

# Flexibility and Anthropometric Characteristics as Predictors of Agility Performance in Recreational Basketball Athletes: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Due to the dynamic nature of basketball, agility, flexibility and physical characteristics have a higher importance in the performance of an athlete, so understanding their association and influence of different factors will help in predicting injury risk, designing training regimes and athlete profiling at the recreational level. This study is intended to explore interaction between and predict outcomes of performance of recreational basketball athletes' agility based on their level of flexibility and anthropometric characteristics.

**Aim:** To identify if either flexibility or anthropometric characteristics can predict an individual's ability to execute agility in athletic skills by both correlation and regression analysis.

**Materials and Methods:** A cross-sectional study was conducted in the sports complex of Maharishi Markandeshwar (Deemed to be University), Mullana- Ambala, Haryana, India from January 2025-December 2025. The study included 62 healthy recreational basketball athletes of age 18-30 years who participated with each of their heights, weights and Body Mass Index (BMI) recorded as anthropometric measurements. Both agility and flexibility were assessed via t-test for agility and the Sit and Reach Test (SRT) for flexibility. Pearson's correlation

coefficient and regression analysis were conducted to assess associations and to identify agility predictions. Statistical significance was set at p-value <0.05.

**Results:** In terms of agility,  $F(4,57) = 0.778$ , p-value=0.544,  $R^2=0.052$ , the regression model was non significant. However, anthropometric variables had significant moderate relationship with flexibility  $F(4,57) = 6.113$ , p-value <0.001,  $R^2=0.300$ . For flexibility and agility ( $F(1,59) = 0.36$ , p-value=0.543,  $R^2=0.006$ ), the model was not statistically significant. BMI had very small correlations with agility, while age, height and weight weren't related. Gender showed a weak negative association with agility ( $r=-0.266$ , p-value <0.05). Flexibility showed a negative relationship with age ( $r=-0.323$ , p-value <0.05), weight ( $r=-0.296$ , p-value <0.01), and BMI ( $r=-0.359$ , p-value <0.01) but not with height or gender. No statistically significant link between agility and flexibility was found.

**Conclusion:** In summary, flexibility along with anthropometric characteristics exhibited limited ability to predict an athlete's agility indicating recreational basketball athletes should be evaluated and develop agility as a distinct physical trait apart from all other variables.

**Keywords:** Athletes, Body mass index, Regression analysis, Young adult

## INTRODUCTION

Basketball performance is influenced by the combined effects of multiple factors, including technical skill, tactical proficiency, mental focus and physical capacity [1]. Among the physical determinants, agility and flexibility are two important components due to highly dynamic and intermittent nature of the sport [2]. These components are essential during rapid accelerations, decelerations, directional changes, jumps and repeated activities which necessitate high intensity. Consequently, physical conditioning serves as an important role in performance development and reducing the incidence of injury [3,4].

Unlike elite athletes, recreational basketball players often exhibit considerable variability in levels of physical fitness, training exposure and movement efficiency [5]. This heterogeneity results in a change in functional outcomes that are influenced by a unique interaction between skill-related fitness components and individual physical characteristics [6].

Agility refers to the capability of an individual to efficiently and effectively sustain the position of the body during directional changes [7]. It is widely recognised as a key determinant of performance in many sports and is closely associated with neuromuscular conditioning and adaptations involving proprioceptive elements such as spindles of muscle, Golgi tendon organs and the receptors of the joint [8].

Previous research indicates that skilled players can effectively perform at a higher level based on superior agility performance [9].

Flexibility, on the other hand, contributes to efficient execution of movement by allowing great range of motion at the hip, knee and ankle during task-specific activities including sprinting, cutting, jumping and landing [10]. Adequate flexibility facilitates longer stride length, better shock absorptions and smoother transitions between phases of movement particularly during the shift from concentric to eccentric muscle activity [11]. Furthermore, dynamic stretching interventions have been shown to enhance muscle flexibility and improve performance in agility skills involving rapid directional changes, such as 180° turns [12].

Body composition is another important factor that has been extensively studied and has a notable link to athletic performance [13]. Anthropometric variables including weight, height and BMI, in conjunction with neuromuscular characteristics to influence athletic performance [14]. There are many factors that contribute to poor movement efficiency and higher mechanical loads during fast movements such as agility, and those factors can include excess body mass or raised BMI values [15]. Evidence suggests that decreased flexibility due to high body weight and mass or increased age can negatively affect the range of motion of key joints, potentially impairing performance [16].

