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Normative value of Jebsen Taylor Hand Function Test, India (JTHFT-I) among children 6-14 years of age

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Abstract
Background: Hand function plays a crucial role in daily activities, and its assessment is essential for identifying motor skill development and impairments in children. The Jebsen-Taylor Hand Function Test (JTHFT) is a standardised tool used to evaluate fine and gross motor skills. However, there is no normative data for Indian children aged 6-14 years. Establishing these values will help clinicians in assessing and monitoring children's hand function effectively.
Methods: A cross-sectional study was conducted among 278 typically developing school children aged 6-14 years in Mysuru, India. Participants were selected using a purposive sampling method. The JTHFT, consisting of seven subtests measuring functional hand use, was administered to assess hand function. Data were analysed using descriptive statistics, including mean, standard deviation, median, and percentile distributions.
Conclusion: The study provides normative reference values for the Jebsen-Taylor Hand Function Test in Indian children aged 6-14 years. These benchmarks will facilitate better assessment and early intervention planning for children with motor impairments. Future studies should explore longitudinal changes in hand function and its relationship with real-life activities.

Keywords: Hand function assessment, paediatric normative data, JTHFT, motor development, Indian children, fine motor skills

Introduction
Introduction or background
Hand function is crucial for performing essential daily activities, such as dressing, grooming, and feeding, which directly impact a person's independence and quality of life [1]. Impairments in hand function can make these simple self-care tasks extremely challenging, leading to increased reliance on others for assistance [2]. The hand is responsible for approximately 90% of upper limb function, enabling precise movements like writing and drawing, as well as the ability to grip objects of various sizes and shapes [2]. This complex structure allows for a wide range of activities, from delicate tasks requiring fine motor skills to stronger movements like gripping and lifting. Any decline in grip strength or dexterity can significantly affect an individual's capacity to carry out these tasks, making it evident that the hand plays a pivotal role in functional independence and overall life satisfaction [2]. Hand strength, particularly grip strength, is one of the most important indicators of hand function. It reflects not just physical strength but also the ability to perform tasks such as opening jars, typing, or carrying objects [3]. For children, developing strong hand function is vital for their overall growth, enabling them to participate in play, learning, and social activities, all of which are essential for cognitive and social development [3]. For adults, maintaining hand function ensures that they can continue performing work-related tasks and remain independent in daily life [3]. A strong grip and dexterity are not just essential for personal tasks but also for professional performance in a variety of fields, highlighting the importance of hand function for health and well-being [3]. Impairments in hand function, such as reduced grip strength, can make these tasks more difficult, leading to frustration, loss of independence, and a decline in overall quality of life. This is particularly significant for children with developmental delays, injuries, or neurological conditions that affect

hand function, as it can impede their ability to engage in critical developmental activities such as writing, drawing, and playing [9].

Assessing hand function is crucial for understanding the limitations and capabilities of individuals, particularly those with motor impairments, as it allows healthcare providers to design effective treatment plans [4]. Several assessment tools are available to evaluate hand function, each focusing on different aspects of hand dexterity and motor skills. These tests include the Box and Block Test (BBT), which measures gross manual dexterity, and the Purdue Pegboard Test (PPT), which assesses fine motor skills through peg placement [5, 6]. The Nine-Hole Peg Test (NHPT) is another commonly used tool that evaluates finger dexterity through a timed peg insertion task [7]. The Peabody Developmental Motor Scales (PDMS) are used for assessing fine and gross motor skills in young children [8]. These tools are valuable for understanding motor function in specific contexts but may not fully capture the complexity of hand function in daily life. One assessment that has proven effective in evaluating both fine and gross motor skills through simulated daily tasks is the Jebsen-Taylor Hand Function Test (JTHFT). This tool, developed in 1969, is widely used to assess hand function, particularly in individuals with neurological and musculoskeletal conditions. The JTHFT evaluates the ability to perform seven subtests, including writing, page-turning, picking up small objects, simulated feeding, stacking, and lifting both light and heavy objects [3]. Each subtest is timed, and the final score is based on the total time taken to complete all tasks, with a lower score indicating better hand function. This test is designed to simulate the types of tasks that individuals typically perform in their daily lives, providing a more practical measure of hand function than other tests that focus on isolated movements [3].

