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To Evaluate Upper Extremity Endurance In Physiotherapy Students Using Unsupported Upper Limb Exercise Test

A CROSS – SECTIONAL STUDY

Sampada G. Thakare [1], Dr.Priti Patil [2]

P.E.S Modern College Of Physiotherapy ,Pune-05 411005

ABSTRACT : This cross-sectional study evaluated upper extremity endurance in physiotherapy students using the Unsupported Upper Limb Exercise Test (UULEX). The findings showed variable endurance levels with no significant gender differences and a strong positive correlation between endurance and test duration. These results emphasize the importance of assessing and improving upper limb endurance in physiotherapy students.

KEYWORDS: Upper extremity endurance, physiotherapy students, Unsupported Upper Limb Exercise Test, UULEX, cross-sectional study

INTRODUCTION

Upper extremity function plays a vital role in performing daily activities such as reaching, lifting, writing, and handling objects. These tasks require not only strength but also adequate **upper extremity endurance**, which allows muscles to sustain activity over time. Muscular endurance is also a core component of physical fitness among university students and contributes significantly to cardiovascular performance, body composition, and overall physical health. Evidence shows that students engaged in endurance-based activities demonstrate better physical fitness and wellness highlighting the importance of structured endurance training in academic settings [1].

Physiotherapy students represent a unique group within the university population because their training includes demanding academic work as well as physically intensive practical sessions. They frequently perform repetitive upper limb tasks—including manual therapy, patient handling, and therapeutic exercises—requiring good upper limb endurance. However, existing literature indicates that many physiotherapy students exhibit low levels of health-related fitness, including reduced endurance, balance, and agility. This may

predispose them to fatigue, overuse injuries, and reduced clinical efficiency if adequate physical conditioning is not maintained [2].

Upper limb endurance becomes even more relevant considering the increasing academic stress and mental workload reported among health science students. Mental fatigue has been shown to negatively impact muscular endurance, including elbow flexor endurance, suggesting that psychological demands can directly influence physical performance[3] Therefore, evaluating upper limb endurance in physiotherapy students provides insight not only into physical readiness but also the impact of academic stress on functional capacity.

The **Unsupported Upper Limb Exercise Test (UULEX)** is a standardized, graded functional assessment used to measure unsupported upper limb endurance. Initially developed for individuals with chronic obstructive pulmonary disease (COPD), the test has demonstrated feasibility, repeatability, and clinical usefulness in assessing upper limb exercise capacity[4]

Over time, UULEX has been validated across different populations, and several studies have established normative reference values in both Brazilian and Canadian adults, showing that performance varies according to age, gender, height, and BMI [5,6]

These reference standards help clinicians interpret endurance levels more accurately.

Reliability studies consistently support UULEX as a robust assessment tool. It demonstrates excellent test–retest reliability, minimal learning effect, and strong within-day consistency in healthy adults [7,8,9]

Emerging research is also exploring its applicability in neurological populations, indicating growing interest in the test's broader clinical utility [10] Systematic reviews in pulmonary rehabilitation further highlight the value of unsupported arm endurance tests in evaluating functional limitations and guiding treatment strategies [11].

Despite the widespread clinical use of UULEX, **limited research exists on upper limb endurance among young, healthy physiotherapy students**, who represent a population with high upper limb physical demands but potentially low physical fitness levels. Reference data in this group are scarce, and their endurance capacity remains underexplored. Understanding their endurance profile is essential for identifying fitness gaps early, improving clinical readiness, and supporting curriculum-based fitness promotion.

Need for the Study

Physiotherapy students rely heavily on upper limb endurance for practical skills, patient care activities, and safe clinical practice. However, existing evidence suggests that this group may not possess optimal physical fitness levels, and there is a lack of standardized data on their upper limb endurance. The **UULEX**, while validated in clinical and healthy adult populations, has not been adequately studied in physiotherapy students. Generating baseline endurance values will help identify deficits, guide fitness recommendations, and contribute to establishing normative data for this specific population. Therefore, this study is needed to evaluate upper extremity endurance in physiotherapy students using the Unsupported Upper Limb Exercise Test.

AIM

To evaluate upper extremity endurance in physiotherapy students using the Unsupported Upper Limb Exercise Test (UULEX).

OBJECTIVES

1. To assess upper extremity endurance in physiotherapy students using the Unsupported Upper Limb Exercise Test (UULEX).
2. To determine the influence of demographic variables (age, sex, BMI) on UULEX performance among physiotherapy students.

REVIEW OF LITERATURE

Upper extremity endurance plays an essential role in performing daily functional tasks and is particularly important in populations that engage in repetitive upper-limb activities, such as physiotherapy students. Efficient upper limb endurance contributes to sustained performance of manual tasks, clinical skills, and therapeutic procedures. This review summarises existing literature on physical fitness among university and physiotherapy students, the development and use of the Unsupported Upper Limb Exercise Test (UULEX), its normative values, reliability, and its application in both healthy and clinical populations. The review concludes with key gaps in the literature relevant to the present study.

