DOI: 10.7860/JCDR/2026/82311.23485

Original Article

Physiotherapy Section

Evaluating the Efficacy of Recreational Activities to Conventional Physiotherapy to Restore Hand Grip in Geriatrics: A Randomised Controlled Study

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ABSTRACT

Introduction: Ageing is a complex biological process associated with a gradual decline in physical and mental well-being. Hands are one of the vital upper limb parts of the body, and their functional reduction affects people's environmental interaction. However, the studies related to the practices to improve Handgrip Strength (HGS) and function among the geriatric population are very limited.

Aim: To evaluate the HGS and hand function among adults using hand dynamometer test and the Jebsen Hand Function Test (JHFT), following conventional physiotherapy and recreational activities.

Materials and Methods: This single-blind randomised clinical trial was undertaken in Elderly Care Centres (ECCs) in Assam, India, during the period from February 2025 to June 2025. A total of 92 geriatric people were screened, of whom 80 eligible participants were randomly allocated into two groups. Group A received conventional physiotherapy, whereas Group B participated in recreational activities for six weeks (five sessions per week). Handgrip strength and hand function were assessed using a hand dynamometer and the Jebsen Hand Function Test at baseline, third week, and sixth week. Paired t-tests were used to analyse within-group differences, and the effect size was calculated using Cohen's d. A p-value of <0.05 is regarded as statistically significant.

Results: The research outcomes proved that the conventional physiotherapy improved handgrip strength from 9.75±1.81 to 12.13±1.73, while recreational activities improved hand function, with JHFT completion time reducing from 44.53±8.26 seconds at baseline to 31.0±8.74 seconds at post-intervention in group B.

Conclusion: Both interventions improved handgrip strength and hand function in older adults. Conventional physiotherapy showed greater improvement in handgrip strength, whereas recreational activities produced greater improvement in hand function. Therefore, proprioceptive training is a valuable intervention for promoting the overall well-being as well as Quality of Life (QoL) in the elderly.

Keywords: Ageing, Elderly people, Geriatric population, Hand function

INTRODUCTION

Ageing is a natural process that is associated with progressive variations and alterations in the physical, physiological, and metabolic functions of people. These changes reduce the muscle mass and muscle power of the elderly, which leads to the loss of functionality, independence, and QoL. The advancement in age leads to the decline in motor coordination and balance, risk of falls, and abnormal joint dysfunctions due to the use of polypharmacy and lack of physical activities [1-5]. The age-associated factors, namely multiple ailments, inadequate nutrient intake, and other hormonal issues, also result in impaired hand function. Therefore, cautious monitoring and measuring the HGS helps to assess the ageing process and physical stability of older people. However, the conventional therapies neglected the integrated hand function-sensory perception and proprioception, which affect the movement, position, and orientation of limbs [6-9].

The ageing factors highly influence the physical and physiological functions of Elderly People (EP). Especially, the HGS is adversely affected by the cognitive function of the elderly, which can be overcome by resistance exercises and handgrip practices [10]. It also exposed that the handgrip training improves the precision and hand function of older women [11]. Moreover, the human body and upper limb movements are studies evaluating interventions to improve handgrip strength [12]. Recently, home-based physical activities have become popular among adults to enhance their physical fitness level. In addition, these practices diminish the rate of falls and increase the balance of older adults [13,14]. However, advancing age reluctantly causes various health issues, but the physical functions should be properly measured to prevent avoidable disasters [15]. The hydraulic hand dynamometer [16] and Jebsen-Taylor Tests [17] are used to evaluate the physical strength and hand functions of EP. Although various HGS and function evaluations have been carried out on the older generation, only a limited number of studies have been conducted about the geriatric population's handgrip and function. Thus, the current research aimed to examine the HGS and hand functions of EP using standard measures by introducing interactive and recreational physical activities into their daily lives.

The primary objective of the study was to analyse the impact of recreational fine motor training and

- Conventional physiotherapy methods on EP's HGS at varying time intervals.