Despite the recognised importance of agility, flexibility, and anthropometric characteristics, their combined ability to predict agility performance in recreational basketball players remains unclear. In sports science research, regression-based analytical methods are frequently employed to identify important predictors of sport-specific performance outcomes. For instance, Loturco I et al., demonstrated that upper- and lower-body power and strength could significantly predict punching acceleration in elite karate athletes using multiple regression analysis to explain the complex athletic action of punching [17].

Existing literature has largely investigated agility, flexibility, and anthropometric characteristics in isolation, with limited attention given to their interrelationships in a comprehensive analytical framework [18]. Although several studies have examined agility and flexibility through field tests, no study has reported results on the interactions and predictions of these variables using multivariate statistical techniques. Understanding the relationship between agility and flexibility and whether these variables function independently, is particularly important in recreational basketball players who often lack structured training. Identifying the most relevant physical determinants of performance can aid in developing effective conditioning programs and screening tools tailored to this population.

The aim of the study was to examine the association and predictive influence of flexibility and anthropometric characteristics on agility performance in recreational basketball athletes. The primary objective of the study was to determine the association and predictive value of anthropometric characteristics on agility performance in recreational basketball athletes and to determine the association and predictive value of flexibility on agility performance in recreational basketball athletes. The secondary objective of the study was to determine the association and predictive value of anthropometric characteristics on flexibility in recreational basketball athletes.

## Hypotheses

- **Null hypotheses:** There is no significant association between flexibility and anthropometric characteristics with agility performance in recreational basketball athletes.
- **Alternate hypotheses:** There is a significant association between flexibility and anthropometric characteristics with agility performance in recreational basketball athletes.

## MATERIALS AND METHODS

A cross-sectional study was conducted in the sports complex of Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana, India from January 2025 to December 2025. The data were collected by using purposive sampling method. This study was reviewed and recommended by the Institutional Ethical Committee with a reference number: IEC-3102. Following ethical clearance, the study was prospectively registered in Clinical Trial Registry India (*ctri.gov.in*) with a unique identification number: CTRI/2025/07/090299. All participants of this study were informed about the purpose and procedure of the study and written informed consent to participate was obtained prior to their involvement in the study.

**Inclusion criteria:** Recreational basketball athletes of the age group between 18-30 years, both genders, willing to participate and meeting the criteria of the Athletic Identity Measurement Scale (AIMS) scoring [19] were included in the study.

**Exclusion criteria:** Athletes with any neuromuscular condition, and any surgery within 6 months were excluded to limit confounding factors.

**Sample size:** To obtain an estimated sample size, an online calculator named *Sample-size.net* was used. The assumed significance level was ( $\alpha=0.05$ ), with a statistical power 90% ( $\beta=0.10$ ). An expected correlation coefficient ( $r=0.40$ ) was considered

based on prior literature. The formula used was Fisher's method  $N = ((Z\alpha+Z\beta)/C)^2+3$  [18]. After calculating these values, total sample size obtained was 62.

The primary outcome measures in this study were the AIMS, t-test and SRT [20]. AIMS is a seven-item self-reported questionnaire that allows an individual to assess their role as an athlete. This scale is a validated instrument that is easier to administer in various categories of athletes like elite, professional and recreational. It helps in assessing the athlete's self, social identity, negative and positive emotionality. Total score of AIMS is 49; if the participant has at least 35 out of 49, was included in the study. The test-retest reliability of AIMS is 0.80 [19]. The t-test was used to assess multidirectional agility. This test is a standard outcome measure to evaluate the skill-related component with a reliability coefficient (R) of 0.98 [21].

The SRT was utilised to determine the flexibility of the athlete's hamstring and lower back region. This test is cost-effective, time-saving and simple in utility which doesn't require specialised equipment. In studies, the reliability coefficient for successive measures of SRT was observed to be 0.98 [20]. The apparatus utilised for SRT was built following EUROFIT guidelines with the dimensions of length -35 cm, width -45cm and height -32 cm [22].