The JTHFT is suitable for individuals aged five and older, making it versatile across a wide range of age groups and clinical contexts. It is particularly useful for assessing the functional capabilities of children, adults, and elderly individuals, including those recovering from injuries or managing chronic conditions. This tool follows the International Classification of Functioning, Disability, and Health (ICF) framework, which considers not just individual impairments but also the broader context of how a person functions in their environment. The test evaluates both fine motor skills and functional tasks involving objects of varying weights, which is important for understanding how well individuals can manage tasks that require different types of hand function [11]. The JTHFT has demonstrated excellent reliability, with intraclass correlation coefficients (ICCs) ranging from 0.84 to 0.97 for both dominant and non-dominant hands [12]. These high reliability scores indicate that the JTHFT provides consistent results over time, making it a trusted tool for tracking changes in hand function, especially for those recovering from injuries or undergoing rehabilitation. This is particularly valuable for clinicians who need to monitor progress and adjust treatment plans as necessary. Consistent results also mean that any changes in hand function observed are likely due to real improvements or declines, rather than variability in the assessment process itself. This makes the JTHFT a reliable method for monitoring the effectiveness of interventions aimed at improving hand function, such as physical therapy or rehabilitation programs. The high reliability and validity of the JTHFT make it a valuable tool for both clinical practice and research, allowing clinicians and researchers to confidently assess hand function and track the progress of patients or study participants over time.

One of the key advantages of the JTHFT is its ability to assess hand function in a way that closely mimics daily activities. Unlike other tests that may only evaluate isolated motor tasks, the JTHFT assesses an individual's ability to perform activities that they would typically encounter in everyday life. This makes it an especially useful tool for understanding how impairments in hand function can impact a person's ability to perform daily tasks such as dressing, eating, and writing. The test's focus on simulated activities of daily living makes it more relevant and applicable to real-world scenarios, ensuring that the results reflect the practical challenges that individuals face [3].

Grip strength is a crucial component of hand function, and evaluating it is essential for understanding an individual's ability to perform common tasks [9]. Grip strength is a strong indicator of overall hand function and can help clinicians assess whether a child's hand function is developing normally or if there are concerns that need to be addressed. By comparing a child's grip strength to normative data, clinicians can identify areas of concern early, allowing for timely intervention to improve hand function and prevent further complications. This is particularly important in paediatric rehabilitation, where early intervention can have a significant impact on the child's development and long-term outcomes [9].

Material and Methods

A cross-sectional study was conducted between January and April 2025 at Mysuru, Karnataka. The purpose was to establish normative values for the Jebsen-Taylor Hand Function Test (JTHFT-I) in typically developing children aged 6-14 years.

A purposive sampling method was used to recruit 278 school-going children from Mysuru. Inclusion criteria were typically developing children within the age range; children with known hand impairments or recent upper limb injuries were excluded. Institutional ethical clearance was obtained prior to data collection.

The Jebsen-Taylor Hand Function Test a standardised tool with established reliability and validity (Jebsen *et al.*, 1969) was used to assess hand function across seven subtests simulating daily activities. Each participant performed tasks using both dominant and non-dominant hands, and the completion time was recorded using a stopwatch.

All assessments were conducted in controlled school environments. Data were analysed using descriptive statistics (mean, standard deviation, median, percentiles) via Jamovi software (version 2.3.21).

The experimental design and measurement techniques were adapted from previously validated protocols, ensuring standardisation and reliability.

Tables and Figures

Table 1: Demographic characteristics of the participants

Age	Male	Female
7 - 7.11	16	13
8 - 8.11	12	20
9 - 9.11	21	18

Inferential Statistics

Table 2: Mean and standard deviation

Age group	Gender	Non-dominant hand (mean ±standard deviation)	Dominant hand (mean ±standard deviation)
7 - 7.11 years	Male	159±21.5	84.5±22.7
	Female	137±24.5	87.1±28.1
8 - 8.11 years	Male	127±82.5	76.8±12.5
	Female	117±90.2	69.4±11.0
9 - 9.11 years	Male	121±87.7	68.8±12.9
	Female	119±84.3	71.1±13.0

Table 3: Median, 25th percentile, 75th percentile

Age group	Gender	Non-dominant hand Median (25th percentile - 75th percentile)	Dominant hand Median (25th percentile - 75th percentile)
7 - 7.11 years	Male	155 (142 - 178)	90.5 (79.3 - 102)
	Female	139 (130 - 151)	87.3 (67.0 - 91.4)
8 - 8.11 years	Male	130 (122 - 135)	81.9 (63.1 - 85.2)
	Female	113 (105 - 131)	68.9 (60.1 - 75.7)
9 - 9.11 years	Male	117 (106 - 135)	66.7 (59.7 - 74.6)
	Female	126 (106 - 113)	72.7 (64.6 - 81.4)

