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Assessment of Reaction Time and Agility in Badminton Players for Talent Identification in Uttarakhand

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ABSTRACT

Introduction: Badminton game requires open and fast actions toward the shuttlecock across the net at the court. Speedy nature of Badminton in terms of reaction time and agility requires to doing specific movements' of badminton. Many studies investigating reaction abilities and agility performance were well documented. **Aim of the study:** Present study was conducted to develop norms of reaction time and agility of state level badminton players' of Uttarakhand for talent identification, selection, training and improvement (TISTI) program. **Material and methods:** The purposive sampling was used to select n=50 players (25 girls and 25 boys) under the age of 8 to 14 years with playing experience of one year at inter-district level competition. Descriptive statistics, percentile and sigma scale were used to assess and develop norms of reaction time and agility. **Results:** The mean and standard deviation of reaction time and agility in boys were 0.15 sec ± 0.02 (0.11 to 0.20 sec) & 21.37 ± 2.24 (17.41-25.3) respectively. The mean and standard deviation of reaction time and agility in girls were 0.144 ± 0.024 (0.11 to 0.29 sec) & 20.88 ± 2.63 (16.6-28.8) respectively. The present study showed that the girls have performed

better reaction time and in agility compared to boys appeared in the test. Boys displayed higher values of time taken in both variables than as compare to girls' badminton players. The norms was divided in five groups/ five point scales, >P80 in Excellent (EX), P61 to P80 in Above Average (AA), P41 to P60 in Average (AV), P20 to P40 in Below Average (BA < P20 in Need Improvement (NI). **Conclusions:** Intensively, the norms may form to help in talent identification, selection, training and improvement (TISTI) in the field of Badminton at early phase.

Introduction

Badminton is one of the fastest sports with its long history spanning more than centuries was also played in India as a very similar game, called **'Poona' later called Badminton by British.** Badminton refers to a sport that is played with racket in which a shuttlecock is volleyed across a net. World federation defines any person who playing badminton at any competitive or non competitive level as a badminton player. The game involves most of the body muscles with the energy acquired from both aerobic and anaerobic processes. Regular badminton training enhances physical fitness, especially speed, strength and aerobic fitness. Badminton also requires a constant analysis of continuously changing situation on the court, focusing the player to racket precisely and quickly, improving his or her assessment and anticipating the next move (Cinthuja, et al., 2015).

Through the process of talent identification, a student's or player's latent abilities and untapped potentials in the realm of physical activities and sporting prowess can be uncovered. The government of India (GoI) also introduced Khelo India Protocols (KIP) for better shaping of Indian Sports (Talent identification Protocols, 2025). The process of determining a performer's level of competence and providing that individual with the opportunity to engage in an activity that plays to his or her strengths is known as talent identification. It has been suggested in multiple studies (Gould and Carson, 2008; Meylan et al., 2010; David et al., 2000), that brilliant children should be selected for opportunities based on how good they will be in the future rather than on how good they are now. William et al. (1998) explained that talent identification programme should address four common phases, which are talent detection, talent identification, talent selection, and talent development. These four phases are all related to talent nurturing.

In terms of speed in Badminton, exclusively, the shuttlecock's speed can reach up to 493 km/h, which is the fastest recorded speed for any projectile in a racket sport (The physics behind badminton, 2025). This speed, combined with the rapid reflexes and quick footwork required, contributes to badminton's reputation as a fast-paced and dynamic sport. Players need extremely quick reflexes to react to the shuttlecock's speed and direction in requisites of good reaction and Badminton game demands rapid changes in direction, lunges and jumps, high level of agility and speed along with so many other physical and mental potential.

Agility is an important physical capacity for sport performance. The sports-science literature presents different definitions of agility, but overall agility is defined as the ability to move and control the body as quickly as possible during required accelerations, decelerations, and direction changes (Beekhuizen, et al., 2009: Twist & Benicky, 1996). However, in most sports, fast body movement is preceded by selection of where to run. Hence, successful sports performance depends not only on movement time but also on the athlete's ability to quickly and effectively define the direction in which he or she should run. Thieschafer & Busch (2022) stated that rising in agility research in youth is still in its infancy. As consider the significance of agility for different sports performance, prospect investigation is suggested to design evidence based strategies for long-term agility development in young athletes.

Considering the relevance of the processes associated with decision making, Sheppard & Young (2006) proposed a new definition for agility as a rapid whole-body movement with change of velocity or direction in response to a stimulus. Thus, the tasks involving preplanned movements should be considered not agility but change of direction (COD) (Loureiro, & de Freitas, 2016).

