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Exploring Hand Function and Performance Disparities among Women in Varied Occupational Spheres: A Preliminary Report

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Abstract

Introduction The hand represents the most interactive aspect of the upper extremity. Previous research indicates that young individuals and females typically exhibit superior hand dexterity. Limited literature exists regarding the impact of occupations that require dexterous activities on hand function, potentially influencing the preservation of dexterity as individuals age.

Objectives This study sought to assess the hand dexterity, grip strength, and pinch strength of female beedi rollers involved in intricate tasks with those of female nonbeedi workers across different age brackets.

Materials and Methods This study in a community setting included a sample of 664 female participants, evenly distributed between two groups. The participants were further categorized into age brackets: 25 to 34, 35 to 44, 45 to 54, and 55 to 64 years. Dexterity, grip strength, and pinch strength were assessed using Purdue Pegboard, Jamar hand dynamometer, and pinch meter, respectively.

Statistical Analysis Descriptive statistics with mean and standard deviation; analysis of variance and post hoc Bonferroni test were done for multiple comparisons.

Results Manual dexterity scores, grip strength, and pinch strength were evaluated and recorded for all age groups among both beedi rollers and nonbeedi workers. Manual dexterity scores were higher in beedi rollers than nonbeedi workers for all age groups, with statistically significant differences ($p < 0.05$). Similarly, grip strength and pinch strength scores were significantly greater in beedi rollers across all age groups ($p < 0.05$), except for pinch strength in the nondominant hands of participants aged 35 to 44 and 45 to 54 years of nonbeedi workers, where the differences were not statistically significant ($p > 0.05$).

Conclusion Across all age brackets, beedi rollers exhibited superior manual dexterity, grip strength, and pinch strength compared with nonbeedi rollers. The elevated dexterity scores observed in beedi rollers aged 25 years and older suggest that

Keywords
- hand dexterity
- Purdue Pegboard
- grip strength
- pinch strength
- dexterity occupations

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occupations requiring dexterity may positively influence and maintain hand performance as individuals age, thus highlighting the potential benefits of dexterity-based occupations on aging.

Introduction

The hand is an important sensory end organ with a unique functional and creative capability.[1] Hand function and manual dexterity by large, determine the quality of performance in daily activities.[2,3] Both neurological and musculoskeletal functions must remain intact to execute intricate, precise movements.[4] Research findings indicate that younger individuals typically exhibit superior dexterity compared with older adults, and females generally demonstrate greater dexterity than males.[5,6] Dexterity is also a fundamental skill that is required in occupational tasks.

Hand performance is impacted by factors such as grip strength, pinch strength, and dexterity, with dexterity often assessed through standardized tests like the Purdue Pegboard Test. The instrument's goal, validity, reliability, and specifics define this test.[7] This test also showed good intrarater reliability in the clinimetric evaluation done by Schoneveld et al.[8]

The Jamar hand dynamometer is the most precise tool for measuring grip strength.[9] The American Society of Hand Therapists has established a standardized hand grip strength measurement position.[7] Studies have also shown an inverse relationship between hand grip strength and age.[1,10–13] Hand dexterity is affected by both grip and pinch strength, making it a crucial aspect of hand assessment. Numerous normative studies have explored the correlation between age, grip strength, pinch strength, and hand dexterity. However, only one study has investigated the specific relationship between age and grip strength concerning hand dexterity among adults.[1]

In a research endeavor examining expertise and the structural neuroplasticity of the brain, it was noted that musicians and nonmusicians undergo structural alterations in the hand region's representation, with training influencing these changes.[14] Horton et al observed that the decline in proficiency over time varied depending on an individual's performance and experience compared with typical aging adults.[15] Previous research had examined hand function disparities between males and females. Beedi rolling movements can reveal variability in strength and dexterity over time. This can help identify individuals who may experience more significant declines in strength which is important for understanding the impact of prolonged manual tasks. Furthermore, there is a lack of documented studies investigating hand function among beedi rollers or the influence of age and occupations requiring manual dexterity. Understanding the relationship between these factors and dexterity could enhance or maintain this demographic's manual dexterity. Therefore, this study aimed to evaluate and compare the hand performance and functions of female beedi rollers engaged in dexterous activities, with female nonbeedi workers across various age groups.

Methods

Ethical approval was obtained from the Institutional Ethics Committee with protocol no.YEC-1/2018/224. Guidelines of the Declaration of Helsinki and National Ethical Guidelines for Biomedical and Health Research involving human participants given by the Indian Council of Medical Research were followed.