1. Physical Fitness and Endurance in University Students

Muscular endurance is a core component of physical fitness and contributes to cardiovascular health, body composition, and muscular efficiency in young adults. Okilanda et al. (2024) examined the effect of endurance training on physical health among university students and demonstrated significant positive correlations between endurance exercise frequency and multiple health indicators, including cardiovascular fitness and muscular strength . Their findings highlight the importance of structured endurance programs in maintaining overall health in university populations.[12]

2. Physical Fitness Profile of Physiotherapy Students

Physiotherapy students are required to perform repeated upper-limb tasks during academic labs and clinical placements, demanding adequate endurance and physical conditioning. However, emerging evidence suggests that physiotherapy students often exhibit suboptimal fitness levels. In a cross-sectional study assessing 109 physiotherapy students, Al-Khlaifat et al. (2024) reported generally poor health-related physical fitness—including reduced endurance, agility, and balance—which may compromise clinical performance and increase risk of musculoskeletal strain . These findings underscore the need to assess and monitor specific components of physical fitness, such as upper limb endurance, in this population[13].

3. Development of the Unsupported Upper Limb Exercise Test (UULEX)

The UULEX was originally developed by Takahashi et al. (2003) as a standardized functional assessment to evaluate unsupported upper extremity endurance in individuals with chronic obstructive pulmonary disease (COPD) . The authors demonstrated that the test was feasible, well tolerated, and reproducible across repeated assessments, establishing UULEX as a valid clinical tool for upper-limb endurance testing. Since its development, the test has gained widespread acceptance in both research and rehabilitation settings[3].

4. Normative Studies on UULEX in Healthy Adults

Several studies have established normative reference values for UULEX across different populations. In Brazil, Lima et al. (2019) provided reference standards for 100 healthy adults and identified age, gender, BMI, and height as significant predictors of test performance . Similarly, Liu et al. (2022) developed age- and sex-specific normative values for healthy Canadian adults using both UULEX and the 6-Minute Pegboard and Ring Test . These normative datasets assist clinicians and researchers in interpreting endurance capacity and identifying deviations from expected performance in healthy population.[5,14].

5. Reliability and Measurement Properties of UULEX

The UULEX demonstrates strong measurement reliability. Marques et al. (2020) reported excellent test–retest reliability with minimal learning effect, indicating that participants do not require multiple familiarisation trials [15]. In a study evaluating within-day reliability among healthy adults, Oliveira et al. (2018) found strong consistency between repeated trials and highlighted the influence of age and gender on test performance [16]. Additionally, Janaudis-Ferreira et al. (2018) confirmed excellent reproducibility of UULEX and the 6-Minute Pegboard and Ring Test in healthy individuals, supporting the use of a single test session for endurance assessment [10]. Together, these studies establish UULEX as a reliable and practical method for evaluating upper-limb endurance.

6. UULEX in Clinical and Neurological Populations

Beyond healthy adults, the UULEX has been applied to clinical groups to assess functional upper-limb limitations. A systematic review by Vogiatzis et al. (2011) emphasised the value of unsupported arm endurance tests in evaluating exercise capacity in patients with COPD [17]. More recently, a registered clinical trial aims to investigate the validity and reliability of UULEX in individuals with multiple sclerosis, reflecting ongoing interest in adapting the test for neurological populations [18]. These studies further establish UULEX as a versatile assessment tool across diverse healthcare settings.

7. Psychological Determinants of Upper Limb Endurance

Upper limb endurance is influenced not only by muscular and cardiovascular factors but also by psychological variables. Türkmen et al. (2024) demonstrated that mental fatigue induced through motor imagery significantly reduced elbow-flexor endurance, indicating that cognitive load can alter physical performance in the upper extremities [19]. This finding is relevant to physiotherapy students, who often experience high academic stress, potentially affecting endurance levels during physical tasks.

8. Summary and Identified Research Gap

The literature highlights the importance of muscular endurance among students, the physical demands placed on physiotherapy students, and the validity and reliability of the UULEX as a tool for assessing upper limb endurance. While normative values exist for healthy adults in Brazil and Canada, **there is a lack of research evaluating upper extremity endurance specifically among physiotherapy students**,

who represent a physically demanding academic population. Furthermore, no studies have established endurance profiles of this group using UULEX, particularly within the Indian context. Understanding endurance capacity in this population is essential for identifying potential deficiencies, promoting physical preparedness, and guiding educational or preventive interventions.

The present study aims to address this gap by evaluating upper extremity endurance in physiotherapy students using the Unsupported Upper Limb Exercise Test.

METHODOLOGY

Study design: Cross sectional study

Sample population: Physiotherapy students (UG)

Sampling Method: Convenient

Sampling Design: Purposive sampling

Duration of study: 6 months

Study Area: Pune city

Sample size: 24

Sample formula:n= $n = Z\,2 \times p \times (1 - p)/E^2$

CRITERIA

INCLUSION CRITERIA

Age group: 18-24 year (UG)

Student pursuing physiotherapy degree

Both male and female

Participant willing to participate

EXCLUSION CRITERIA

Sport person

Recent upper limb injury

Regular upper limb exercise

History of upper limb fractures (acute fracture)

Upper extremity pain or discomfort

Pre-existing medical condition (multiple sclerosis, spinal cord injury, tennis elbow, shoulder impingement, radiculopathies)

Materials

Tools

Pen

Paper

Consent Form

Plastic Bar with different weights

UULEX Chart - A0-size chart marked with 8 different colors (84 cm 120 cm)

Stopwatch

Data Collection Sheet

PROCEDURE

Ethical clearance was obtained from the ethical committee in P.E.S. Modern college of Physiotherapy.