And the secondary objectives were to evaluate the HGS and hand function using a hand

- Dynamometer and the Jebsen test at different interventions.
- To compare the impact of recreational fine motor activities and
- Conventional physiotherapy on geriatric participants' HGS and hand function.

Hypotheses of the Study

Null Hypothesis (H_0): There is no statistically significant difference in HGS and hand function between elderly individuals receiving conventional physiotherapy and those receiving recreational fine

motor activities at baseline (0 week), mid-intervention (3rd week), and post-intervention (6th week).

Alternate Hypothesis (H_1): There is a statistically significant difference in HGS and hand function between elderly individuals receiving conventional physiotherapy and those receiving recreational fine motor activities at baseline (0 week), mid-intervention (3rd week), and post-intervention (6th week).

MATERIALS AND METHODS

This single-blind randomised controlled trial was undertaken in Elderly Care Centres (ECCs) in Assam, India. In this study, the outcome assessor responsible for measuring handgrip strength and Jebsen Hand Function Test scores was blinded to group allocation, while participants were aware of the intervention received from February 2025 to June 2025. The study was conducted in ECCs in Assam subsequent to approval from the Institutional Ethics Committee, Assam Down Town University (Memo No: AdtU/R/2023/193 dated 22/05/2023). The trial was registered in the Clinical Trials Registry of India (CTRI/2025/03/027651). After explaining the motive and process of the research, written informed consent was taken from all the participants.

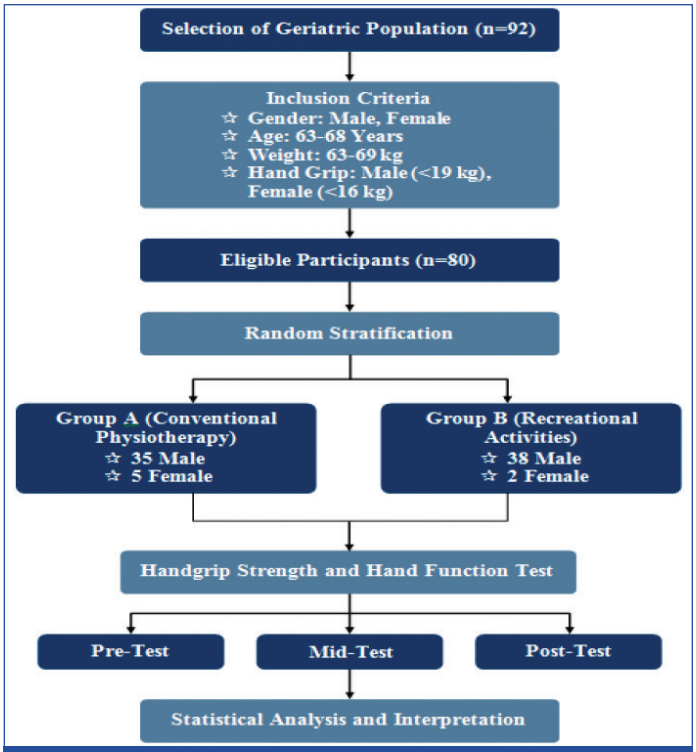
Sample size: Sample Size (SS) was obtained utilising the comparison of the mean formula. According to the Cohen method, the SS was chosen utilising standard assumptions: 0.8 for the power of the test, 0.05 for the significance level, and 0.5 for ES, accounting for a medium ES. For the randomised controlled trial, the sample size was estimated using Cohen's effect size assumptions for two-group comparisons (effect size=0.5, power=80%, alpha=0.05) [18], representing that at least sixty-four participants were required for achieving 80% power to identify a medium ES (Cohen's d=0.5) with a 0.05 significance level (alpha) utilising a two-sided two-sample t-test. Assuming a dropout of 15% (post-randomisation), 40 older people per group had to begin with the intervention. Here, researchers screened 92 geriatric people centered on the selection criteria. Nevertheless, this study excluded 12 people who didn't meet the criteria. Amongst the exclusions, three people had neurological defects, two people had mental disorders, four people had chronic heart diseases, only one person had upper limb defects, and two participants had recent surgery in the spine and hand. This research aimed to evaluate the HGS and hand function of older people using the hand dynamometer test and the JHFT regarding conventional physiotherapy and recreational activities.

