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Construction of physical fitness norms for the students of athletics background

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Abstract
Study Aim: The aim of the study was to construct physical fitness percentile norms and distribution of grades for the students of athletics background.
Material and Methods: Forty-five (N=45) male subjects, ages 18 to 25, from the Department of Physical Education at Guru Nanak Dev University in Amritsar, Punjab, India, participated in the observational research study. The subsequent physical fitness variables were measured *viz.*, Strength and Power Abilities (*viz.*, Muscular Strength & Muscular Power), Endurance Abilities (*viz.*, Muscular Endurance), Basic Movement Patterns (*viz.*, Running Speed, Running Agility, Jumping Ability & Throwing Ability), Neuromuscular Abilities (Flexibility & Balance).
Statistical Analysis: The normality of the data was checked by using the Shapiro-Wilk (SW) Test of Normality. Under the data analysis, exploration of data was made with descriptive statistics and graphical analysis. Distribution of Grades under Normal Distribution was used, further it was sorted into five grades i.e., Excellent, Good, Average, Poor & Very Poor Descriptive and percentile statistics calculator was used for data analysis.
Results: In Muscular Strength: - Rating below 4.366 was very poor, 4.366 -14.625was poor, 14.625-35.143 was average, 35.143-456.402 was good whereas, rating above 45.402 was excellent. In Muscular Power: - The rating below 29.453 was very poor, 29.453 -32.382 was poor, 32.382-38.24 was average, 38.24-41.169 was good whereas, Rating above 41.169 was excellent. In Muscular Endurance: - The rating below 1.43 was very poor, 1.43-2.826 was poor, 2.826-5.618 was average, 5.618-7.014 was good whereas, Rating above 7.014 was excellent. In Running Speed: - The rating above 4.252 was very poor, 4.252-4.164 was poor, 4.164-3.988 was average, 3.988-3.9 was good whereas, Rating below 3.9 was excellent. In Running Agility: - The rating above 22.376 was very poor, 22.376 -21.738 was poor, 21.738-20.462 was average, 20.462-19.824 was good whereas, Rating below 19.824 was excellent. In Jumping Ability: - The rating below 1.616 was very poor, 1.616-1.762 was poor, 1.762-2.054 was average, 2.054-2.22 was good whereas, Rating above 2.2 was excellent. In Throwing Ability: - The rating below 1.956 was very poor, 1.956-2.989 was poor, 2.989-5.055 was average, 5.055-6.088 was good whereas, Rating above 6.088 was excellent. In Flexibility: - The rating below 12.957 was very poor, 12.957-14.956 was poor, 14.956-18.954 was average, 18.954-20.953 was good whereas, Rating above 20.953 was excellent. In Balance: - The rating below 11.748 was very poor, 11.748-13.574 was poor, 13.574-17.226 was average, 17.226-19.052 was good whereas, Rating above 19.052 was excellent. In Muscular Strength: -The 10th percentile is 13.5 and 90th percentile is 41.72. In Muscular Power: -The 10th percentile is 31 and 90th percentile is 40. In Muscular Endurance: -The 10th percentile is 2 and 90th percentile is 6. In Running Speed: -The 10th percentile is 3.96 and 90th percentile is 4.19. In Running Agility: The 10th percentile is 20.13 and 90th percentile is 21.85. In Jumping Ability: The 10th percentile is 1.684 and 90th percentile is 2.096. In Throwing Ability: The 10th percentile is 3 and 90th percentile is 5.6. In Flexibility: The 10th percentile is 14 and 90th percentile is 20 and In Balance: The 10th percentile is 13 and 90th percentile is 18.