The participants were selected on the basis of the inclusion and exclusion criteria.

Written consent was taken from the participants.

The unsupported upper limb exercise test was conducted on each participant.

Data was recorded and analysis was done.

OUTCOME MEASURE

Unsupported Upper Limb Exercise Test Chart–

Figure 1

Figure2

Measurement instrument

Unsupported upper limb exercise test chart

To perform the test, the participant sat on a chair facing a board (120 cm in height × 84 cm in width) with eight 8-cm-wide color bands, which were 5 cm apart (Figure 2).

The participant remained seated throughout the test. The first level was set at knee-height.

The participant received a PVC tube weighing 0.2 kg. The test started with the participant warming up for 2 min, moving his or her arms from the pelvic girdle to the first level on the board, located at knee-height.

After the warm-up period, the participant moved to the next level on the board (level 2), performing the same movement for 1 min.

The level was changed every minute. When the maximum vertical height, that is, level 8 on the board, was reached, the 0.2-kg PVC tube was replaced by a 0.5-kg one and the participant should continue the exercise by moving the tube from the pelvic girdle to level 8 on the board, without stopping at the other levels, for 1 min.

From this time point onward, the tube was replaced by a 0.5-kg heavier one every minute until a maximum of 2.0 kg was reached.

The maximum test duration was 15 min; if the volunteer completed 15 min of test, the test was ended.

As soon as a participant finished each test, we recorded the band reached, total exercise time, self-reported dyspnea and local muscle fatigue (using the MBS)

The outcome measure was the maximum time (in min) to completion of the test, that is, a longer time equals a better result.

Test interruption criteria were as follows:

1. requesting to stop the test
2. not performing the full arc of motion.
3. or being unable to keep up with the metronome pace.

Test Result

The mean and standard deviation of the UULEX scores were 11.36 ± 2.98 minutes for women and 12.42 ± 2.53 for men

The UULEX score is the total time the subject can sustain the exercise before stopping

This reflects upper limb endurance and functional capacity.

Category Interpretation

Typical Performance Range

1.	Excellent endurance	Performs close to healthy reference value	> 13–14 minutes
2.	Good endurance	Slightly below average but functional	10–13 minutes
3.	Moderate endurance	Noticeable fatigue; limited activity tolerance	7–10 minutes
4.	Poor endurance	Markedly reduced tolerance, may indicate functional impairment	< 7 minutes

(Healthy adults generally complete around 13 ± 2 minutes; COPD or cardiac patients may average 8–10 minutes.)

DATA AND STATISTICAL ANALYSIS

Data were entered into excel spreadsheets, tabulated, and subjected to statistical analysis.

All data were analyzed using standard statistical software (SPSS) to evaluate mean, standard deviation, and compare endurance outcomes across gender and other variables.

The collected data were summarized by using the Descriptive Statistics: frequency, percentage; mean and S.D.

The Independent sample “t” test was used to compare age, height, weight, BMI, time taken to complete the

test, and the upper extremity endurance (Band reach); between males and females, as well as according to Dyspnoea.

The Likelihood ratio test was used to find the association of upper extremity endurance, and gender

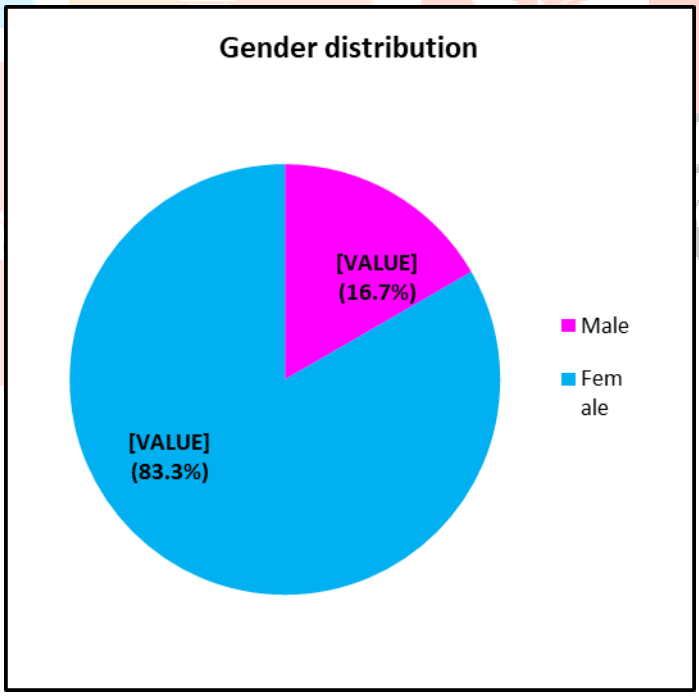
To find the correlation between the upper extremity endurance (Band reach), time taken to complete the test, age, height, weight, BMI, the Spearman's ratio was used