In this cross-sectional study, the data was obtained from a community setting in a specific geographical area of Mangalore, Karnataka, India. The research comprised healthy female volunteers divided into two categories: beedi rollers (group A) and nonbeedi rollers (group B), recruited from the community. Eligible participants met the following criteria: employed as beedi or nonbeedi rollers for at least 1 year, possessing intact functional vision (tested using an eye chart), and functional cognition (assessed via the Montreal Cognitive Assessment). Exclusion criteria encompassed limited range of motion, upper extremity pain exceeding 4 on a Visual Analogue Scale, and known neurological or musculoskeletal disorders. A purposive sampling technique was employed to recruit participants who provided informed consent. Considering two-group comparisons for manual dexterity normative data and assessment with a 5% level of significance and 80% power, the effect size was calculated separately for each subtest of manual dexterity. Beedi rolling group and nonbeedi workers had a total sample of 664. The subgroups of 25 to 34, 35 to 44, 45 to 54, and 55 to 64 years had an equal distribution of 83 in group A and group B (►**Fig. 1**). Sampling method for beedi rolling group: The sampling frame was created from an area and clusters were chosen by computer-generated simple random method. Once the clusters were decided, the samples were collected until the sample size for each age group was achieved. Group A comprised individuals engaged in beedi rolling, while group B comprised housewives or individuals employed in housekeeping roles. Hand dominance was determined using the Edinburgh Handedness Inventory - Short Form. The specified assessments were conducted for all participants in both groups.

Assessment of manual dexterity by Purdue Pegboard (Lafayette Instrument Company):

Purdue Pegboard assessment for the dominant hand (30 seconds), nondominant hand (30 seconds), both hands (30 seconds), and assembly (60 seconds) was done using the standard protocol, and values obtained were recorded. The scores for each hand consisted of the pins (peg) inserted. For bimanual, it was the total pairs inserted and assembly score

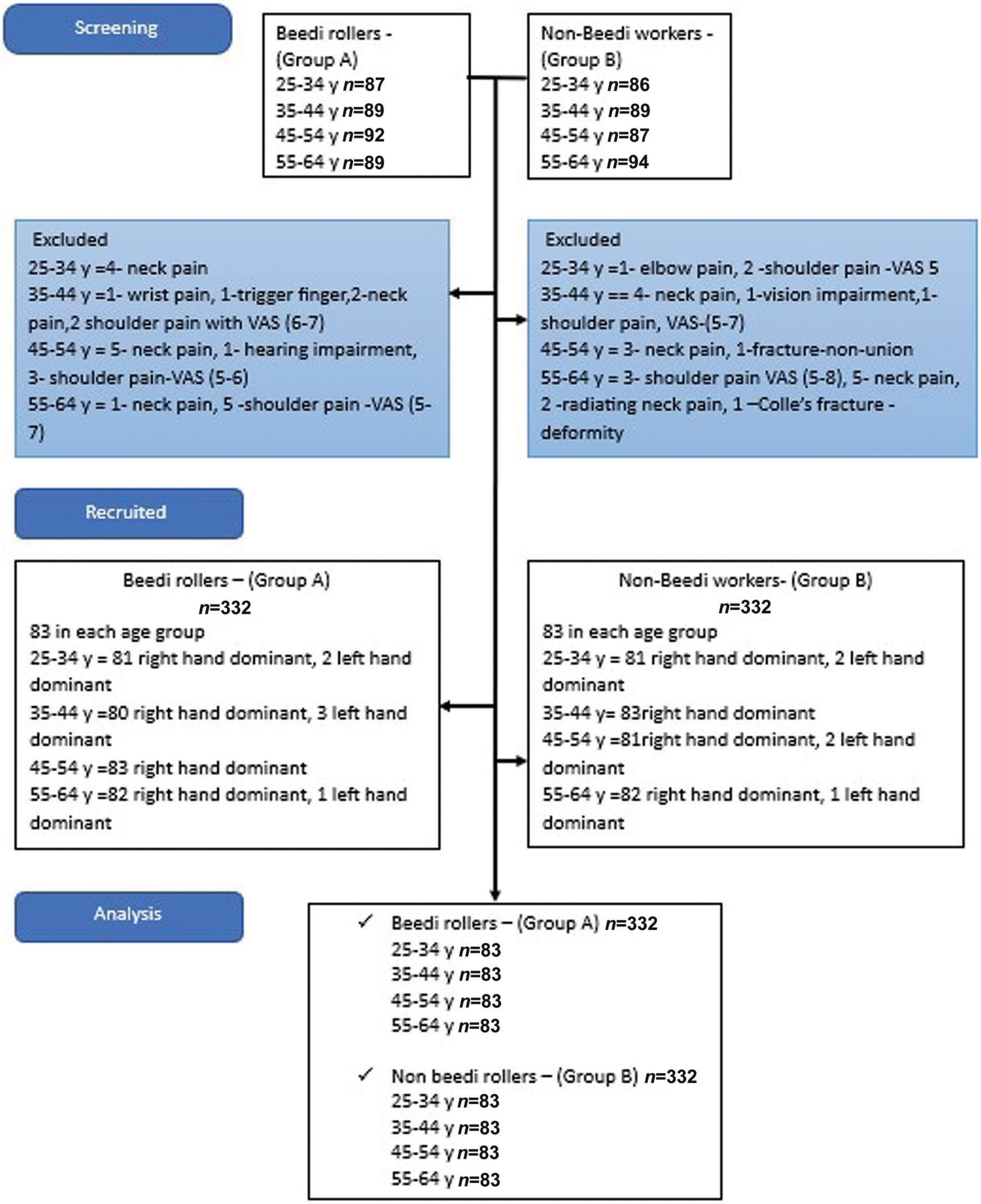

Fig. 1 Flow of participants.