## Study Procedure

Initially, 150 participants were screened for eligibility according to predetermined inclusion and exclusion criteria. Based on screening, 65 participants qualified and were enrolled into the study. Only participants who met the study objectives and criteria as per the AIMS were analysed. Following determination of sample size, the final sample of 62 participants was included in the study.

After obtaining consent from participants, anthropometric measurements of all the participants were collected in an appropriate environment. Measurements of height and body weight were taken using a stadiometer and a calibrated KRUPS brand weighing machine. Participants were instructed to wear light clothing during these measurements to avoid any errors. All test procedures were thoroughly explained to the participants before performance testing including demonstrations of t-test and SRT to the participants prior to the assessment. An effective standardised warm-up session of 15 minutes was administered by each participant to minimise the chances of injury [23]. In addition, prior to actual testing for agility and flexibility, all participants were familiarised with the testing protocol.

In T-test, four cones were used, labelled A, B, C and D. Cone A was placed 9.14 meters apart from cone B, Cone B, 4.57 metres from cone C and cone D. Participants were instructed to stand behind the first cone marked as A at the starting position. On the command "Ready-steady-go", each participant sprinted forward to the second cone (B) and touched it with their right hand. Then, the participant laterally shuffled to the left to touch the third cone (C) with their left hand and then laterally shuffled to the right to touch the fourth cone (D) with their right hand. After completing the lateral movements, participants shuffled back to cone B and then backpedalled to cone A. Participants were given a maximum of three attempts to perform the test and the time taken by the participant was recorded in seconds by using a stopwatch. The score of the test was quantified as the total time taken by the participant to complete the entire course, which is measured from the moment of beginning at cone A until the participant returns to finish back at cone A again. The smaller time values suggest better agility performance. The best time is selected from the three successful trials and recorded to the nearest 0.1 seconds [21].

Following completion of t-test, a 10-minute rest was given before undergoing the flexibility assessment. Flexibility was measured using SRT with a standard test box. Participants were seated on the floor with their legs fully extended, feet placed flat against the front of the standard test box and knees maintained full extension throughout

the procedure. With both arms extended forward, participants reached forward along the measurement scale to determine how far participants can reach without bending their knees. At the point of maximum reach, participants were instructed to hold that position briefly to allow the tester to record a measurement. Each participant performed three separate trials with sufficient rest between each trial. Scoring was recorded with the zero point aligned on the standardised box at the level of the feet. Distances reached beyond the toes were assigned as positive values, while distances short of the toes were recorded as negative values. Only the best distance was recorded in centimetres for statistical analysis [20].

## STATISTICAL ANALYSIS

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 24.0. A sample size of 62 was recruited and the Kolmogorov-Smirnov (K-S) test assessed whether the data followed a normal distribution. A p-value >0.05 indicated no significant deviation from normality, while p-value <0.05 indicated non normal distribution. Pearson's correlation coefficient was used to assess any bivariate relationship between the independent and dependent variables. The relationship between independent and dependent variables was established using linear regression analysis. The regression coefficient ( $\beta$ ), the coefficient of determination ( $R^2$ ) and the related p-values were used to find intensity and the direction of the connections. An alpha value of p-value <0.05 was considered significant. An exploratory analysis was performed in which participants were divided based on t-test scores into three groups (high, moderate, and low agility), and descriptive statistics (mean $\pm$ SD) were calculated and compared across groups.

## RESULTS

[Table/Fig-1] demonstrates a sample of the study that consisted of young basketball players in the age group between 18 and 30 years. Gender distribution revealed a greater percentage of male participants, ranging 83.87% and female participants accounted for 16.13% of the total study sample. The mean values of the t-test were 12.93 $\pm$ 1.09 seconds (range: 10.76-15.94 seconds), which reflects a moderate to low agility performance among the study participants. Primarily, these higher scores point to reduced ability to change direction rapidly. Evaluation of the score range reveals that there is clearly substantial interindividual variability. While a segment of participants demonstrated better agility, plenty of others exhibited much lower performance levels of agility [20]. The SRT scores, which measure flexibility, showed a mean score of 22.69 $\pm$ 6.32 cm, indicating moderate flexibility aligned with expected values in normal young adults [24]. There is great interindividual variation in scores for the SRT flexibility test based on the range between 8-35 cm and therefore demonstrates a good to limited flexibility in the participants.