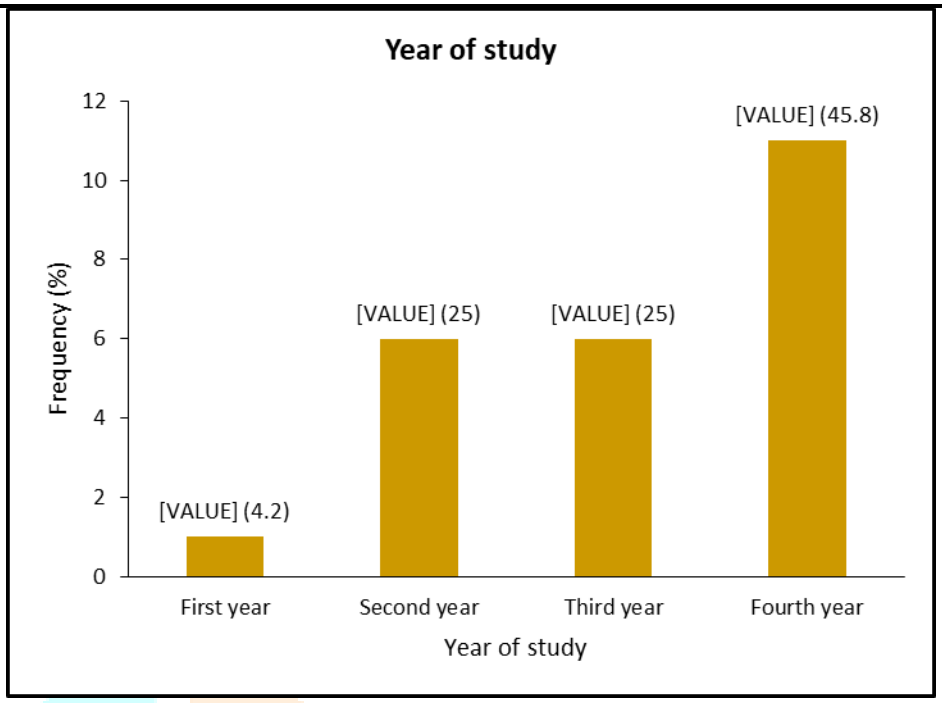
The p value < 0.05 was considered as significant. Data were analyzed by using the SPSS software (SPSS Inc.; Chicago, IL) version 29.0.10.

Demographic Data

Table 1: Gender, year of study, and dominant hand

		Frequency	%
Gender	Male	4	16.7
	Female	20	83.3
Year of study	First year	1	4.2
	Second year	6	25
	Third year	6	25
	Fourth year	11	45.8
Dominant hand	Right	24	100

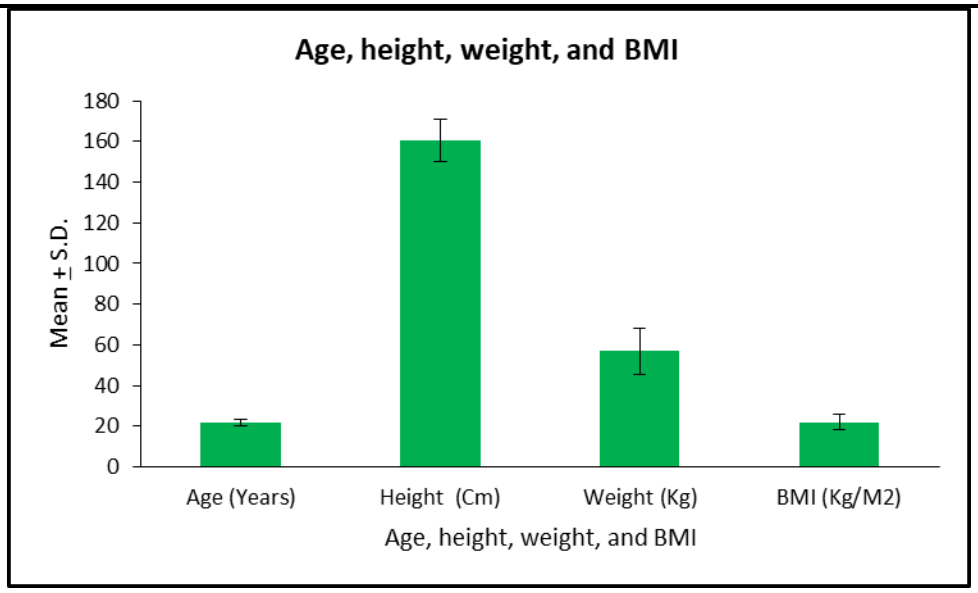




Among the 24 participants; the majority were females (83.3%); and the 16.7% were males. Regarding year of study; most of the students were in fourth year (45.8%); followed by second year (25%), third year (25%), and first year (4.2%). All the participants (100%) had the right hand dominant. [Table – 1]