Reaction time is defined as the period of time that elapses between the occurrence of a stimulus and initiation of the movement (Bankosz, Nawara, & Ociepa, 2013). It involves reception of the stimuli by the sense organ, conduction of the information through the nerve to the brain and from the brain to the muscle contraction, and the movement of the muscle. The contribution of the central processes in the brain is usually far larger than all the others put together (Welford, 1977).

Aim of Study

The players of Uttarakhand like Lakshya Sen, the Thomas Cup winner and bronze medalist of World Championship is inspiring the game's growth in this hilly state of India. From Almora to Kashipr to Pithoragarh to Dehradun, badminton courts have come up and several toddlers of badminton from the state are among India's most promising at junior and other age-groups (Lakshya Sen drives

Uttarakhand's badminton, 2025). TISTI program are direly needed scientific framework, protocol as such norms construction with special reference to physical attributes, geographical conditions etc of that particular region. Norms for reaction time and agility in badminton talent identification involve establishing baseline performance levels for these physical attributes. These norms are used to assess a player's potential and track their progress, with higher scores generally indicating better performance which may helpful to fill the gap of scanty edge of Uttarakhand Badminton TISTI program.

Material & Methods

Participants

This normative study was conducted on state level badminton players of Uttarakhand who were represented their district at state level and some were played for their state also at inter- state level competitions. Purposive sampling was used to select the participants for study consisting of 50 Uttarakhand state level badminton players (30 girls and 30 boys) with age range of 8 to 14 years. The consent was taken from the participants and demographic data was also collected. Anthropometric reading such as height, weight, was measured: body mass index (BMI) was calculated which was followed by the general details. Two motor fitness tests were performed such as reaction time (RT) and agility (AY) for the present study which are conducted in district sports stadiums, academies and clubs of Uttarakhand.

Variable

Age- Official records

Level of Participation- Sports participant certificate

Reaction Time– Ruler drop reaction time test

Agility- Zigzag agility fitness test

Design

Purposive sampling as the nature of the present study to meet the sports training and competition bas was set minimum inter-district (state) level participation by the participants

Procedure

The participants who full the inclusion criteria were selected in the present study. An appropriate training was given to the investigating supporting team on the operation of equipment and the use of standardized testing protocols to ensure that the all tests are conducted in a valid and reliable manner as

required. Planned visits were made according to the dates agreed by the stadium/ academies authorities. Consent letters were collected and the procedure, purpose of the study was explained to the in-charge, coach and the participating shutters. All the participants were familiarized about testing administration with demonstration of activity if needed. The data collection form were directed by the investigator while athlete performing the tests. Warm up and stretching exercises were done 15 min before starting the test procedure. Age, height, weight and competition level, were recorded followed by reaction time and agility test were perform. Scores were recorded for selected test as required followed by statistical analysis.

Statistical Analysis

Descriptive Statistics used to analyze the data, such as mean, standard deviation, range and percentile. For norms construction, five point sigma scales was prepared by using percentiles. Based on the norms, the badminton players were classified into five grades and these grades are ranging from excellent to very poor on the five points scale i e. Excellent (EX), Above Average (AA), Average (AV), Below Average (BA) and Need Improvement (NI) scale/groups.

Results

Mean scores along with SD and range of reaction time (RT) and agility (Ag) of boys and girls badminton players of Uttarakhand are presented in table 1 and 2 followed by graphical representation figure 1 to 4 respectively.

Table 1. Descriptive Statistics of Reaction Time and Agility of Boys' Badminton Players

Motor Fitness Component	Test Items	Mean ± SD	Minimum	Maximum
Reaction Time	Ruler Drop Reaction Time (sec)	0.15 ± 0.02	0.11	0.20
Agility	Zig- Zag Run Agility (sec)	21.37 ± 2.24	17.41	25.3