Table 4: Mode, minimum and maximum values

Age group	Gender	Non-dominant hand Mode (minimum-maximum)	Dominant hand Mode (minimum-maximum)
7 - 7.11 years	Male	132 (132 - 201)	67.0 (67.0 - 153)
	Female	95.0 (95.0 - 180)	46.9 (46.9 - 150)
8 - 8.11 years	Male	82.5 (82.5 - 153)	83.5 (61.3 - 93.0)
	Female	90.2 (90.2 - 160)	53.5 (53.5 - 96.3)
9 - 9.11 years	Male	87.7 (87.7 - 186)	53.1 (53.1 - 93.3)
	Female	84.3 (84.3 - 151)	(44.2 - 93.1)

Results and Discussion

Demographic Characteristics: The data includes children aged 7 to 9.11 years. Participants are categorized into three age groups: 7-7.11, 8-8.11, and 9-9.11 years. Both males and females are included in each age group.

5.2 Inferential Statistics

The table shows mean and standard deviation values for a specific measurement in the non- dominant and dominant hands of children aged 7 to 9 years, categorised by gender. Across all age groups, the non-dominant hand consistently shows higher values than the dominant hand. Males exhibit greater values than females, particularly in the non-dominant hand. At ages 7-7.11 years, males have higher non-dominant hand values (159±21.5) compared to females (137±24.5), while dominant hand values remain similar (males: 84.5±22.7, females: 87.1±28.1). As age increases, a decreasing trend is observed, with 9-9.11-year-old males and females showing lower values in both hands (males: 121±87.7 and 68.8±12.9, females: 119±84.3 and 71.1±13.0). These findings suggest age-related changes in hand function, potential differences in motor development between genders.

The table presents median values along with the interquartile range (25th to 75th percentile) for a specific measurement in the non-dominant and dominant hands of children aged 7 to 9 years, categorized by gender. Across all age groups, the non-dominant hand consistently shows higher median values compared to the dominant hand. Among 7-7.11-year-olds, males exhibit a higher non-dominant hand median (155, range: 142-178) than females (139, range: 130-151), while dominant hand values are similar (males: 90.5, range: 79.3-102; females: 87.3, range: 67.0-91.4).

At ages 8-8.11 years, both genders show a decline, with males recording a non-dominant hand median of 130 (range: 122-135) and females 113 (range: 105-131), while their dominant hand values drop to 81.9 (males) and 68.9 (females). By 9-9.11 years, the non-dominant hand median for males decrease to 117 (range: 106-135), while females show a slightly higher value of 126 (range: 106-113). The dominant hand continues to show lower values, with males at 66.7 (range: 59.7-74.6) and females at 72.7 (range: 64.6-81.4). These findings indicate a general decline in values with age, with males initially demonstrating higher values, though females. The differences may suggest gender-related variations in motor development and functional hand dominance during childhood.

The table presents the mode, minimum, and maximum values for a specific measurement in the non-dominant and dominant hands of children aged 7 to 9 years, categorized by gender. The non-dominant hand have higher mode values than the dominant hand across all age groups. Among 7-7.11-year-olds, males show a higher non-dominant hand mode (132, range: 132-201) than females (95.0, range: 95.0-180), while the dominant hand mode is also higher in males (67.0, range: 67.0-153) compared to females (46.9, range: 46.9-150). At ages 8-8.11 years, males show a decrease in non-dominant hand mode (82.5, range: 82.5-153), while females show a slightly higher mode (90.2, range: 90.2-160). The dominant hand values remain lower, with males at 83.5 (range: 61.3-93.0) and females at 53.5 (range: 53.5-96.3). By 9-9.11 years, non-dominant hand modes are similar between males (87.7, range: 87.7-186) and females (84.3, range: 84.3-151), whereas dominant hand modes decreases (males: 53.1, range: 53.1-93.3; females: 44.2, range: 44.2-93.1). The findings suggest that while the non-dominant hand maintains relatively higher values, the dominant hand shows greater variability, with males initially having higher values but decreasing with age. This could indicate age-related changes in motor function and gender differences in hand strength or coordination.

Conclusion

The Jebsen-Taylor Hand Function Test (JTHFT) results show that children generally use their dominant hand more efficiently for tasks requiring speed and coordination. The non-dominant hand takes longer to complete tasks across all age groups, which is expected since it's used less for precise movements. As child get older, both hands improve in function, with tasks taking less time. Boys tend to have slightly higher times for the non-dominant hand compared to girls, but their dominant hand performance is similar. Younger children show more variation in their results, meaning their hand skills are still developing, while older kids show more consistency. These findings highlight how hand function improves with age and suggest that therapy or training should focus on strengthening both hands, especially the non-dominant one, to improve overall coordination and independence in daily activities.

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