Variables	Mean $\pm$ SD	Range
Age (years)	20.89 $\pm$ 2.58	18-28
Height (cms)	170.47 $\pm$ 8.21	144-187
Weight (kgs)	66.68 $\pm$ 12.50	40-110
BMI (kg/m <sup>2</sup> )	22.77 $\pm$ 3.34	16.90-33.20
T-Test (sec)	12.93 $\pm$ 1.09	10.76-15.94
S & R test (cm)	22.69 $\pm$ 6.32	8-35

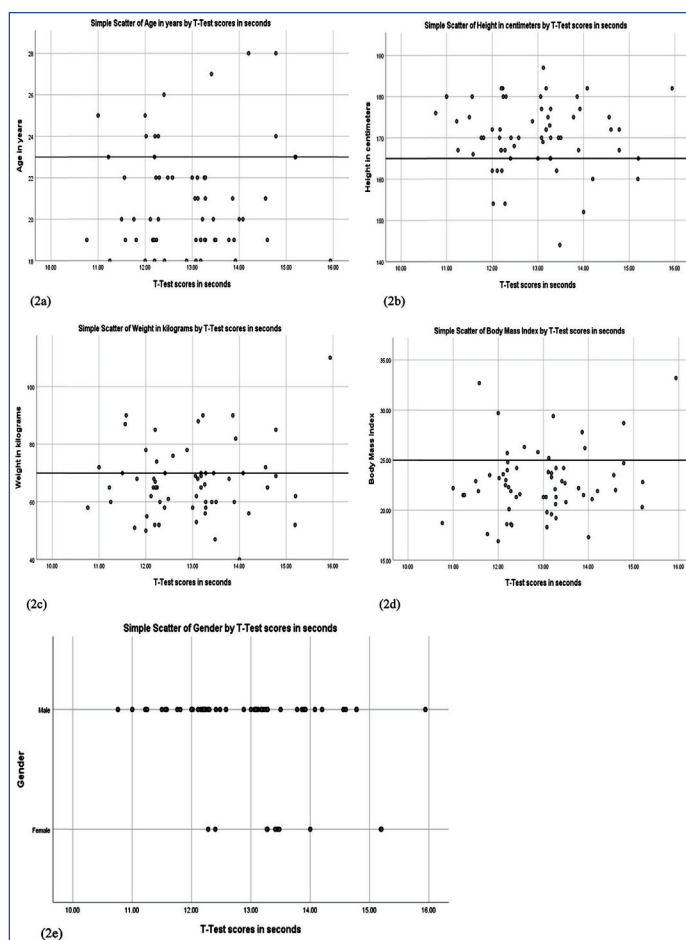
[Table/Fig-1]: Baseline characteristics of participants' demographics and fitness parameters.

Abbreviations: y: years; cm: centimeters; kg: kilogram; m: meters; sec: seconds; BMI: Body mass index; SD: Standard deviation; S & R: Sit and Reach

### Correlation between Anthropometric variables and Agility (t-test)

The results of the correlation analysis demonstrated no significant relationships between agility performance as determined by t-test and age ( $r=0.080$ ,  $p\text{-value}=0.268$ ), height ( $r=-0.046$ ,  $p\text{-value}=0.361$ ), or body weight ( $r=0.147$ ,  $p\text{-value}=0.127$ ) among recreational