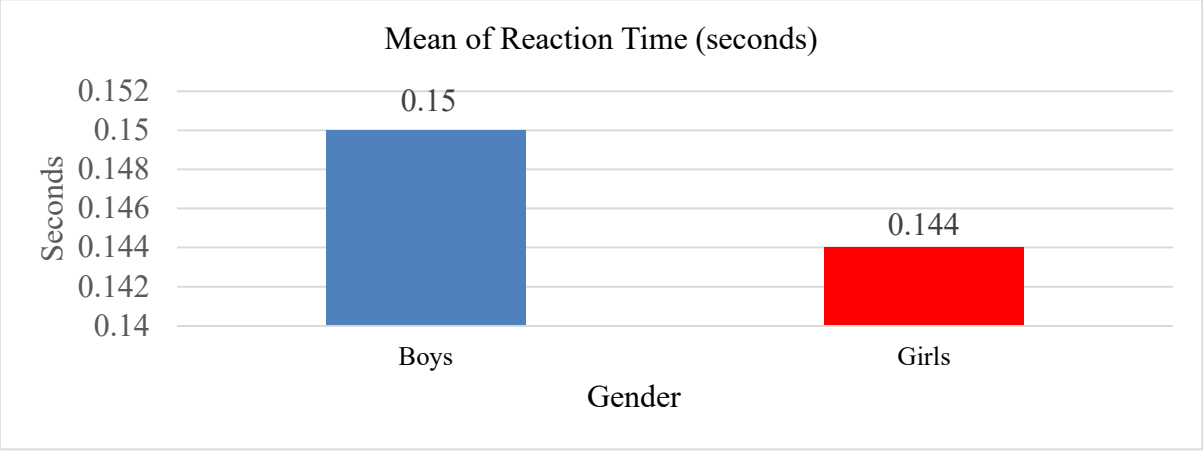
The mean and SD of reaction time and agility were 0.15 ± 0.02 & 21.37 ± 2.24 respectively, whereas minimum and maximum value of reaction time was 0.11 sec and 0.20 sec. The minimum value for Zig Zag agility was 17.41 seconds, whereas the maximum value was 25.3 seconds (Table 1).

Table 2. Descriptive Statistics of Reaction Time and Agility of Girls' Badminton Players

Motor Fitness Component	Test Items	Mean ± SD	Minimum	Maximum
Reaction Time	Ruler Drop Reaction Time (sec)	0.144 ± 0.024	0.11	0.29
Agility	Zig- Zag Run Agility (sec)	21.37 ± 2.24	16.60	28.8

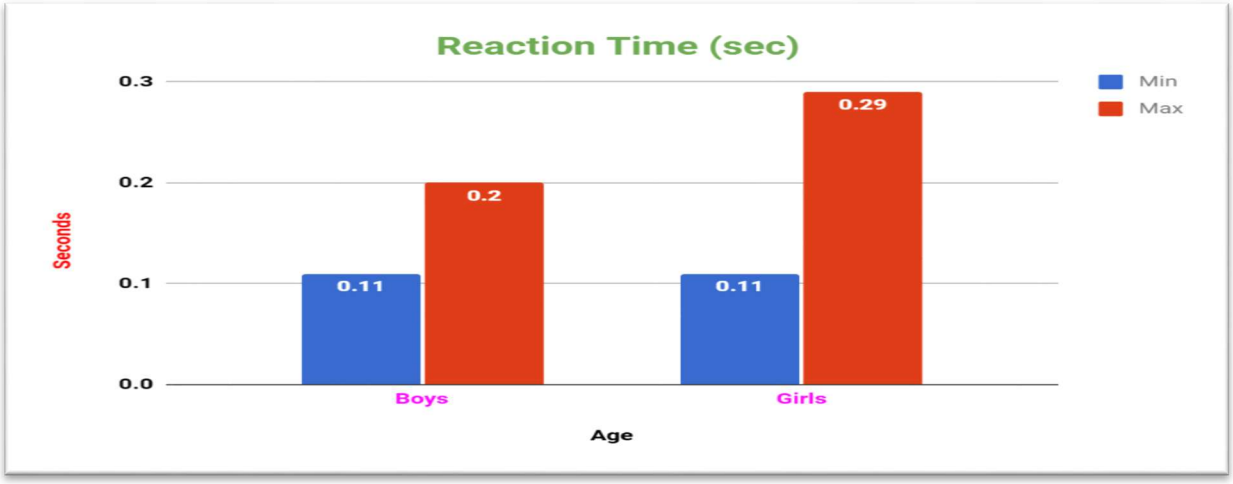
The table 2 displays the Mean ± SD of reaction time and agility for talent identification players of age of eight to fourteen years girls in badminton of Uttarakhand. The mean and SD of reaction time was 0.144 ± 0.024 whereas minimum and maximum value of Reaction Time was 0.11 sec and 0.29 sec. The mean and SD of Zig Zag Agility was 20.88 ± 2.63 seconds, whereas the minimum and maximum value were 16.6 and 28.8 seconds respectively.

Figure 1. Comparison of Mean Values of Reaction Time of Boys' and Girls' Badminton Players



The girls have performed better reaction time compared to boys appeared in the test. Boys displayed higher values than girls mean (Figure 1).