Keywords: Norms, percentile, strength and power abilities, endurance abilities, basic movement patterns, neuromuscular abilities

Introduction
Physical activity and physical fitness are significant skill and health-related factors for the youth population [1, 2]. Physical fitness, which can be achieved by physical activity, is the ability of the body to adapt to the surrounding environment [3, 4, 5]. Physical fitness is an important indicator of physical and mental health across the lifespan [6]. An emerging body of research has also shown the importance of physical fitness for cognitive functioning and

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attention [7, 8]. Physical fitness is a multicomponent construct that is closely related to the ability to perform physical activity [9, 10]. It is considered to be an important health marker, because high levels of fitness during childhood and adolescence have a positive impact on adult health [11]. Additionally, higher levels of physical fitness enable participation in a variety of physical activities and decrease the risk of health problems [12, 13]. A norm is a benchmark against which grades are measured. It is to some extent the basic components of a scientific test because all tests are regulated and controlled by standards. Basically, a standard is a way of doing things. Thus, the test order is based on its standards. However, the standards for different tests may vary. A standard is a set of rules that apply to different test groups. It is a set of instructions for conducting experiments in a scientific manner. A standard is not a standard established by a statistical average of people's actions. This is expected behavior. In the sense that most people follow it as standard practice, it is statistical. Standards are not strict guidelines.

Material and Methods Participants
Participants:
Forty-five (N=45) male subjects, ages 18 to 25, from the Department of Physical Education at Guru Nanak Dev University in Amritsar, Punjab, India, participated in the observational research study.

Variables
Strength and Power Abilities
- Muscular Strength.
- Muscular Power.

Endurance Abilities
- Muscular Endurance.

Basic Movement Patterns
- Running Speed.
- Running Agility.
- Jumping Ability.
- Throwing Ability.

Neuromuscular Abilities
- Flexibility.
- Balance.

Ethical Considerations
The following moral standards were established for the duration of the study.
- Students' well-being and dignity were always upheld.
- The researcher had the subjects' consent to use their true identities in the research report, and the research data was kept private throughout the investigation.

Statistical analysis
- Under the data analysis, exploration of data was made with descriptive statistics and graphical analysis.
- Distribution of Grades under Normal Distribution was used, further it was sorted into five grades i.e.,
a. Very Poor.
b. Poor.
c. Average.
d. Good.
e. Excellent.
- Descriptive and percentile statistics calculator was used for data analysis.

Results

Table 1: Descriptive statistics of subjects of university boys for Strength and Power Abilities (*viz*., Muscular Strength & Muscular Power), Endurance Abilities (*viz*., Muscular Endurance), Basic Movement Patterns (*viz*., Running Speed, Running Agility, Jumping Ability & Throwing Ability), Neuromuscular Abilities (Flexibility & Balance).

Sr. No.	Physical Fitness		Mean (X) & Standard Deviation (SD)		Max.	Min.
1.	Strength and Power Abilities	Muscular Strength	Mean	24.884	44.3	12.6
			SD	10.259		
2.		Muscular Power	Mean	35.311	40	30
			S. D	2.929		
3.	Endurance Abilities	Muscular Endurance	Mean	4.222	6	2
			SD	1.396		
4.	Basic Movement Patterns	Running Speed	Mean	4.076	4.20	3.95
			SD	0.088		
5.		Running Agility	Mean	21.100	21.92	20.01
			SD	0.638		
6.		Jumping Ability	Mean	1.908	2.11	1.60
			SD	0.146		
7.		Throwing Ability	Mean	4.022	6	3
			SD	1.033		
8.	Neuromuscular Abilities	Flexibility	Mean	16.955	20	14
			SD	1.999		
9.		Balance	Mean	15.4	18	13
			SD	18.26		

1. **Muscular Strength:** The Mean (X) & Standard Deviation (SD) counts was 24.884 and 10.259 respectively, whereas the maximum and minimum counts was 44.3 and 12.6 reciprocally.
2. **Muscular Power:** The Mean (X) & Standard Deviation (SD) counts was 35.311and 2.929 respectively, whereas the maximum and minimum counts was 40 and 30 reciprocally.