Inclusion criteria: Participants aged 63-68 years, including both males and females, were recruited for the study. Individuals who were apparently healthy, without any acute illness and without a history of recent surgery, were eligible for participation. Older adults with age-related health conditions that did not interfere with participation in the study procedures were also included. For classification based on muscle strength, participants with handgrip strength <19 kg in males and <16 kg in females were also considered.

Exclusion criteria: Participants with neurological defects, mental disorders, chronic heart diseases, upper limb defects, and recent surgery in the spine and hand were excluded from the research.

The overall research design, including participant screening, eligibility assessment, randomisation, allocation to intervention groups, follow-up, and analysis, is illustrated in the CONSORT flow diagram [Table/Fig-1] in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines.

A total of 92 elderly participants were initially screened. A thorough explanation was provided to all the participants concerning the research. Participation data, namely gender, age, and HGS, were gathered from all the samples. Participants were chosen subsequent to studying the medical records of senior residents in elderly centres and completing a demographic questionnaire. Afterwards, eligible male (n=73) and female (n=7) participants were randomly (picked up by coded envelopes) assigned based on inclusion as well as exclusion criteria to



[Table/Fig-1]: CONSORT flow diagram showing research design of the present study.

- Group A (conventional physiotherapy) - 35 male and five female participants, who were trained with conventional physiotherapy practices, and
- Group B (recreational activities) - 38 male and two female participants, who performed the recreational activities.

The treatment session was carried out for five days a week and one hour per day. The hand dynamometer and JHFT were utilised to evaluate the hand grip and hand function of geriatric people at three different points:

- pre-test (before the start of the training),
- mid-test (after three weeks), and
- post-test (at the end of the six-week training period).

Prior to taking the measurement, the subject was requested for standing in a comfortable position. Moreover, the subject was asked to squeeze the dynamometer as hard as possible without moving the rest of the body. Therefore, for both hands, the final grip strength was measured. From the dynamometer scale, the reading was taken. While the pointer was no longer moved, hand function was evaluated via the JHFT, which recorded the time taken to complete various tasks.

Group A- Conventional physiotherapy exercises for dexterity

- High numbers of gripping and thumb-finger opposition movements: The participants were asked to grasp the objects with the involvement of the thumb and other fingertips.
- Hand exerciser: The EPs were asked to close and control the release of the device, which engaged various muscles in the hand, wrist, and forearm.
- Power web exerciser: The older people were requested to modify and adjust the hand position and finger insertion depth on the power web exerciser.

Group B- Recreational fine motor activities

- Dough activities: The participants were asked to roll, press, and squeeze a ball of dough by using their hands and fingers.
- Pegboard exercises: The participants were trained to take the pegs from a container and place them into the holes on the

board. Also, they were instructed to quickly remove the pegs and put them back into the container.

- Buttoning and unbuttoning: All the participants were instructed to button and unbutton their shirts and other dresses.
- Tripod grasp: The older people were requested to hold a tripod or move a small ball to the front and back, or asked to draw using a pencil or crayon.

Outcome measures: The hand grip and hand function inspection used the hand dynamometer and JHFT, respectively, to identify the hand strength of the participants. The evaluation was carried out at different time intervals, such as pre-test (0 weeks), mid-test (3rd week), and post-test (6th week). And, the obtained results were documented for the statistical analysis.

Hand dynamometer test: A hand dynamometer was utilised for measuring the dominant hand's grip strength. By utilising Fess' methodology, the dynamometer was calibrated [19]. The participants were asked to squeeze the hand dynamometer for five seconds with their maximum strength, and an average (r) of three values was recorded and used for both the dominant as well as non-dominant hand.