Table 2: Descriptive Statistics for age, height, weight, and BMI

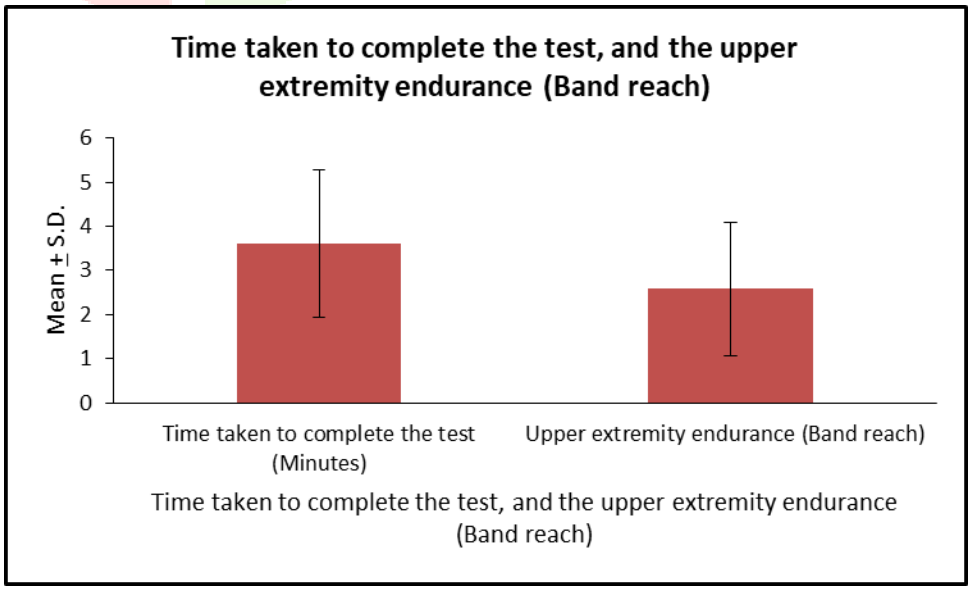
(n = 24)	Range	Mean	S.D.	Median
Age (Years)	19 to 24	22.04	1.60	23.00
Height (Cm)	139 to 183	160.50	10.42	162.50
Weight (Kg)	36 to 78	56.79	11.65	53.50
BMI (Kg/M^2)	15.4 to 32.9	22.04	4.03	22.06



Age of the participants ranged from 19 to 24 years with mean: 22.04 ± 1.60 years, and median = 23; height ranged from 139 to 183 Cm with mean: 160.50 ± 10.42 Cm, and median = 162.50; weight ranged from 36 to 78 Kg with mean: 56.79 ± 11.65 Kg, and median = 53.50; and the BMI ranged from 15.4 to 32.9 Kg/M^2 with mean: 22.04 ± 4.03 Kg/M^2, and median = 22.06 [Table – 2]

Table 3: Descriptive Statistics for maximum band weight, time taken to complete the test, and the upper extremity endurance (Band reach)

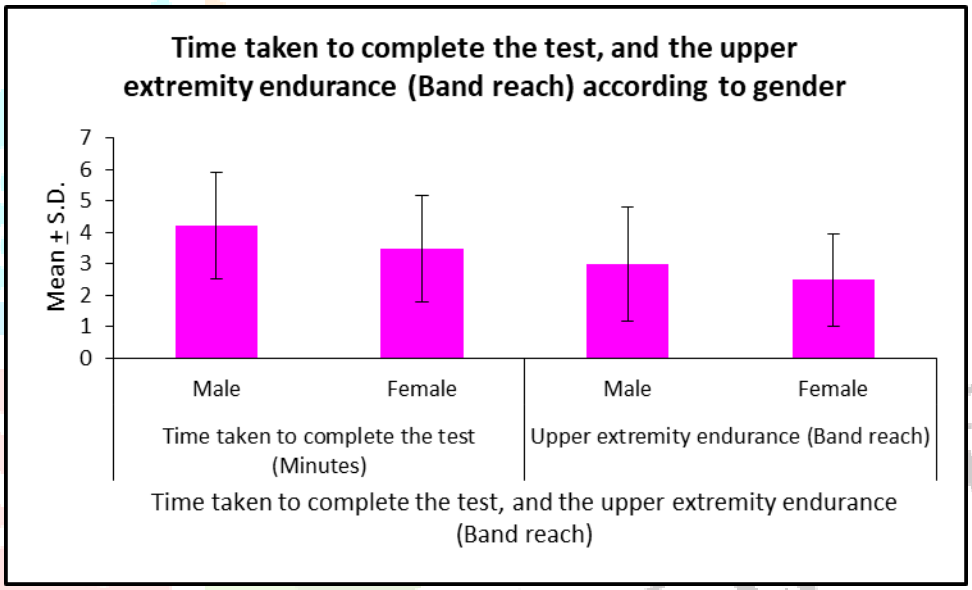
	Range	Mean	S.D.	Median
Maximum band weight (Gm)	200 to 200	200.00	0.00	200.00
Time taken to complete the test (Minutes)	1.3 to 7.22	3.60	1.67	3.28
Upper extremity endurance (Band reach)	1 to 6	2.58	1.50	2.00



The maximum band weight was found to be 200 Gm among all the participants; the time taken to complete the test ranged from 1.3 to 7.22 minutes with mean: 3.60 ± 1.67 minutes, and median = 3.28; and the upper extremity endurance (Band reach) ranged from 1 to 6 with mean: 2.58 ± 1.50, and median = 2. [Table – 3]

Table 4: Comparison of time taken to complete the test, and the upper extremity endurance (Band reach) according to gender

		Mean	S.D.	"t"	p value
Time taken to complete the test (Minutes)	Male	4.21	1.70	0.78	0.441
	Female	3.48	1.68		
Upper extremity endurance (Band reach)	Male	3.00	1.83	0.60	0.555
	Female	2.50	1.47		