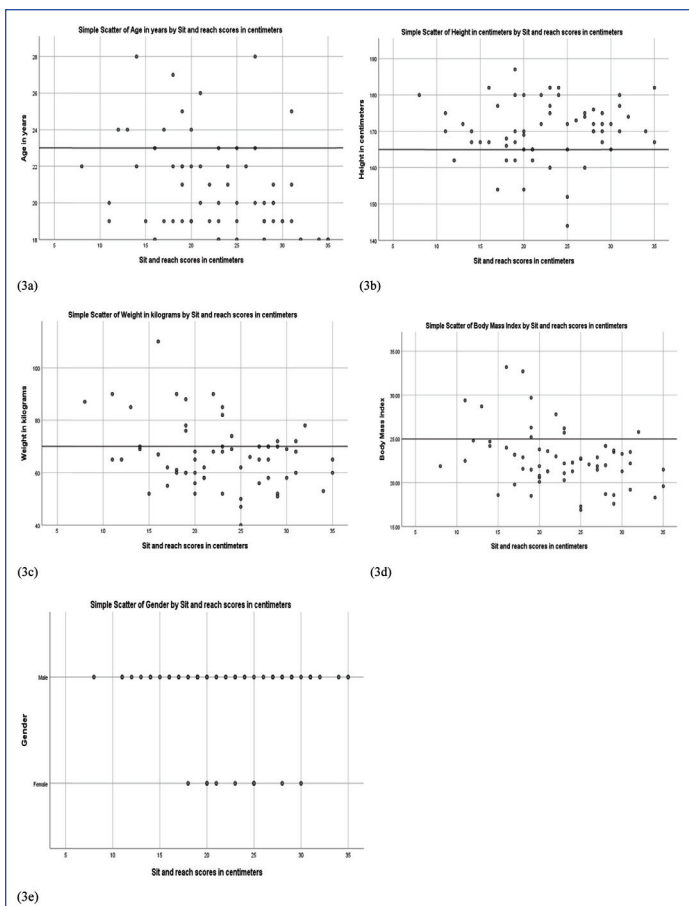
basketball players. BMI presented a small yet statistically significant positive association with t-test time ( $r=0.209$ ,  $p\text{-value}<0.05$ ), implying that individuals with greater BMI tend to exhibit poor agility performances. An additional, weak but significant negative correlation of gender and t-test values ( $r=-0.266$ ,  $p\text{-value}<0.05$ ) was found, which may indicate that male and female athletes differed in their agility performance. These findings imply that BMI may have little impact on agility among anthropometric factors, whereas age, height, and weight didn't show any associations with agility performance in recreational basketball athletes. The scatter plots in [Table/Fig-2-d] indicate no clear linear relationship between t-test performance and age, height, weight and BMI. Data points are widely dispersed around the horizontal reference line, suggesting weak or negligible associations, whereas the scatter plot for gender in [Table/Fig-2e] showed a slight clustering difference between genders with wide dispersion.



[Table/Fig-2]: Scatter plot showing the relationship between anthropometric variables and agility: a) Relationship between age and agility; b) Relationship between height and agility; c) Relationship between weight and agility; d) Relationship between BMI and agility; e) Relationship between gender and agility.

### Correlation between Anthropometric Variables and Flexibility (SRT)

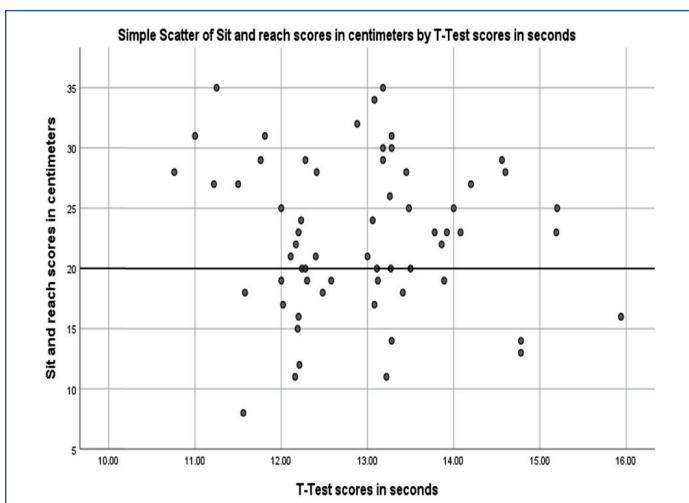
The SRT exhibit a significant negative correlation to age, ( $r=-0.323$ ,  $p\text{-value}=0.005$ ), weight ( $r=-0.296$ ,  $p\text{-value}<0.01$ ), and BMI ( $r=-0.359$ ,  $p\text{-value}<0.01$ ), indicating that increasing age, the more weight and higher BMI is associated with reduced flexibility. There was no significant correlation found between height and flexibility scores ( $r=0.073$ ,  $p\text{-value}=0.287$ ). No significant relationship was exhibited between gender and the SRT ( $r=-0.056$ ,  $p\text{-value}=0.332$ ). This data suggests that increasing body mass and increased body age factors may be associated with decreased flexibility, but height and sex differences have no effects on flexibility in the participants of this study. The scatter plots in [Table/Fig-3a-e] demonstrate no clear linear relationship between flexibility and age, height, weight, BMI and gender. Overall, the data showed a wide dispersion but with weight and BMI exhibiting a slightly downward scattered pattern.