Jebsen Hand Function Test (JHFT): The JHFT was a standardised, performance-centric measure evaluating the daily function of the upper extremities [20]. The hand function was assessed by printing, card turning, picking up small things, sticking stickers, stimulated feeding, and moving large cans. In this test, the overall task completion time was recorded at different time intervals.

STATISTICAL ANALYSIS

In the present analysis, the t-test was utilised to compare the impacts of conventional physiotherapy and recreational activities. Further, Cohen's d value and statistical significance (p-value of <0.05) were used to quantify the present study's range of improvements. Thus, the ES was determined with Cohen's d, which was a standardised measure of ES used in studies comparing two group means and computed by dividing the difference betwixt the means by the pooled SD. This indicated the magnitude of the difference (large ~0.8, medium ~0.5, small ~0.2) [21].

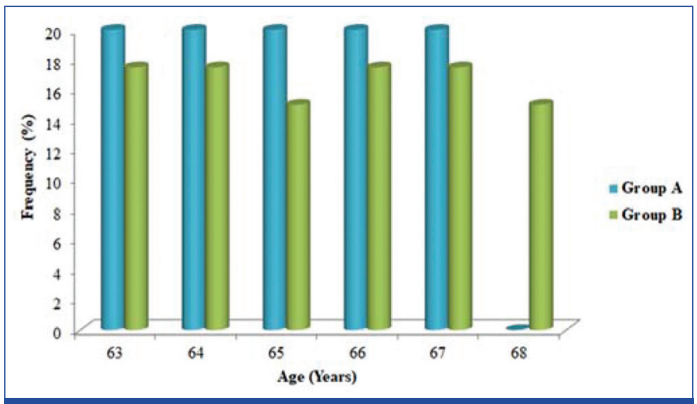
RESULTS

In the present study, 80 eligible participants were randomly assigned to group A and group B. Group A comprised 35 (87.5%) male and 5 (12.5%) female participants, whereas in group B, 38 (95%) participants were male and only 2 (5%) were female [Table/Fig-2].

Group	Gender	Total Participants	Frequency (%)
A	Male	35	87.5
	Female	5	12.5
B	Male	38	95
	Female	2	5

[Table/Fig-2]: Gender distribution studies.

Further, the age distribution analysis showed that group A possessed an equal age scattering (20%) among the selected EP; however, participants were distributed between 63 and 67 years; no participant aged 68 years was enrolled in Group A despite the eligibility criterion allowing ages 63-68 years. This occurred because no eligible participant aged 68 years was available in the selected elderly care centres during the recruitment period. In group B, the majority of the people were aged 63 years 14 (17.5%), 64 years 14 (17.5%), 66 years 14 (17.5%), and 67 years 14 (17.5%), while people aged 65 and 68-year-old showed the lowest participation rate 12 (15%). However, gender and age disparities potentially influenced the outcomes. Similarly, (Wickramarachchi B et al., 2023) also proved that the age and gender differences affected the Physical Activity (PA) and functions of the geriatric people. The age distribution of the chosen participants is displayed in [Table/Fig-3].



[Table/Fig-3]: Age distribution of the selected participants.

The HGS analysis was conducted utilising a hand dynamometer. The post-test report proved that group A showed a marginal improvement (male 11.86±1.66 and female 14.0±0.89) than group B (male 11.81±2.05 and female 12.5±0.5). Moreover, group A displayed statistical significance (p-value <0.05), whereas group B did not show significance. As a result of Cohen's d-value, there was a large effect size for group A (1.86) and moderate effect size for group B (0.79) in mid-test week compared to pre-test week and post-test week. The outcomes are exhibited in [Table/Fig-4].

The JHFT test was used to evaluate the effects of conventional physiotherapy and recreational activities on the hand function of EP. The obtained data are shown in [Table/Fig-5].