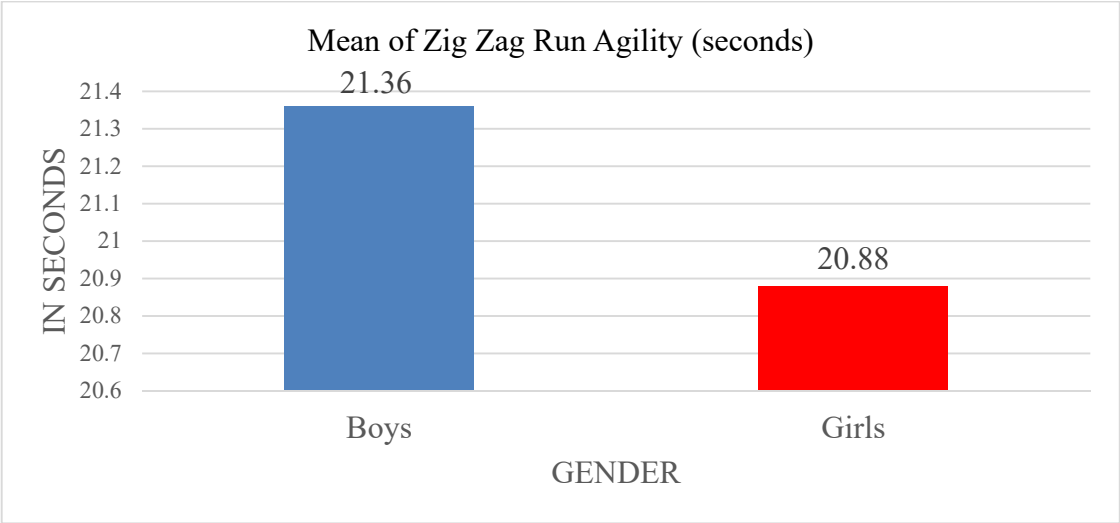
Figure 2. Minimum and Maximum Values of Reaction Time of Boys' and Girls' Badminton Players



The maximum values of boy's players were less than the girl's players however both are claimed similar lower value in RT (Figure 2). Minimum value score by each gender was 0.11 sec whereas maximum value was presented by the Girls players. The more variation between the minimum and maximum scores of was observed in the boys and girls badminton players, whereas minor variation was seen in the case of the boys. The deference between minimum and maximum value was greater in case of girls' players.

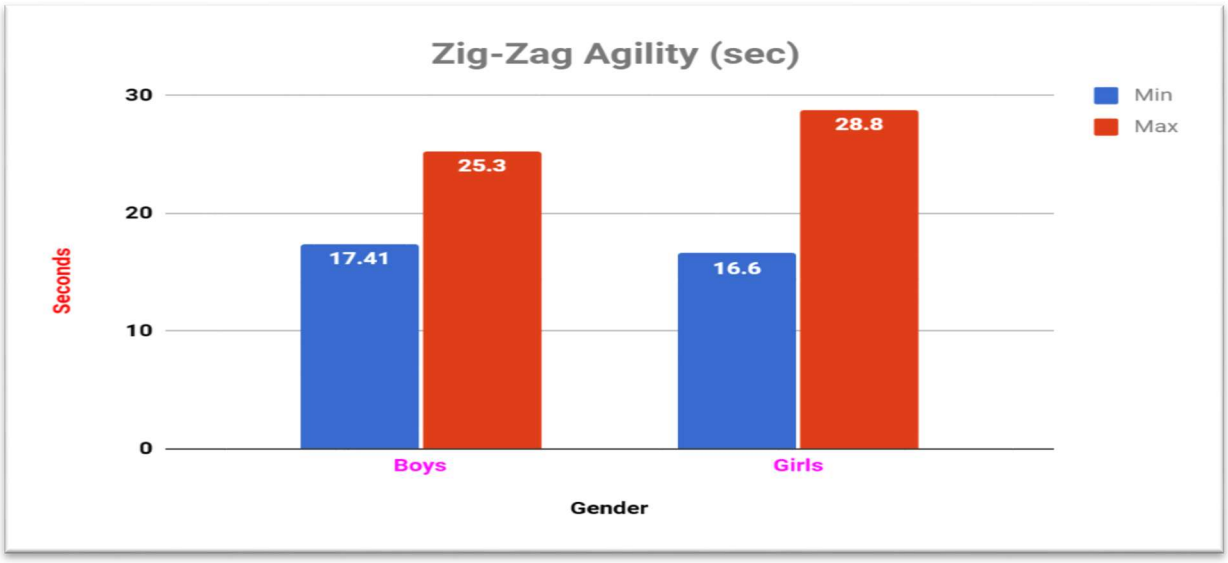
The figure given below was a graphical presentation of the mean score and maximum and minimum values of Zig-zag run agility for selected Badminton boys and girls players with age of eight to fourteen years have been displayed in Figure 3 to 4 respectively.