**[Table/Fig-3]:** Scatter plot showing the relationship between anthropometric variables and flexibility: a) Relationship between age and flexibility; b) Relationship between height and flexibility; c) Relationship between weight and flexibility; d) Relationship between BMI and flexibility; e) Relationship between gender and flexibility.

### Correlation between Agility and Flexibility

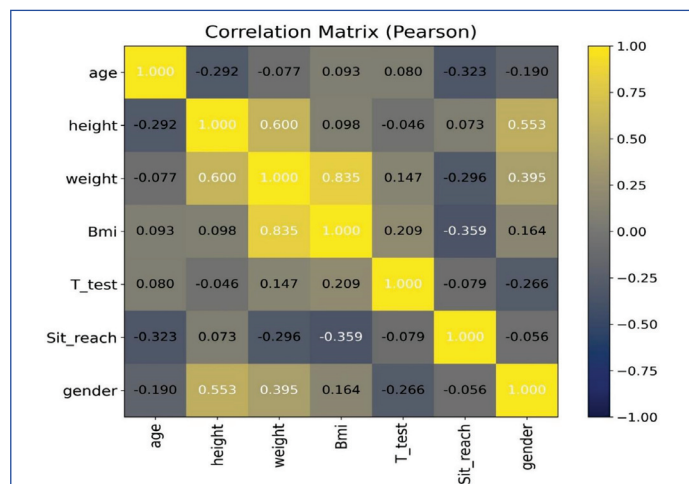
Pearson’s correlation analysis demonstrated a weak negative association between agility performance, measured through the t-test, and flexibility, as assessed by the SRT ( $r=-0.079$ ,  $p\text{-value}=0.272$ ). However, the relationship between these variables was not statistically significant, indicating that agility and flexibility are largely independent physical characteristics in this sample, as performance in one does not appear to predict performance of the other variable. The scatter plot in [Table/Fig-4] represents the wide dispersion of data around the reference line.



**[Table/Fig-4]:** Scatter plot showing the relationship between agility and flexibility.

The Heatmap presented in [Table/Fig-5] illustrates the strengths and direction of the association among anthropometric variables, agility and flexibility measurements. Agility performance did not show significant relationship with age, height and weight whereas BMI had a small correlation with t-test scores. Additionally, gender

exhibited a significant negative correlation with agility. With respect to flexibility, weight, and BMI had a significant negative correlation. In contrast, height and gender didn’t demonstrate any association.



**[Table/Fig-5]:** Correlation matrix for anthropometric measures and physical performance variables.

### Linear Regression Analysis for Prediction of Agility and Flexibility

A linear regression framework was employed for identifying whether age, height, weight, and BMI could predict agility and flexibility measures [Table/Fig-6,7]. For agility, regression model was not statistically significant,  $F(4,57) = 0.778$ ,  $p\text{-value} = 0.544$ ,  $R^2 = 0.052$ , indicating that the predictor variables accounted for 5.2% of the variance in agility scores. No predictor was found to be statistically significant (all  $p\text{-value} > 0.05$ ), indicating that age, height, weight, and BMI did not independently contribute to agility performance in this sample. For flexibility, the regression model was statistically significant,  $F(4,57) = 6.113$ ,  $p\text{-value} < 0.001$ ,  $R^2 = 0.300$ , indicating that 30.0% of the variance in flexibility scores was explained by the predictors. Height ( $\beta = 0.888$ ) and BMI ( $\beta = 0.960$ ) showed positive associations with flexibility, whereas age ( $\beta = -0.279$ ) and weight ( $\beta = -1.652$ ) were negatively associated. [Table/Fig-7] represents the regression analysis examining the relationship between flexibility and agility. The model revealed no significant correlation between agility and flexibility ( $B = -0.014$ ;  $\beta = -0.079$ ), indicating that flexibility accounted for only 0.6% of the variance in agility scores.