3. **Muscular Endurance:** The Mean (X) & Standard Deviation (SD) counts was 4.222and 1.396 respectively, whereas the maximum and minimum counts was 6 and 2 reciprocally.
4. **Running Speed:** The Mean (X) & Standard Deviation (SD) counts was 4.076and 0.088 respectively, whereas the maximum and minimum counts was 4.20 and 3.95 reciprocally.

5. **Running Agility:** The Mean (X) & Standard Deviation (SD) counts was 21.100 and 0.638 respectively, whereas the maximum and minimum counts was 21.92 and 20.01 reciprocally.

6. **Jumping Ability:** The Mean (X) & Standard Deviation (SD) counts was 1.908 and 0.146 respectively, whereas the maximum and minimum counts was 2.11 and 1.60 reciprocally.

7. **Throwing Ability:** The Mean (X) & Standard Deviation (SD) counts was 4.022 and 1.033 respectively, whereas

the maximum and minimum counts was 6 and 3 reciprocally.

8. **Flexibility:** The Mean (X) & Standard Deviation (SD) counts was 16.955and 1.999 respectively, whereas the maximum and minimum counts was 20 and 14 reciprocally.

9. **Balance:** The Mean (X) & Standard Deviation (SD) counts was 15.4 and 18.26 respectively, whereas the maximum and minimum counts was 18 and 13 reciprocally.
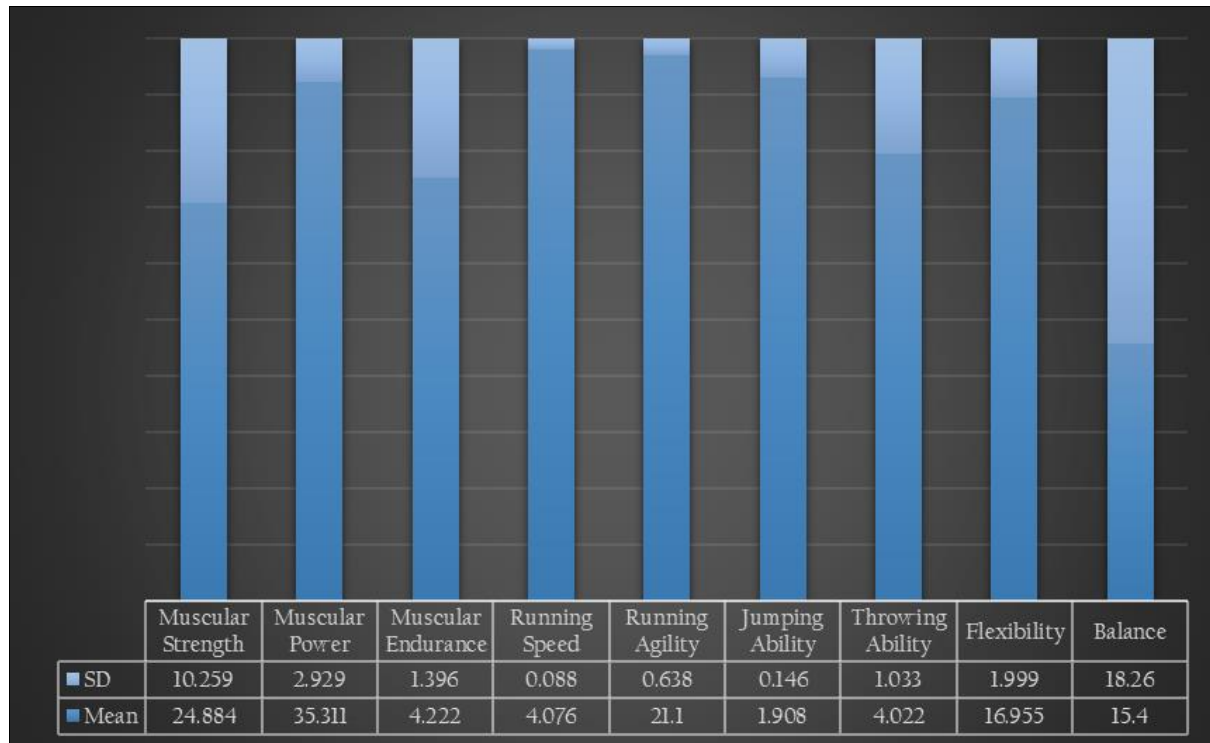