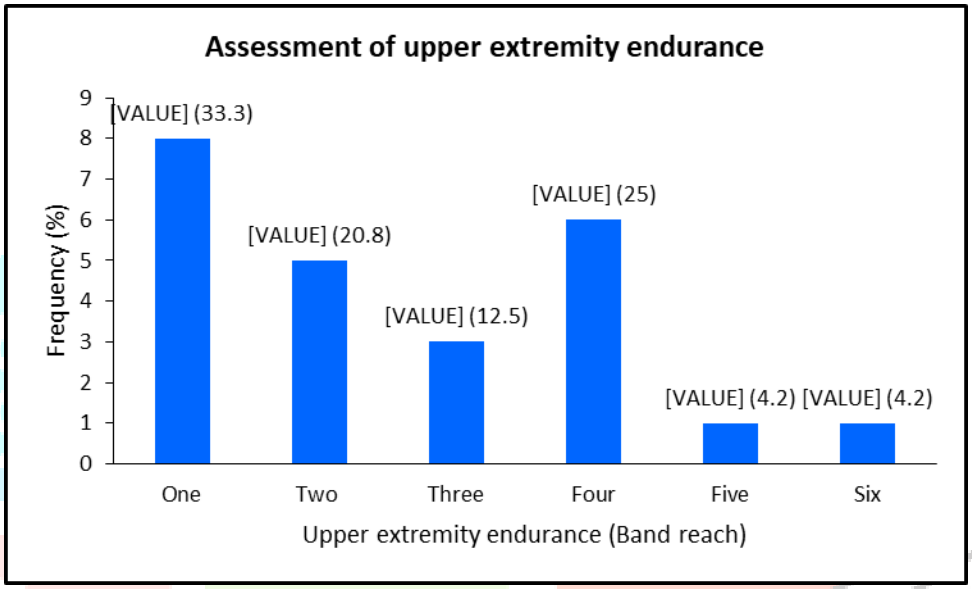


("t" = Independent sample "t" test)

The Independent sample "t" test was used to compare time taken to complete the test, and the upper extremity endurance (Band reach); according to gender. There was no difference ($p > 0.05$) in the time taken to complete the test, as well as the upper extremity endurance (Band reach); between males and females. [Table – 4]

Table 5: Assessment of upper extremity endurance

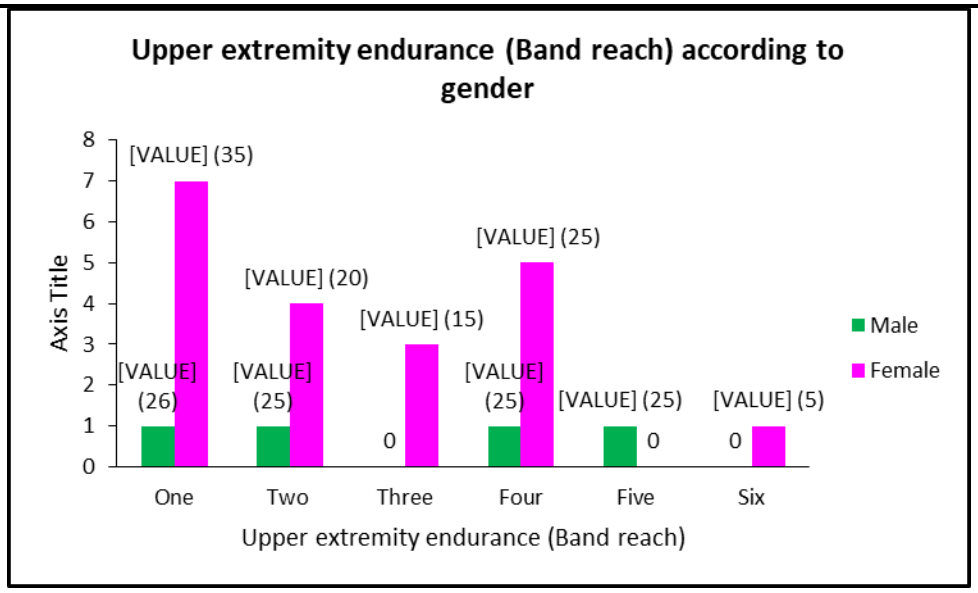
Upper extremity endurance		Frequency	%
Band reach	One	8	33.3
	Two	5	20.8
	Three	3	12.5
	Four	6	25
	Five	1	4.2
	Six	1	4.2



Assessment of upper extremity endurance (band reach) reveals the scores: “One” (33.3%), “Two” (20.8%), Three” (12.5%), “Four” (25%), “Five” (4.2%), “Six” (4.2%). [Table – 5]