### Exploratory Analysis for Comparison

An exploratory analysis was conducted to examine differences in anthropometric and flexibility measures across high, moderate and low agility groups among male and female participants as shown in [Table/Fig-8,9], respectively. Among male participants ( $n=52$ ), participants were categorized into high- ( $n=21$ ), moderate- ( $n=17$ ), and low-agility ( $n=14$ ) groups. Minor variations were observed in anthropometric and flexibility characteristics across the agility groups, with comparatively higher weight and BMI values noted in the low-agility group [Table/Fig-8]. Among female participants ( $n=10$ ), only moderate-agility ( $n=3$ ) and low-agility ( $n=7$ ) groups were identified, with no participants categorised into the high-agility group. Minor variations were also observed across anthropometric and flexibility variables between the female agility groups [Table/Fig-9].

### DISCUSSION

The present study aimed to examine whether selected anthropometric variables- age, height, weight, and BMI- could predict agility and flexibility in recreational basketball players. The results indicate that none of these variables significantly contributed to the variance observed in either agility or flexibility scores. The findings state that the performance of agility in recreational basketball players may be more strongly influenced by more skill-related and neuromuscular factors rather than basic anthropometric characteristics.

Dependent variables	Predictors	B (95%CI)	$\beta$	R <sup>2</sup>	Adjusted R <sup>2</sup>	SEE	p-value
Agility	Age	0.019 (-0.095 to 0.133)	0.044	0.052	-0.015	1.105	0.748
	Height	-0.023 (-0.129 to 0.083)	-0.172				0.671
	Weight	0.020 (-0.105 to 0.145)	0.226				0.756
	BMI	0.011 (-0.363 to 0.385)	0.033				0.955
Flexibility	Age	-0.683 (-1.244 to -0.122)	-0.279	0.300	0.251	5.47	0.020
	Height	0.684 (0.161 to 1.207)	0.888				0.013
	Weight	-0.835 (-1.450 to -0.220)	-1.652				0.010
	BMI	1.814 (0.038 to 3.666)	0.960				0.060

**[Table/Fig-6]:** Regression analysis of anthropometric variables with agility and flexibility.

SEE: Standard error estimation, B: Unstandardised regression coefficient; CI: Confidence Interval;  $\beta$ : Standardised regression coefficient; R<sup>2</sup>: Coefficient of determination; adjusted R<sup>2</sup>: Adjusted coefficient of determination

Dependent variable	Predictor	B (95%CI)	$\beta$	R <sup>2</sup>	Adjusted R <sup>2</sup>	SEE	p-value
Agility	Flexibility	-0.014 (-0.058-0.031)	-0.079	0.006	-0.010	1.103	0.543

**[Table/Fig-7]:** Linear regression analysis of flexibility and agility.

SEE: Standard error estimation, B: Unstandardised regression coefficient; CI: Confidence Interval;  $\beta$ : Standardised regression coefficient; R<sup>2</sup>: Coefficient of determination; adjusted R<sup>2</sup>: Adjusted coefficient of determination

Variables	High agility (n=21) Mean±SD	Moderate agility (n=17) Mean±SD	Low agility (n=14) Mean±SD
Age (y)	20.71±2.41	20.18±1.66	21.21±3.30
Height (cm)	170.95±7.56	173.59±5.91	173.29±6.26
Weight (kg)	67.00±11.27	67.94±10.60	72.64±14.67
BMI (kg/m <sup>2</sup> )	22.71±3.66	22.51±3.11	24.07±3.78
Flexibility (cm)	21.86±7.19	24.18±6.82	21.57±5.88

**[Table/Fig-8]:** Exploratory comparison of anthropometric and flexibility characteristics among male participants (n=52) across agility groups.

SD: Standard deviation; An exploratory analysis was performed in which male participants were divided based on t-test scores into three groups (tertiles): high, moderate, and low agility, and descriptive statistics (mean±SD) were calculated and compared across groups.

Variables	High agility (n=0) Mean±SD	Moderate agility (n=3) Mean±SD	Low agility (n=7) Mean±SD
Age (y)	-	23.00±3.60	21.57±2.93
Height (cm)	-	161.33±6.35	159.71±8.88
Weight (kg)	-	55.33±3.05	55.57±10.03
BMI (kg/m <sup>2</sup> )	-	21.26±0.65	21.64±2.28
Flexibility (cm)	-	20.33±0.57	24.86±3.80

**[Table/Fig-9]:** Exploratory comparison of anthropometric and flexibility characteristics among female participants (n=10) across agility groups.