	Muscular Strength	Muscular Power	Muscular Endurance	Running Speed	Running Agility	Jumping Ability	Throwing Ability	Flexibility	Balance
■ SD	10.259	2.929	1.396	0.088	0.638	0.146	1.033	1.999	18.26
■ Mean	24.884	35.311	4.222	4.076	21.1	1.908	4.022	16.955	15.4

Fig 1: Graphical illustration of descriptive statistics of subjects of university boys for Strength and Power Abilities (*viz*., Muscular Strength & Muscular Power), Endurance Abilities (*viz*., Muscular Endurance), Basic Movement Patterns (*viz*., Running Speed, Running Agility, Jumping Ability & Throwing Ability), Neuromuscular Abilities (Flexibility & Balance)

Table 2: Distribution of grades of subjects of university boys for Strength and Power Abilities (*viz*., Muscular Strength & Muscular Power), Endurance Abilities (*viz*., Muscular Endurance), Basic Movement Patterns (*viz*., Running Speed, Running Agility, Jumping Ability & Throwing Ability), Neuromuscular Abilities (Flexibility & Balance)

Physical Fitness		Very Poor	Poor	Average	Good	Excellent
Strength and Power Abilities	Muscular Strength	Rating Below 4.366	4.366-14.625	14.625- 35.143	35.143-456.402	Above 45.402
	Muscular Power	Rating Below 29.453	29.453 -32.382	32.382-38.24	38.24-41.169	Above 41.169
Endurance Abilities	Muscular Endurance	Rating Below 1.43	1.43-2.826	2.826-5.618	5.618-7.014	Above 7.014
Basic Movement Patterns	Running Speed	Rating Above 4.252	4.252-4.164	4.164-3.988	3.988-3.9	Below 3.9
	Running Agility	Rating Above 22.376	22.376 -21.738	21.738-20.462	20.462-19.824	Below 19.824
	Jumping Ability	Rating Below 1.616	1.616-1.762	1.762-2.054	2.054-2.22	Above 2.2
	Throwing Ability	Rating Below 1.956	1.956-2.989	2.989-5.055	5.055-6.088	Above 6.088
Neuromuscular Abilities	Flexibility	Rating Below 12.957	12.957-14.956	14.956-18.954	18.954-20.953	Above 20.953
	Balance	Rating Below 11.748	11.748-13.574	13.574-17.226	17.226-19.052	Above 19.052

1. **Muscular Strength:** The rating below 4.366 was very poor, 4.366 -14.625 was poor, 14.625- 35.143 was average, 35.143-456.402 was good whereas, rating above 45.402 was excellent.

2. **Muscular Power:** The rating below 29.453 was very poor, 29.453 -32.382 was poor, 32.382-38.24 was average, 38.24-41.169 was good whereas, rating above 41.169 was excellent.

3. **Muscular Endurance:** The rating below 1.43 was very poor, 1.43-2.826 was poor, 2.826-5.618 was average, 5.618-7.014 was good whereas, rating above 7.014 was excellent.

4. **Running Speed:** The rating above 4.252 was very poor, 4.252-4.164 was poor, 4.164-3.988 was average, 3.988-3.9 was good whereas, Rating below 3.9 was excellent.

5. **Running Agility:** The rating above 22.376 was very poor, 22.376 -21.738 was poor, 21.738-20.462 was average, 20.462-19.824 was good whereas, rating below 19.824 was excellent.

6. **Jumping Ability:** The rating below 1.616 was very poor, 1.616-1.762 was poor, 1.762-2.054 was average, 2.054-2.22 was good whereas, rating above 2.2 was excellent.

7. **Throwing Ability:** The rating below 1.956 was very poor, 1.956-2.989 was poor, 2.989-5.055 was average,

5.055-6.088 was good whereas, rating above 6.088 was excellent.