Table 6: Association between upper extremity endurance and gender

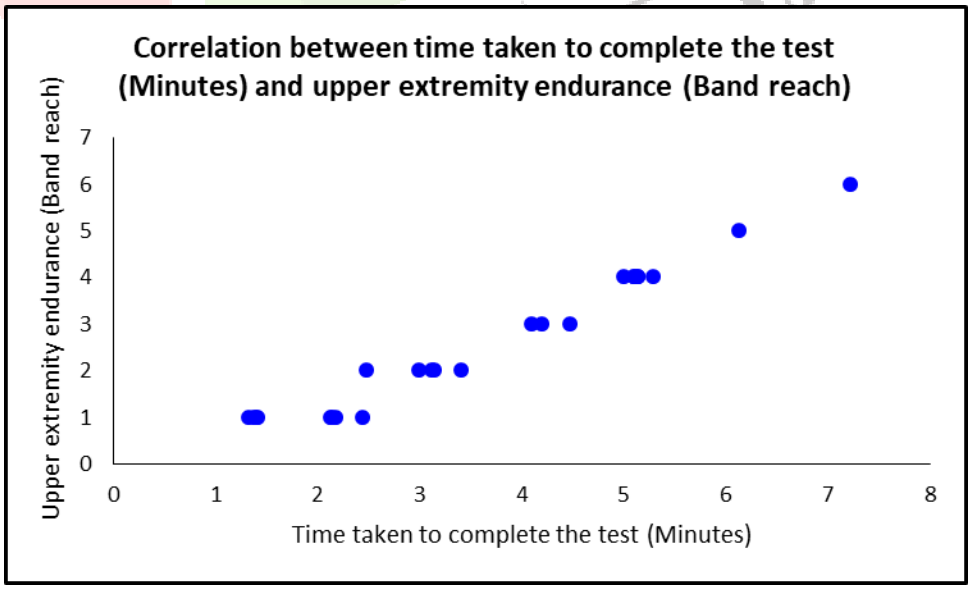
		Gender				Likelihood ratio	p value
		Male		Female			
		n	%	N	%		
Upper extremity endurance (Band reach)	One	1	25	7	35	5.19	0.393
	Two	1	25	4	20		
	Three	0	0	3	15		
	Four	1	25	5	25		
	Five	1	25	0	0		
	Six	0	0	1	5		



The Likelihood ratio test was used to find the association; between upper extremity endurance and gender. There was no association ($p > 0.05$); between upper extremity endurance and gender. [Table – 6]

Table 7: Correlation of upper extremity endurance (Band reach) with age, height, weight, BMI, and time taken to complete the test

	Upper extremity endurance (Band reach)	
	Spearman's ratio	p value
Age (Years)	0	1
Height (Cm)	-0.123	0.567
Weight (Kg)	-0.374	0.072
BMI (Kg/M^2)	-0.322	0.125
Time taken to complete the test (Minutes)	0.969	< 0.001*



(* Significant)

The Spearman's ratio was used to find the correlation of upper extremity endurance (Band reach) with age, height, weight, BMI, and time taken to complete the test. There was a positive correlation ($p < 0.05$) between upper extremity endurance (Band reach) and the time taken to complete the test. [Table – 7]

RESULT

The following study was conducted to evaluate the upper limb endurance in physiotherapy students.

The collected data were summarized by using the Descriptive Statistics: frequency, percentage; mean and S.D.

The Independent sample "t" test was used to compare age, height, weight, BMI, time taken to complete the test, and the upper extremity endurance (Band reach); between males and females, as well as according to Dyspnoea.

The Likelihood ratio test was used to find the association of upper extremity endurance, and Dyspnoea with gender.

To find the correlation between the upper extremity endurance (Band reach), time taken to complete the test, age, height, weight, BMI, the Spearman's ratio was used.

The p value < 0.05 was considered as significant. Data were analyzed by using the SPSS software (SPSS Inc.; Chicago, IL) version 29.0.10.

DISCUSSION

The present study aimed to evaluate upper extremity endurance among physiotherapy students using the Unsupported Upper Limb Exercise Test (UULEX). The mean time to complete the test was 3.60 ± 1.67 minutes, and the mean upper extremity endurance (band-reach score) was 2.58 ± 1.50. No significant differences were observed between males and females, and upper-limb endurance showed no correlation with age, height, weight, or body mass index (BMI). However, a strong positive correlation was observed between upper extremity endurance and the time taken to complete the test, indicating that the ability to sustain unsupported arm activity reflects true endurance capacity. [20]

Upper Extremity Endurance Levels in Physiotherapy Students

The endurance scores observed in the present study appear lower than those reported in healthy young adults. Köprülüoğlu et al. found that healthy young adults demonstrated better grip strength and grip endurance, which were positively associated with upper extremity functional capacity and activities of daily living. This suggests that individuals without heavy academic or professional demands may exhibit superior upper-limb endurance compared to physiotherapy students.[21]

Sunarjo reported that the UULEX and the 6-Minute Pegboard and Ring Test are reliable measures of upper-limb endurance and demonstrated acceptable endurance performance even in individuals with respiratory and musculoskeletal disabilities. When physiotherapy students demonstrate lower endurance scores than these populations, it indicates potential deficits in endurance capacity related to insufficient conditioning rather than pathology.

