline in endurance may be linked to aging, chronic fatigue, and diminished recovery capabilities, as noted by Jorge Arede (2018). Conversely, juniors exhibit superior cardiovascular efficiency and developmental advantages, aligning with findings from Ransone et al. (2017), which highlighted the enhanced aerobic fitness of younger athletes. These findings suggest that senior players could benefit from specialized endurance and recovery programs to counteract age-related declines, while juniors should focus on sustaining and refining their endurance through tailored training regimens.

8.2 Discussion of the second hypothesis which assumes Junior players are anticipated to achieve higher performance levels in tests assessing explosive power, such as the standing long jump, owing to their ongoing physical development and growth-related physiological adaptations:

The findings of the Standing Long Jump Test do not support this hypothesis. Seniors significantly outperformed juniors, recording a mean jump distance of 223.8 ± 20.85 cm compared to juniors' 189.13 ± 24.09 cm ($t(U) = 4.880$, $p = 0.000105$). This result is consistent with prior research, such as Jorge Arede's (2018) study, which highlighted the superior power outputs of post-pubertal athletes. The greater muscular development, physical maturity, and experience in strength training of senior players likely contribute to this performance disparity. In contrast, juniors, despite their ongoing physical development, may not yet possess the muscle mass or neuromuscular coordination required for maximum explosive power. This emphasizes the need for age-specific strength and power training interventions to maximize performance potential across age categories.

8.3. Discussion of the third hypothesis which supposes Senior players will outperform juniors in tasks requiring precision and technique, such as passing accuracy and dribbling with shooting, because of their developed skill set and game experience:

The findings support this hypothesis in the context of the Dribbling Test, where seniors demonstrated significantly better performance than juniors, recording a mean time of 8.36 ± 0.80 seconds compared to juniors' 9.44 ± 0.83 seconds ($t(U) = -3.529$, $p = 0.00252$). The superior performance of senior players can likely be attributed to their experience, enhanced coordination, and refined ball-handling skills. These results are consistent with research by Sergio J. Ibáñez (2018) and Michael Barth (2022), which highlight the role of technical-tactical expertise and specialized training in senior athletes.

In contrast, the Dribble-Shoot Test did not show a significant difference between the two groups ($t(U) = -0.447$, $p = 0.659$). This indicates that while seniors generally outperform in precision-based tasks, juniors may be narrowing the gap in specific technical areas, such as shooting accuracy, due to their ongoing development. Coaches should focus on enhancing technical skills in juniors while maintaining seniors' proficiency through advanced tactical training.

9. Conclusions and suggestions:

This study offers important insights into the physiological and technical differences across age groups by highlighting notable physical performance differences between junior and senior basketball players. Seniors' advanced physical maturity, years of specialized training, and gaming experience were all factors in their superior explosive power (Standing Long Jump Test) and dribbling efficiency (Dribbling Test). Juniors, on the other hand, demonstrated higher aerobic endurance (Cooper Test), which was indicative of their developmental advantages and cardiovascular efficiency. These results highlight the complex relationship between age, experience, and training specificity and basketball performance. Seniors gain from their honed abilities and physical fitness, but endurance issues arise due to

age-related physiological decline. Conversely, juniors exhibit encouraging potential in endurance even though they are still honing their technical skills.

Based on the findings and discussion, the following recommendations are proposed:

highlight the need for age-specific training programs designed to address the distinct requirements of junior and senior players. Juniors should concentrate on building strength, power, and technical skills while leveraging their natural aerobic advantage through consistent endurance training. For seniors, the focus should be on recovery strategies and maintaining endurance, alongside preserving explosive power and honing precision-based techniques. Injury prevention and careful load management are critical for seniors to reduce the risk of fatigue and overuse injuries. Incorporating mixed-age training sessions can promote mutual learning and strengthen team cohesion. Regular performance evaluations should be implemented to track progress and pinpoint areas needing improvement. Furthermore, a holistic approach that integrates tactical, mental, and physical development is vital to maximize performance and prepare athletes for higher competitive levels.

10. Referrals and Quotations:

1. Ahlinvi, J.-C. (2019). *Mesure de la performance sportive au basketball compétitif à l'aide d'une adaptation du "Team Sport Assessment Procedure"*. <https://corpus.ulaval.ca/entities/publication/00e2108b-7388-43e8-8a42-b57c687fb3ac>
2. Almuzaini, K. S., & Fleck, S. J. (2008). Modification of the Standing Long Jump Test Enhances Ability to Predict Anaerobic Performance. *Journal of Strength and Conditioning Research*, 22(4), 1265-1272. <https://doi.org/10.1519/JSC.0b013e3181739838>
3. Aragón, L. F. (2000). Evaluation of Four Vertical Jump Tests : Methodology, Reliability, Validity, and Accuracy. *Measurement in Physical Education and Exercise Science*, 4(4), 215-228. https://doi.org/10.1207/S15327841MPEE0404_2
4. Arede, J., Ferreira, A. P., Gonzalo-Skok, O., & Leite, N. (2019). Maturation Development as a Key Aspect in Physiological Performance and National-Team Selection in Elite Male Basketball Players. *International Journal of Sports Physiology and Performance*, 14(7), 902-910. <https://doi.org/10.1123/ijsp.2018-0681>
5. Boroujeni, S. T., & Shahbazi, M. (2011). The Effect of Instructional and Motivational Self-Talk on Performance of Basketball's Motor Skill. *Procedia - Social and Behavioral Sciences*, 15, 3113-3117. <https://doi.org/10.1016/j.sbspro.2011.04.255>
6. Bui, H. T., Farinas, M., Fortin, A., Comtois, A., & Leone, M. (2015). Comparison and analysis of three different methods to evaluate vertical jump height. *Clinical Physiology and Functional Imaging*, 35(3), 203-209. <https://doi.org/10.1111/cpf.12148>
7. Castillo, D., Yanci, J., & Cámara, J. (2018). Impact of Official Matches on Soccer Referees' Power Performance. *Journal of Human Kinetics*, 61(1), 131-140. <https://doi.org/10.1515/hukin-2017-0116>
8. *Cooper Test—12 minutes pour évaluer votre vo2max.* (s. d.). Consulté 13 septembre 2024, à l'adresse <https://www.brianmac.co.uk/gentest.htm>
9. Guimarães, E., Baxter-Jones, A. D. G., Williams, A. M., Tavares, F., Janeira, M. A., & Maia, J. (2021). The role of growth, maturation and sporting environment on the development of performance and technical and tactical skills in youth basketball players : The INEX study. *Journal of Sports Sciences*, 39(9), 979-991. <https://doi.org/10.1080/02640414.2020.1853334>
10. Mikołajec, K., Maszczyk, A., & Zajac, T. (2013). Game Indicators Determining Sports Performance in the NBA. *Journal of Human Kinetics*, 37(1), 145-151. <https://doi.org/10.2478/hukin-2013-0035>
11. Scanlan, A., Humphries, B., Tucker, P. S., & Dalbo, V. (2014). The influence of physical and cognitive factors on reactive agility performance in men basketball players. *Journal of Sports Sciences*, 32(4), 367-374. <https://doi.org/10.1080/02640414.2013.825730>
12. Van Puyenbroeck, S., Hermans, F., Boen, F., Fransen, K., & Vande Broek, G. (2024). The relation between perceived need-supportive coaching behaviours, winning games, and team resilience : A longitudinal examination among basketball and soccer teams. *International Journal of Sport and Exercise Psychology*. Scopus. <https://doi.org/10.1080/1612197X.2024.2366421>