Figure 3. Comparison of Mean Values of Agility of Boys' and Girls' Badminton Players



The boys badminton players have been greater mean value scores as compare to girls' badminton players (Figure 3). There was much difference between the mean value of boys and girls. Girl player's performance was good in terms of lesser comparison to boys' players.

Figure 4. Minimum and Maximum Values of Agility of Boys' and Girls' Badminton Players



The greater variation between the minimum and maximum scores for Zig-zag run for agility was observed in the boys' subjects followed by girls. The minimum score of 17.41 was observed in the boy's badminton players, and a score of 16.60 was observed in the case of girls. Further, the maximum score for Zig-zag running was observed in the boys which are 25.3 seconds and in girls was 28.8 seconds respectively (Figure 4).

Table 3. *Norms Structure for Agility and Reaction Time for Uttarakhand Boys' and Girls' Badminton Players*

Motor Fitness Category	Percentile Value
Excellent (EX)	> P 80
Above Average (AA)	P 61 to P 80
Average (AV)	P 41 to P 60
Below Average (BA)	P 20 to P 40
Need Improvement (NI)	< P 20

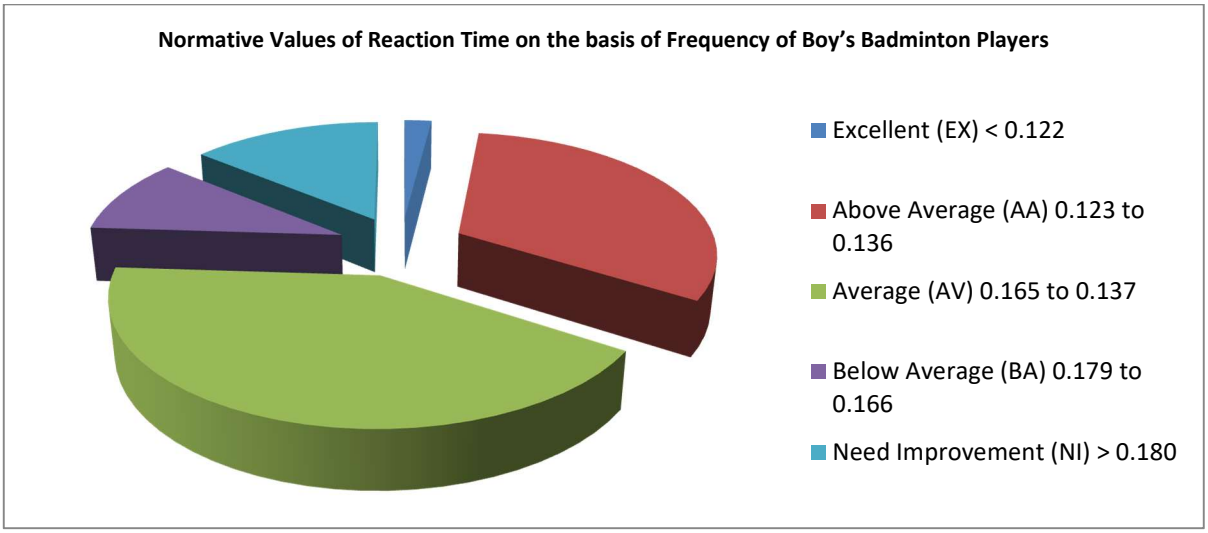
Table 3 reflects the percentile value and motor fitness category nomenclature under five categories of motor fitness namely- Excellent (EX), Above Average (AA), Average (AV), Below Average (BA) and Need Improvement (NI) scale/groups.

Norm's construction structure and scale for motor fitness components reaction time (RT) and agility (AY) of Uttarakhand boys' and girls' badminton players are shown in following tables 4-7 followed by figure 5-8.