The tabulated reports proved that the post-test values showed a greater impact than the pre-test. Also, the recreational activities demonstrated greater improvement in JHFT completion time

(male 31.31±8.79 and female 25.01±5.01) than the conventional physiotherapy practices (male 38.65±10.87 and female 25.01±3.16). Furthermore, Cohen's d-value revealed that when compared to group B in pre-test week, group A achieved the highest value, i.e., 2.23; meanwhile, it significantly dropped in post-test weeks. Furthermore, all the interferences didn't express statistical significance (p-value <0.05) among the selected participants.

The overall impact of conventional physiotherapy exercises and recreational activities was evaluated. The comparative data-driven reports are demonstrated in [Table/Fig-6].

The results proved that the conventional physiotherapy practices resulted in significant improvement from 9.75±1.81 to 12.13±1.73 in restoring the HGS of the geriatric population compared to the recreational activities (9.62±1.93 to 11.13±1.94). In contrast, when compared to the conventional physiotherapy practices, the

Sets	Pre-test (0 week)		Mid-test (3rd week)		Post-test (6th week)	
	Group A	Group B	Group A	Group B	Group A	Group B
Male	9.57±1.02	10.18±1.97	10.77±1.22	10.89±1.97	11.86±1.66	11.81±2.05
Female	11.0±0.63	11±0.01	12.5±0.5	12±0.01	14.0±0.89	12.5±0.5
Cohen's d-value	0.07	0.59	1.86	0.79	1.61	0.46
p-value	0.004	0.564	0.003	0.436	0.007	0.641

[Table/Fig-4]: Results of the hand dynamometer test.

Sets	Pre-test (0 week)		Mid-test (3rd week)		Post-test (6th week)	
	Group A	Group B	Group A	Group B	Group A	Group B
Male	46.28±8.04	45.02±8.81	41.54±10.38	38.29±8.61	38.65±10.87	31.31±8.79
Female	33.01±2.44	37.5±2.5	27.01±2.45	30.01±5.01	25.01±3.16	25.01±5.01
Cohen's d-value	2.23	1.16	1.92	1.18	1.71	0.88
p-value	0.000	0.241	0.003	0.189	0.008	0.325

[Table/Fig-5]: Jebsen test measurements.

Sets	Handgrip Test			Jebsen Test		
	Pre-test (0 week)	Mid-test (3rd week)	Post-test (6th week)	Pre-test (0 week)	Mid-test (3rd week)	Post-test (6th week)
Group A	9.75±1.81	10.95±1.28	12.13±1.73	44.63±8.76	39.73±10.87	36.95±11.18
Group B	9.62±1.93	10.25±1.93	11.13±1.94	44.53±8.26	37.88±8.65	31.0±8.74
Cohen's d-value	0.06	0.01	0.54	0	0.18	0.59
p-value	0.882	1.00	0.2403	1.00	0.814	0.465

[Table/Fig-6]: Overall results of the hand dynamometer and Jebsen test.

recreational activities enriched the hand function of the elderly adults from 44.53±8.26 to 31.0±8.74. Moreover, in the Jebsen Test Time reduction, Cohen's d of 0.59 was obtained, representing a notable impact of the intervention. Meanwhile, in the Handgrip test, Cohen's d value was 0.54, which was comparatively lower compared to the Jebsen test.

DISCUSSION

The study demonstrated noteworthy enhancements in HGS and hand function among geriatric participants following a 6-week conventional physiotherapy and recreational activities. Findings of the present study revealed that group A (12.13±1.73) significantly increased the HGS compared to group B (11.13±1.94). Furthermore, the recreational accomplishments (36.95±11.18) enhanced the hand function more than the conventional physiotherapy exercises (31.0±8.74) of the geriatric people. The findings of the present study support the study hypothesis that structured physiotherapy and recreational fine motor activities improve handgrip strength and hand function among older adults.