8. **Flexibility:** The rating below 12.957 was very poor, 12.957-14.956 was poor, 14.956-18.954 was average, 18.954-20.953 was good whereas, rating above 20.953

was excellent.

9. **Balance:** The rating below 11.748 was very poor, 11.748-13.574 was poor, 13.574-17.226 was average, 17.226-19.052 was good whereas, rating above 19.052 was excellent.
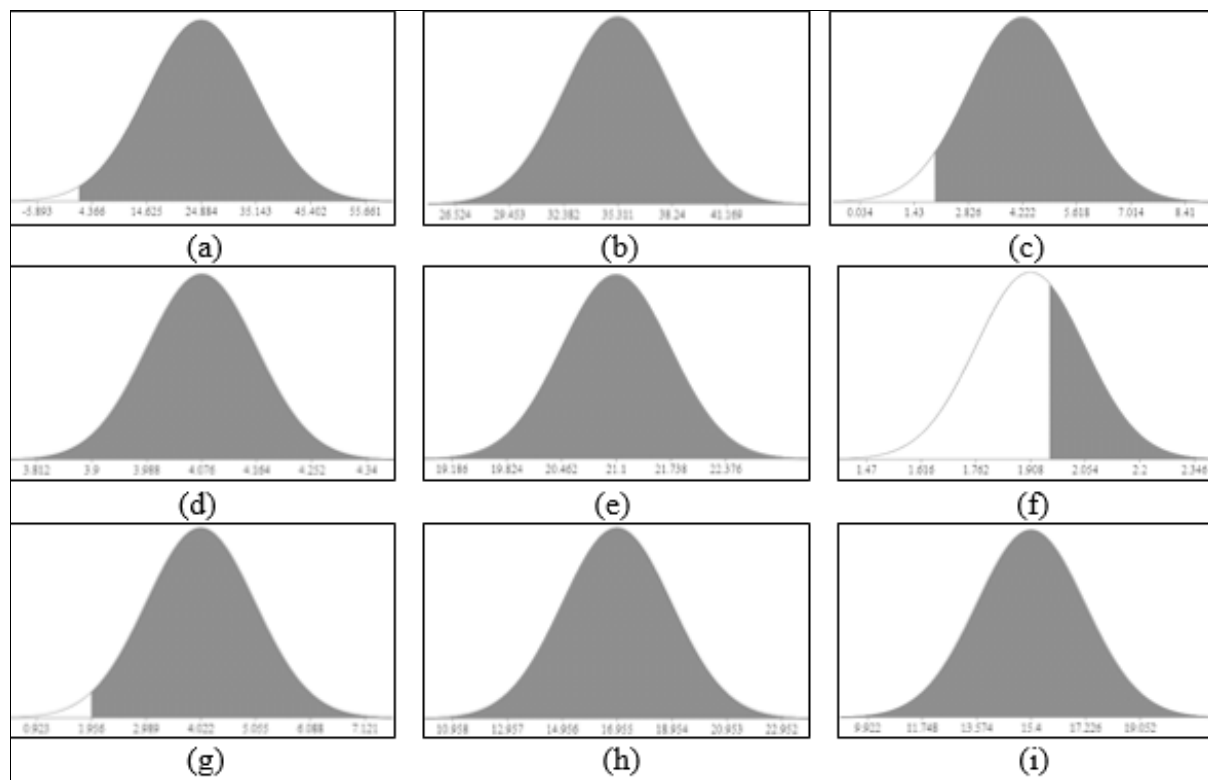

Fig 2: Area Under the normal distribution of university boys for Strength and Power Abilities (*viz.*, (a). Muscular Strength & (b). Muscular Power), Endurance Abilities (*viz.*, (c). Muscular Endurance), Basic Movement Patterns (*viz.*, (d). Running Speed, (e). Running Agility, (f). Jumping Ability & (g). Throwing Ability), Neuromuscular Abilities ((h). Flexibility & (i). Balance)