Table 4. Normative Values, Frequency & Percentage of Reaction Time for Boy's Badminton Players

Categories	Normative Values	Frequency	Percentage
Excellent (EX)	< 0.122	01	02
Above Average (AA)	0.123 to 0.136	16	32
Average (AV)	0.165 to 0.137	21	42
Below Average (BA)	0.179 to 0.166	05	10
Need Improvement (NI)	> 0.180	07	14

Figure 5. Normative Values of Reaction Time on the Basis of Frequency of Boy's Badminton Players



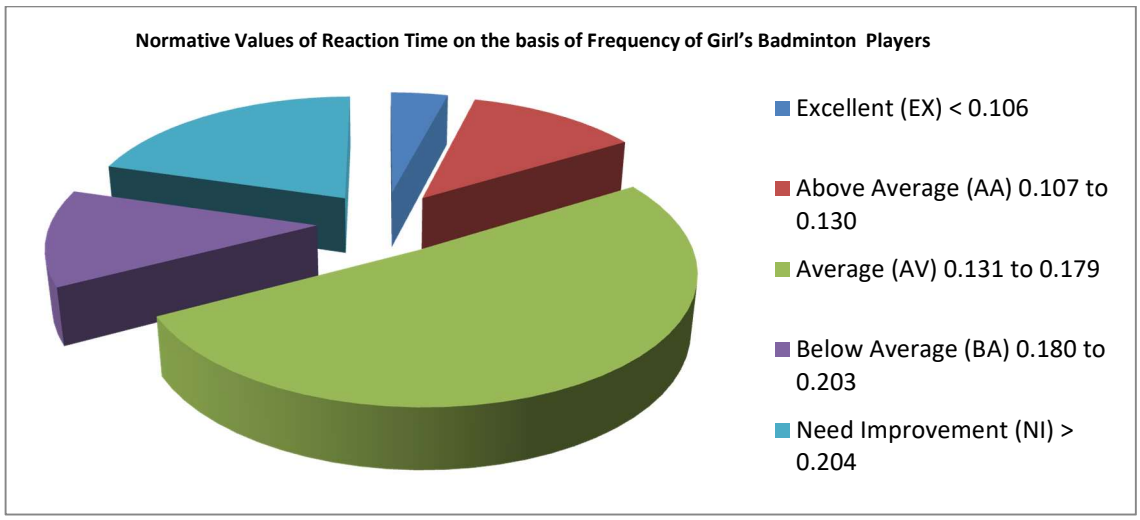
The normative value of reaction time for boys in the category of EX having a score of less than 0.122 seconds ; participants having a score between 0.123 seconds to 0.136 fall in the category of AA; subjects having a score between 0.137 to 0.165 seconds fall in the category of AV; participants having a score between 0.166 to 0.179 seconds fall in the category of BA; and players having a score of greater than 0.180 seconds fall in the category of NI. It could be summarized there were 02 % (01) subjects were in

the excellent (EX) category; 24% (12) of the participants lay in above average (AA) category; 42% (21) of subjects were in the average (AV) category; 08% (04) of the subjects were in below average (BA); and 16% (08) of the participants were in need to improvement (NI) category (table 4 and figure 5).

Table 5. Normative Values, Frequency & Percentage of Reaction Time for Girl's Badminton Players

Categories	Normative Values	Frequency	Percentage
Excellent (EX)	< 0.106	02	04
Above Average (AA)	0.107 to 0.130	06	12
Average (AV)	0.131 to 0.179	25	50
Below Average (BA)	0.180 to 0.203	06	12
Need Improvement (NI)	> 0.204	10	20

Figure 6. Normative Values of Reaction Time on the basis of Frequency of Girl's Badminton Players