was the total sets assembled. The procedure of assessment was adapted from the Lafayette instrument manual (Purdue Pegboard model 32020).

Assessment of grip strength by Jamar hand-held dynamometer (Jamar hand evaluation kit- Product 60lb Gauge): Before the test was administered, the handle of the dynamometer was adjusted for the size of each participant. Grip measurements were taken with participants in an erect sitting position. Grip strength of the dominant hand followed by the nondominant hand was measured with their shoulder adducted and neutrally rotated; elbow flexed at 90 degrees, forearm in neutral position, and wrist in 20 degrees of dorsiflexion. The standard protocol as mentioned by the American Society of Hand Therapists was followed.[12] The values obtained were recorded in kilogram.[7]

Assessment of pinch strength by pinch gauge (Jamar hand evaluation kit- Product 60lb Gauge): Key pinch strength (lateral pinch) was assessed on dominant and nondominant hands of both groups. Participants were seated with the test arm at the side, elbow flexed 90 degrees, and palm facing inward. A pinch gauge was placed between the flexed proximal interphalangeal joint of the index finger and thumb.[7] The values obtained were recorded in kilogram.

Kolmogorov–Smirnov test was used to check the normality. Descriptive statistics and inferential statistics were used in data analysis. Mean and standard deviation were calculated. The level of significance was set at 0.05. Analysis of variance (ANOVA) and post hoc Bonferroni test were used for multiple comparisons. Data was analyzed using the Statistical Package for Social Sciences (SPSS) software version 23.

Results

The tables present descriptive values (►**Table 1**) and a comparative analysis of manual dexterity, grip strength, and pinch strength between beedi rollers and nonbeedi workers across four age groups: 25 to 34, 35 to 44, 45 to

Table 1 Descriptive values for manual dexterity, grip, and pinch strength for beedi rollers and nonbeedi workers

Age group in years	Parameters (SI unit)	Beedi rollers (group A) (*n* = 332) Mean ± SD	Nonbeedi workers (group B) (*n* = 332) Mean ± SD
25–34	MD dominant hand	18.31 ± 0.70	14.89 ± 0.86
	MD nondominant hand	17.31 ± 0.70	13.86 ± 0.87
	MD both hands	15.10 ± 0.60	12.81 ± 0.76
	MD assembly	40.23 ± 2.30	37.27 ± 2.47
	GS dominant hand (kg)	19.01 ± 0.72	17.50 ± 0.63
	GS nondominant hand (kg)	17.61 ± 0.72	16.19 ± 0.33
	PS dominant hand (kg)	4.77 ± 0.15	4.59 ± 0.12
	PS nondominant hand (kg)	4.57 ± 0.10	4.49 ± 0.12
35–44	MD dominant hand	16.22 ± 0.72	14.22 ± 0.72
	MD nondominant hand	15.22 ± 0.72	13.22 ± 0.72
	MD both hands	13.82 ± 0.83	11.89 ± 0.75
	MD assembly	37.47 ± 2.49	35.72 ± 2.58
	GS dominant hand (kg)	17.11 ± 0.93	16.03 ± 0.41
	GS nondominant hand (kg)	16.14 ± 0.37	14.98 ± 0.41
	PS dominant hand (kg)	4.41 ± 0.27	4.32 ± 0.22
	PS nondominant hand (kg)	4.14 ± 0.33	4.19 ± 0.16
45–54	MD dominant hand	14.77 ± 0.61	11.60 ± 1.17
	MD nondominant hand	13.77 ± 0.61	10.60 ± 1.17
	MD both hands	12.63 ± 0.64	9.60 ± 1.17
	MD assembly	35.66 ± 2.90	34.48 ± 3.14
	GS dominant hand (kg)	14.95 ± 0.71	13.77 ± 0.45
	GS nondominant hand (kg)	13.56 ± 0.30	12.24 ± 0.26
	PS dominant hand (kg)	4.15 ± 0.33	3.29 ± 0.31
	PS nondominant hand (kg)	3.74 ± 0.22	3.72 ± 0.30
55–64	MD dominant hand	12.78 ± 0.41	10.77 ± 0.98
	MD nondominant hand	12.22 ± 0.41	9.77 ± 0.98
	MD both hands	10.86 ± 0.35	9.80 ± 0.98
	MD assembly	29.98 ± 2.89	28.78 ± 2.89
	GS dominant hand (kg)	13.08 ± 0.33	12.09 ± 0.48
	GS nondominant hand (kg)	12.08 ± 0.33	11.36 ± 0.27
	PS dominant hand (kg)	3.00 ± 0.27	2.92 ± 0.20
	PS nondominant hand (kg)	2.81 ± 0.33	2.72 ± 0.21

Abbreviations: GS, grip strength; MD, manual dexterity; PS, pinch strength; SD, standard deviation.