Table 3: Percentile norms of university boys for Strength and Power Abilities (*viz.*, Muscular Strength & Muscular Power), Endurance Abilities (*viz.*, Muscular Endurance), Basic Movement Patterns (*viz.*, Running Speed, Running Agility, Jumping Ability & Throwing Ability), Neuromuscular Abilities (Flexibility & Balance)

Percentile	Muscular Strength	Muscular Power	Muscular Endurance	Running Speed	Running Agility	Jumping Ability	Throwing Ability	Flexibility	Balance
10th	13.5	31	2	3.96	20.13	1.684	3	14	13
15th	13.6	33	3	3.96	20.2	1.732	3	14.6	13
20th	15.7	33	3	3.96	20.50	1.758	3	15	14
25th	16.5	33	3	3.98	20.66	1.8	3	16	14
30th	18.7	34	3	3.988	20.68	1.822	3	16	14
35th	18.98	34	4	4.05	20.76	1.874	3	16	14
40th	20	35	4	4.05	20.97	1.886	3.6	16	15
45th	20.7	35	4	4.098	21.26	1.898	4	16	15
50th	21.9	36	4	4.1	21.3	1.93	4	17	15
55th	23.14	36	4	4.102	21.33	1.95	4	17.2	15
60th	24.5	36	5	4.11	21.45	1.978	4	18	16
65th	25.2	36	5	4.126	21.45	2.002	4	18	16
70th	28.9	36.8	5	4.146	21.55	2.02	4.8	18	16
75th	31.4	37	6	4.15	21.7	2.02	5	19	17
80th	36.96	38	6	4.16	21.72	2.038	5	19	18
85th	38.56	38.4	6	4.168	21.77	2.078	5	19	18
90th	41.72	40	6	4.19	21.85	2.096	5.6	20	18

1. **Muscular Strength:** The 10th percentile is 13.5, 15th percentile is 13.6, 20th percentile is 15.7, 25th percentile is 16.5, 30th percentile is 18.7, 35th percentile is 18.98, 40th percentile is 20, 45th percentile is 20.7, 50th percentile is 21.9, 55th percentile is 23.14, 60th percentile is 24.5, 65th percentile is 25.2, 70th percentile is 28.9, 75th percentile is 31.4, 80th percentile is 36.96, 85th percentile is 38.56, 90th percentile is 41.72.

2. **Muscular Power:** The 10th percentile is 31, 15th percentile is 33, 20th percentile is 33, 25th percentile is 33, 30th percentile is 34, 35th percentile is 34, 40th percentile is 35, 45th percentile is 35, 50th percentile is 36, 55th percentile is 36, 60th percentile is 36, 65th percentile is 36, 70th percentile is 36.8, 75th percentile is 37, 80th percentile is 38, 85th percentile is 38.4, 90th percentile is 40.

3. **Muscular Endurance:** The 10th percentile is 2, 15th

percentile is 3, 20th percentile is 3, 25th percentile is 3, 30th percentile is 3, 35th percentile is 4, 40th percentile is 4, 45th percentile is 4, 50th percentile is 4, 55th percentile is 4, 60th percentile is 5, 65th percentile is 5, 70th percentile is 5, 75th percentile is 6, 80th percentile is 6, 85th percentile is 6, 90th percentile is 6.

4. **Running Speed:** The 10th percentile is 3.96, 15th percentile is 3.96, 20th percentile is 3.96, 25th percentile is 3.98, 30th percentile is 3.988, 35th percentile is 4.05, 40th percentile is 4.05, 45th percentile is 4.098, 50th percentile is 4.1, 55th percentile is 4.102, 60th percentile is 4.11, 65th percentile is 4.126, 70th percentile is 4.146, 75th percentile is 4.15, 80th percentile is 4.16, 85th percentile is 4.168, 90th percentile is 4.19

5. **Running Agility:** The 10th percentile is 20.13, 15th percentile is 20.2, 20th percentile is 20.504, 25th percentile is 20.66, 30th percentile is 20.68, 35th percentile is 20.76, 40th percentile is 20.976, 45th percentile is 21.264, 50th percentile is 21.3, 55th percentile is 21.33, 60th percentile is 21.45, 65th percentile is 21.45, 70th percentile is 21.552, 75th percentile is 21.7, 80th percentile is 21.72, 85th percentile is 21.772, 90th percentile is 21.85.