Parkar and Saini assessed upper-limb and core muscle strength in physiotherapy students and reported variable strength levels, attributing these findings to academic workload, prolonged static postures, and limited participation in regular exercise. These findings support the present study and suggest that physiotherapy students may not maintain optimal physical fitness despite belonging to a health-related profession.[22]

Correlation Between Band-Reach Score and Time Taken

Upper extremity endurance demonstrated a very strong positive correlation with UULEX test duration. This relationship is expected, as UULEX performance involves continuous unsupported arm elevation, which progressively increases muscular and metabolic load. Sunarjo emphasized that longer test duration during UULEX directly reflects greater upper-limb endurance capacity. Teixeira et al. established reference values and demonstrated strong reliability for upper-limb functional tests, highlighting that test duration is a valid and consistent indicator of endurance performance. These findings reinforce the strong association observed in the present study between endurance score and time taken.[24]

Gender Comparison

The absence of significant gender differences in UULEX performance in the present study contrasts with some previous findings. Verma and Sharma reported that males generally performed better than females across several physical fitness components; however, muscular endurance did not consistently differ when standardized testing protocols were applied. This indicates that gender differences in endurance may not be prominent in young adult population. Rangel-Caballero et al. examined upper-body muscular endurance in university students and reported that endurance capacity was more strongly associated with aerobic fitness and training exposure than with gender alone. These findings suggest that similar activity levels and lifestyle patterns among male and female physiotherapy students could explain the comparable endurance scores observed in the present study.[23]

Lack of Correlation with Age, Height, Weight, and BMI

Unlike some previous studies, the present study did not demonstrate significant associations between upper-limb endurance and age, height, weight, or BMI. Wang et al. reported that body composition influences upper-limb physical fitness in university students over time; however, their study involved a broader population with greater anthropometric variability.[25]

Çankaya investigated the effect of hand anthropometric properties on upper extremity functionality and reported that anthropometry can influence functional outcomes in healthy youth. In contrast, the present study involved a relatively young and homogeneous sample of physiotherapy students, which may have limited the ability to detect significant correlations with anthropometric variables.[26]

Possible Explanations for Observed Findings

Physiotherapy students often experience high academic demands, prolonged sitting, and reduced participation in structured physical activity. Okilanda et al. reported that endurance training is positively associated with cardiovascular and muscular fitness among university students, emphasizing the importance of regular physical activity. The lower endurance levels observed in the present study may therefore reflect insufficient engagement in endurance-based exercise. In addition to physical factors, cognitive influences may also contribute to reduced endurance performance. Türkmen et al. demonstrated that mental fatigue negatively affects upper-limb endurance, even in the absence of muscular exhaustion. Academic stress and cognitive load experienced by physiotherapy students may therefore play a role in the reduced endurance levels observed in the present study.[27]

Clinical and Academic Implications

Upper-limb endurance is an essential physical requirement for physiotherapy practice, as sustained arm activity is necessary during patient handling, mobilization, and therapeutic procedures. Studies assessing upper-limb functional performance emphasize that inadequate endurance may lead to early fatigue and increase the risk of work-related musculoskeletal disorders. The findings of the present study highlight the need to incorporate structured endurance training and conditioning programs within physiotherapy curricula. Evidence from studies on endurance training and upper-body muscular endurance supports the integration of targeted exercise interventions to improve endurance capacity. The UULEX may also serve as a simple and effective screening tool to identify students who may benefit from endurance-focused conditioning programs. [28]

Strengths and Limitations

A major strength of this study is the use of a standardized UULEX protocol and the inclusion of correlation analysis. However, limitations include a small sample size, unequal gender distribution, and the absence of physical activity level assessment. The study was conducted at a single institution, limiting generalizability. Additionally, the lack of Indian normative values restricts comparison.

FUTURE RECOMMENDATIONS

- Future research should involve larger, multi-center samples and aim to develop normative UULEX values for Indian physiotherapy students.
- Including activity level questionnaires and comparing UULEX with other upper-limb endurance tests such as the 6-Minute Pegboard and Ring Test may provide deeper insights.

CONCLUSION

This study provides preliminary data on upper extremity endurance among physiotherapy students. While no gender differences or demographic correlations were observed, a strong association between endurance and test duration was evident. Overall endurance levels appear lower than published normative values, highlighting the need for enhanced physical fitness promotion within physiotherapy students.

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ANNEXURE 1

CONSENT FORM

I M R / Miss _____ am giving my consent for participating in the study **"TO EVALUATE UPPER EXTREMITY ENDURANCE IN PHYSIOTHERAPY STUDENT USING UNSUPPORTED UPPER LIMB EXERCISE TEST CHART- A CROSS – SECTIONAL STUDY"** conducted by **MISS. SAMPADA GOVIND THAKARE** (Physiotherapy UG student) as a part of her curriculum under the supervision and guidance of **DR. PRITI PATIL.**

I have been informed that no part of my information shall be revealed anywhere else except for the study and adequate secrecy will be maintained throughout.

I am aware that I may choose to quit being a part of study at any time without having to give any reason for doing so.

I agree to cooperate fully and have no objection in participating and hereby give the consent for doing so.

Name of the Participant : _____

Address : _____

_____

Name of the Institution:

Signature: _____ Date: _____

ANNEXURE 2

DATA COLLECTION SHEET

DEMOGRAPHIC DATA

1. Name
2. Age
3. Gender
4. Height
5. Weight
6. Hand dominant
7. Year of study

BAND DETAIL

1. Band reach
2. Maximum band weight
3. Minimum band weight
4. Total time

INCLUSION\EXCLUSION CERITERIA

1. YES
2. NO