These findings aligned with prior research. Lupton-Smith A et al., indicated that the Camry dynamometer was a valid tool for measuring grip strength in hospitalised adult patients, with a strong association and excellent agreement with the present gold standard, the Jamar® dynamometer [22]. The present study also concluded that both conventional physiotherapy and recreational activities improved the handgrip performance of both genders. These results were contrasted with the findings of Bilajac L et al., who depicted that HGS differed between men and women and that the average HGS value was higher in men compared to women [23]. The overall findings revealed that the use of conventional physiotherapy and recreational activities enhanced the handgrip function of elderly participants. The present findings were consistent with Concha-Cisternas Y et al., who demonstrated that neuromuscular training improved postural balance and physical performance in older women, which indirectly supports the role of structured exercise interventions in improving functional outcomes among older adults [16]. Similarly, Białkowska J et al., reported that the Jebsen-Taylor Hand Function Test is a reliable measure for evaluating functional hand recovery following upper-limb rehabilitation, highlighting its usefulness in assessing intervention outcomes [17]. Furthermore, Freire I and Seixas A, Kashyap D et al., and Wołoszyn N et al., also proved that the implementation of supplementary training practices enhanced the HGS and function of EP [3,7,8].

Few clinically beneficial data might be acquired regarding these outcomes, such that in conventional physiotherapy and recreational activities, it might be viable to assess people's grip strength utilising distinct integrated elbow and shoulder positions for determining their maximum grip force. The findings' clinical implications were associated with the advantages that the elderly obtained as of PA. The suggestions for Healthy Ageing (HA) as well as fall prevention were guided by maintaining balance as well as strengthening the muscles of the whole body. Conversely, as per this study, it was essential to support PA in older as well as younger age groups for enhancing the QoL. The measure, which was defined as one among the significant predictors of HA and whose value was directly influenced by PA, was the HGS, and its outcomes were displayed in this research. This suggested that conventional physiotherapy and recreational activities might improve the performance of the hand grip and hand function as well as overall well-being.

Limitation(s)

Certain limitations should be acknowledged. First, the study included a relatively limited sample size. Second, the non recurring evaluation affected the accuracy of the results. The findings were only associated with patients having superior voluntary control; hence, the study findings mightn't be generalised to the whole populace. Several confounding factors, including differences in baseline PA, nutritional status, co-morbidities, gender distribution, learning effect from repeated testing, and medication use, might have influenced the outcomes. Challenges, like limited resources or infrastructure, restricted the potential to utilise more robust study designs or carry out elaborate evaluations. Finally, the short training duration reduced the effectiveness of the study.

In the future, boundless sample inclusion, long-term and recurrent evaluations, and incorporation of conventional and radical practices will be used to advance the efficiency of the study outcomes. Enduring the investigation to assess how treatment effects continue beyond the first 6-week intervention period might render valuable insights into the lasting benefits of other hand function tests for geriatric people.

CONCLUSION(S)

The crucial objective of the current research was to examine the effect of recreational activities and conventional physiotherapy in reinstating the HGS and hand function of the older generation. The results proved that both male and female participants showed an increased HGS and hand function with both practices. In particular, when compared to Group-B (11.13±1.94), Group-A (12.13±1.73) boosted the HGS. But, recreational activities improved hand function more effectively (31.0±8.74 seconds) compared with conventional physiotherapy (36.95±11.18 seconds). Moreover, the present study highlighted the need for effective and additional practices to reduce the adverse physical imbalance of EP and contributed to enhancing the QoL of the geriatric population.

Acknowledgement

The authors acknowledge the Geriatric Society of Zoo Road, Guwahati, for its active participation and support throughout the study.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Aug 01, 2025
- Manual Googling: Feb 17, 2026
- iThenticate Software: Feb 21, 2026 (2%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jul 26, 2025**
Date of Peer Review: **Dec 23, 2025**
Date of Acceptance: **Feb 26, 2026**
Date of Publishing: **Jun 01, 2026**