6. **Jumping Ability:** The 10th percentile is 1.684, 15th percentile is 1.732, 20th percentile is 1.758, 25th percentile is 1.8, 30th percentile is 1.822, 35th percentile is 1.874, 40th percentile is 1.886, 45th percentile is 1.898, 50th percentile is 1.93, 55th percentile is 1.95, 60th percentile is

1.978, 65th percentile is 2.002, 70th percentile is 2.02, 75th percentile is 2.02, 80th percentile is 2.038, 85th percentile is 2.078, 90th percentile is 2.096.

7. **Throwing Ability:** The 10th percentile is 3, 15th percentile is 3, 20th percentile is 3, 25th percentile is 3, 30th percentile is 3, 35th percentile is 3, 40th percentile is 3.6, 45th percentile is 4, 50th percentile is 4, 55th percentile is 4, 60th percentile is 4, 65th percentile is 4, 70th percentile is 4.8, 75th percentile is 5, 80th percentile is 5, 85th percentile is 5, 90th percentile is 5.6.

8. **Flexibility:** The 10th percentile is 14, 15th percentile is 14.6, 20th percentile is 15, 25th percentile is 16, 30th percentile is 16, 35th percentile is 16, 40th percentile is 16, 45th percentile is 16, 50th percentile is 17, 55th percentile is 17.2, 60th percentile is 18, 65th percentile is 18, 70th percentile is 18, 75th percentile is 19, 80th percentile is 19, 85th percentile is 19, 90th percentile is 20.

9. **Balance:** The 10th percentile is 13, 15th percentile is 13, 20th percentile is 14, 25th percentile is 14, 30th percentile is 14, 35th percentile is 14, 40th percentile is 15, 45th percentile is 15, 50th percentile is 15, 55th percentile is 15, 60th percentile is 16, 65th percentile is 16, 70th percentile is 16, 75th percentile is 17, 80th percentile is 18, 85th percentile is 18, 90th percentile is 18.

SWOT analysis

Table 4: SWOT (strengths, weaknesses, opportunities and threats) analysis.

Sr. No.	SWOT	Inferences
1.	Strengths	Regarding the following characteristics, among others, the findings of this study can be advantageous to players, coaches, trainers, instructors, physical education teachers etc.
		Strength and Power Abilities
		Muscular Strength
		Muscular Power
		Endurance Abilities
		Muscular Endurance
		Basic Movement Patterns
		Running Speed
		Running Agility
		Jumping Ability
		Throwing Ability
		Neuromuscular Abilities
		Flexibility
		Balance
2.	Weaknesses	The athletes' diversity was restricted, therefore extrapolating the findings to different sporting environments is not possible.
3.	Opportunities	Research could also aid in creating the framework for the creation of scientific training plans for various sports.
4.	Threats	The study may have been at risk if the researcher had taken into consideration other factors including interest, attitude, collaboration, home environment, genetic composition, socioeconomic status, culture, religion, educational background, and nutrition.

Conclusion
This study underscores the vital role of physical fitness, encompassing various components like strength, endurance, agility, and neuromuscular abilities, in assessing the health and performance of young adults. The findings provide valuable insights for athletes, coaches, and educators, facilitating tailored training programs. However, limitations in participant diversity caution against generalizing results. Nonetheless, this research opens avenues for further investigation into optimizing training strategies across diverse sporting disciplines. Attention to additional factors like individual interests, socioeconomic backgrounds, and cultural influences is crucial for comprehensive future studies in this field.

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