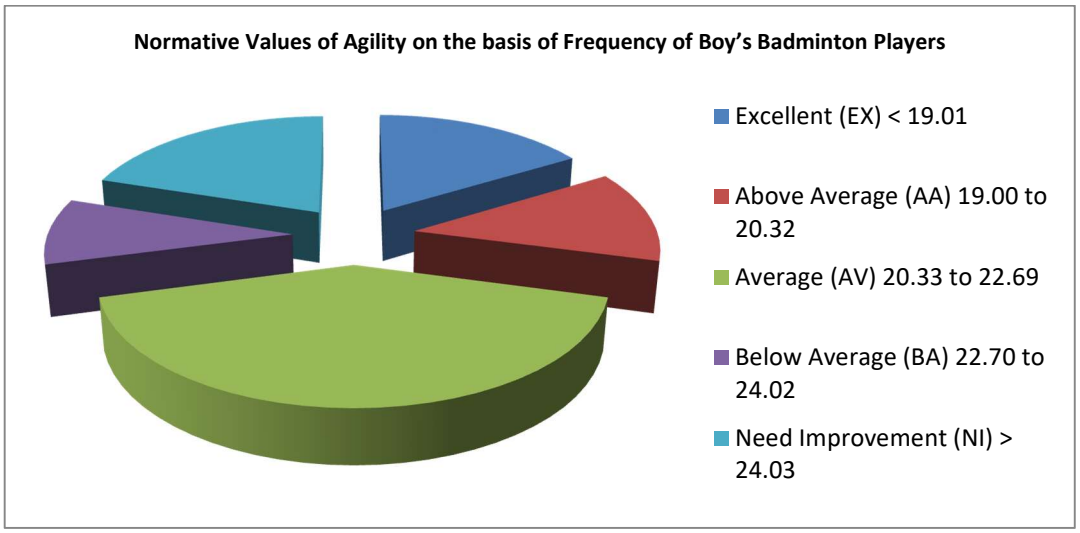
The participants having a score of less than 0.106 seconds fall in the category of excellent (EX); subjects having a score between 0.107 seconds to 0.130 fall in the category of above average (AA); subjects having a score between 0.131 to 0.179 seconds fall in the category of average (AV); subjects having a score between 0.180 to 0.203 seconds fall in the category of below average (BA); and subjects having a score of greater than 0.204 seconds fall in the need improvement category. It may be summarized that there were 04 % (02) subjects were in the excellent category; 12% (06) of the subjects lay in above average category; 50% (25) of subjects were in the average category; 12% (06) of the subjects were in

below average category; and 20% (10) of the subjects were in need to improvement category (table 5 and figure 6).

Table 6. Normative Values, Frequency & Percentage of Agility for Boy's Badminton Players

Categories	Normative Values	Frequency	Percentage
Excellent (EX)	< 19.01	09	18
Above Average (AA)	19.00 to 20.32	07	14
Average (AV)	20.33 to 22.69	23	46
Below Average (BA)	22.70 to 24.02	05	10
Need Improvement (NI)	> 24.03	11	22

Figure 7. Normative Values of Agility on the basis of Frequency of Boy's Badminton Players



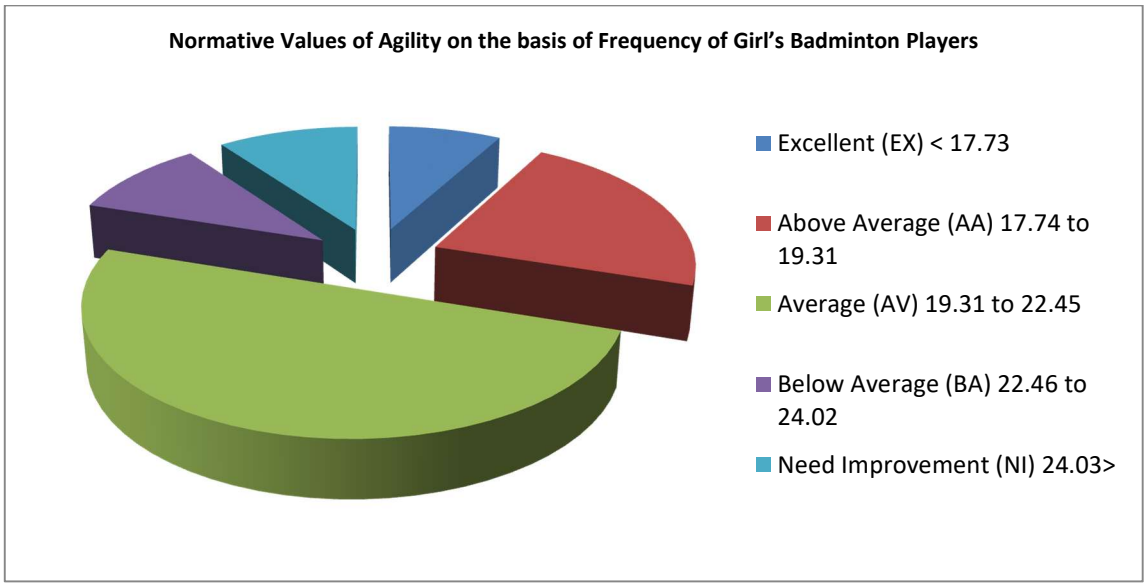
The table 6 and figure 7 display the normative value of Zig-Zag running test to know the agility of boys badminton players of Uttarakhand. The participants having a score of less than 19.01 seconds fall in the category of excellent; subjects having a score between 19.00 seconds to 20.32 fall in the category of above average; subjects having a score between 20.33 to 22.69 seconds fall in the category of average; subjects having a score between 22.70 to 24.02 seconds fall in the category of below average; and subjects having a score of greater than 24.03 seconds fall in the category of need improvement.It also reflects percentage and frequency distribution of subjects under five categories of fitness. It may summarized from that there were 18 % (09) subjects were in the excellent category; 14% (07) of the subjects lay in above average category; 46% (23) of subjects were in the average category; 10% (05) of

the subjects were in category below average; and 22% (11) of the subjects were in need improvement (NI) category.