SD: Standard deviation; An exploratory analysis was performed in which Female participants were divided based on t-test scores into three groups (tertiles): high, moderate, and low agility and descriptive statistics (mean±SD) were calculated and compared across groups

Although BMI demonstrated a small correlation with agility which is broadly consistent with previous research literature. For instance, Dharmajayanti IA et al., reviewed and reported five studies as evidence of the association of BMI, agility and speed for athletes [25]. Height, weight and age demonstrated a weak negative association with agility in the present study. These outcomes are consistent with results stated by Koltai M et al., Garcia Gill M et al., and Neeraj K et al., all of which reported weak to negligible relationships [26-28]. Collectively, results reported that the performance of agility in recreational basketball athletes is less dependent on static anthropometric variables and more reliant upon other factors related to athleticism, such as sport-specific skills, neuromuscular coordination, and biomechanical characteristics of athletic tasks associated with agility testing. Neuromuscular factors influence agility through efficient coordination, proprioception, and dynamic stability, enabling rapid and controlled changes in direction.

Regarding flexibility, the results of this study identified negative associations with weight, BMI, and age. These findings are consistent with Akinoglu B et al., who observed negative correlations between bodyweight and flexibility among female athletes [29]. Similarly, Van der Horst N also stated similar results indicating a negative

correlation between BMI and hamstring flexibility among male amateur soccer players [30]. However, in contrast to the present study, a negative association of height and hamstring muscle length was identified, which was not observed in this study, as this was not part of the objective. The differences in findings may be attributed to differing sports, the physical demands of sports, and different types of ages of athletes. Nikolaïdis PT reported significant correlation between age and decreased flexibility among soccer athletes which additionally supports the outcomes of the present study [31].

The results in this study also identified a weak negative correlation between agility and flexibility indicating independent function of both variables. This finding was partially consistent with that of Tatlisu B et al., who identified an inverse relationship between both variables [32]. However, Shivalingaiah J et al., reported no significant correlation between the two variables investigated in their running study; the researchers may attribute their outcome to the differences in the directionality of both constructs [33]. Flexibility is thought to primarily be a one-dimensional construct, while agility is more of a multidimensional construct; as a result of these differences, the aforementioned researchers may have identified contradictory results. Richardson J and DeBeliso M observed no significant relationship between agility and flexibility of the ankle, since these variables demonstrated no association in the study, also the researchers suggested that there may be variation depending upon the populations being tested, such as runners versus collegiate females, or the testing protocols utilised to measure the variables [34].

Overall, this study provides a comprehensive examination of agility and flexibility in recreational basketball athletes using standardised assessments, contributing to the literature by clarifying the limited role of anthropometric factors. The basketball-specific context further enhances the practical relevance of these findings for training design, performance optimisation, and injury prevention strategies. The result of the present study highlights how anthropometric variables such as age, height, weight, BMI and flexibility exert minimal influence on agility performance among recreational basketball players. Therefore, practitioners and coaches should emphasise neuromuscular movement patterns that are specific to the athlete's sport as the primary elements incorporated in developing an agility-focused training program. Although flexibility training remains important for improving the quality of movement and decreasing the risk of injury but it shouldn't be regarded as a primary determinant factor for agility performance. Besides this the training programs should include task-specific activities which promote reaction ability, rapid changes in direction and coordination.

### Limitation(s)

Nonetheless, certain shortcomings need to be acknowledged, including the modest sport-specific sample size, which reduces

external applicability, and the observational study, which rules out causality. Moreover, unmeasured variables such as training history and neuromuscular efficiency could have affected the findings.

## CONCLUSION(S)

The present study investigated the relationship between anthropometric variables, flexibility and agility in recreational basketball athletes. The results demonstrated no statistically significant associations between the measured anthropometric variables and agility performance, alongside very weak or negligible correlations with flexibility. It is concluded that flexibility and anthropometric measures exhibit limited predictive value for agility performance within this population. Overall, the results suggest that agility is composed of many different factors and is specific to the task rather than based on basic anthropometric and flexibility characteristics.

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