Table 7. Normative Values, Frequency & Percentage of Agility for Girl's Badminton Players

Categories	Normative Values	Frequency	Percentage
Excellent (EX)	< 17.73	04	08
Above Average (AA)	17.74 to 19.31	11	22
Average (AV)	19.31 to 22.45	25	50
Below Average (BA)	22.46 to 24.02	05	10
Need Improvement (NI)	24.03>	05	10

Figure 8. Normative Values of Agility on the basis of Frequency of Girl's Badminton Players



The table 7 and figure 8 display the normative value of Zig-Zag running test to check the agility of girl's badminton players of Uttarakhand. The table indicates that participants having a score of less than 17.73 seconds fall in the category of excellent; subjects having a score between 17.74 seconds to 19.31 fall in the category of above average; subjects having a score between 19.32 to 22.45 seconds fall in the category of average; subjects having a score between 22.46 to 24.02 seconds fall in the category of below average; and subjects having a score of greater than 24.03 seconds fall in the need improvement (NI) category.

It is also reflected the percentage and the frequency distribution of subjects fewer than five categories of fitness. It may be summarized from the above table that there were 04 % (02) subjects were in the excellent category; 22% (11) of the subjects lay in above average category; 25% (50) of subjects were in the average category; 10% (05) of the subjects were in below average category; and 10% (05) of the subjects were in need improvement (NI) category.

Discussion

The prime intention of the researcher was to construct a comprehensive module with limited number of test items and greater level of dependability in terms of selected motor fitness as agility and reaction time in Badminton performance. Two motor fitness tests were performed such as reaction time (RT) and agility (AY) for the present study which are conducted in district sports stadiums, academies and clubs of Uttarakhand. Badminton prominently demands a steady analysis of continuously changing situation on the court; spotlight the player to racket precisely and rapidly, improving his or her assessment and anticipating the next move (Cinthuja, et al., 2015).

This speed, combined with the rapid reflexes and quick footwork required, contributes to badminton's reputation as a fast-paced and dynamic sport. Players need extremely quick reflexes to react to the shuttlecock's speed and direction in requisites of good reaction and Badminton game demands rapid changes in direction, lunges, and jumps, high level of agility and speed along with so many other physical and mental potential.

The present study showed that the girls have performed better reaction time and in agility Zig Zag run compared to boys appeared in the test. Boys displayed higher values of time taken in both variables than as compare to girls' badminton players. Same type of results and finding was reported by Bankosz, Nawara, & Ocipa (2013) that the difference was found between results of all tests taken by boys and most tests taken by girls. The comparison of the obtained reaction times displayed by badminton players with the available standards proved that their values were mostly average, which might be the consequence of the fact that in badminton, like in many other sports, more complex factors, e.g. choice reactions anticipation, etc., are of far greater significance.

Tiwari, Rai, & Srinet, (2011) finding indicates that speed, agility, explosive strength, shoulder strength and muscular endurance were important variables for better performance in Badminton.Furthermore, Cinthuja, et al. (2015) concluded that it decreased player's performance by decreasing agility and speed. It has been suggested in multiple studies (David et al., 2000; Gould and Carson, 2008; Meylan et al.,

2010) that brilliant children should be selected for opportunities based on how good they will be in the future rather than on how good they are now. William et al. (1998) addressed four common phases of TISTI program, which are talent detection, talent identification, talent selection, and talent development. The findings of the study may helpful to find early bird to explore at right pace and place at right time also.

Conclusion

The norms evolved in the present study can be used to find out the performance of players in the motor fitness in agility and reaction time and to locate the talented badminton players at early level TSTI program.

The examination was intended to build up the standards norms for evaluating the motor fitness performance specially agility and reaction time of badminton players TSTI program as the nature of this one of the most promising game of Uttarakhand as well as India. Researchers are trying to fill the gap to standardized motor fitness norms for badminton players of Uttarakahand.

Further interdisciplinary work is needed to enhance understanding of coordination with quick and agile skills in Badminton to predict talent at right time.

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Conflict of Interest

The authors declare no conflict of interest.

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