Table 2 Comparison between the four age groups and between beedi rollers and nonbeedi workers for manual dexterity, grip strength, and pinch strength

Variables	Source	*F*-value	*p*-Value
Manual dexterity - dominant	Beedi vs. nonbeedi	1824.421	< 0.001[a]
	Age	1186.090	< 0.001[a]
Manual dexterity - nondominant	Beedi vs. nonbeedi	1979.138	< 0.001[a]
	Age	1085.199	< 0.001[a]
Manual dexterity - both hands	Beedi vs. nonbeedi	1134.108	< 0.001[a]
	Age	712.281	< 0.001[a]
Manual dexterity - assembly	Beedi vs. nonbeedi	70.321	< 0.001[a]
	Age	359.986	< 0.001[a]
Grip strength - dominant	Beedi vs. nonbeedi	631.941	< 0.001[a]
	Age	2744.987	< 0.001[a]
Grip strength - nondominant	Beedi vs. nonbeedi	1380.678	< 0.001[a]
	Age	5873.916	< 0.001[a]
Pinch strength - dominant	Beedi vs. nonbeedi	57.223	< 0.001[a]
	Age	1555.734	< 0.001[a]
Pinch strength - nondominant	Beedi vs. nonbeedi	3.499	0.062
	Age	1702.450	< 0.001[a]

[a]Highly significant.

54, and 55 to 64 years. The analysis includes statistical data from ►**Tables 2**–**4**, which detail the *F*-values, *p*-values, mean differences, and standard errors for these variables.

Repeated measures ANOVA revealed significant differences in all subtests of manual dexterity and grip strength (dominant and nondominant) between beedi rollers and nonbeedi workers and across age groups. However, the two groups did not show differences in pinch strength for the nondominant hand suggesting that the effects were more prominent in the dominant hand (►**Table 2**).

The post hoc analysis between each age group compared the mean differences for manual dexterity, grip strength, and pinch strength. Significant differences were observed across all age groups for manual dexterity and grip strength in both dominant and nondominant hands with the beedi roller group showing higher values when compared with the nonbeedi worker group. Pinch strength in the dominant hand indicated significant differences across age groups, while the nondominant hand exhibited mixed significance, with age groups 35 to 44 and 45 to 54 years not significantly different ($p > 0.05$). This manifests that there is a reduction in dexterity, grip, and pinch strength as age increases (►**Table 3**).

►**Table 4** compared the mean differences and *p*-values for manual dexterity, grip strength, and pinch strength across four age groups (25–34, 35–44, 45–54, and 55–64 years) between beedi rollers and nonbeedi workers. For manual dexterity (dominant hand and nondominant hand, both hands and assembly), beedi rollers revealed higher mean differences when compared with nonbeedi workers, indicating reduced manual dexterity among nonbeedi workers. Grip strength and pinch strength of the dominant and nondominant hand also showed better strength among beedi rollers than the nonbeedi workers with a significant decline as age increases at $p < 0.05$. The analysis suggested that age and occupation have a significant impact on these physical attributes.

Discussion

This study aimed at evaluating hand performance, focusing on manual dexterity, grip, and pinch strength among a specific occupational group, namely, beedi rollers. Results highlighted superior hand performance across all measured parameters among female workers engaged in beedi rolling (group A).

A study by Martin et al demonstrated that manual dexterity relies on grip strength.[1] Our study found a parallel trend: persons with improved dexterity also had greater grip strength. Furthermore, our study found that beedi rollers had increased pinch strength, suggesting that grip and pinch strength may play important roles in determining dexterity.

The comparison of manual dexterity between beedi rollers and nonbeedi rollers revealed discernible distinctions across all age groups (25–34, 35–44, 45–54, and 55–64 years), indicating that alterations in hand function may commence as early as 25 years of age. Engaging in dexterous activities such as beedi rolling, which necessitates the coordinated use of both hands, may aid in maintaining fine motor skills as individuals age.

Observing superior pinch strength among beedi rollers in the 45 to 54 and 55 to 64 age groups suggests that engaging in

Table 3 Post hoc analysis between groups for manual dexterity, grip strength, and pinch strength

Variable	Age group (y)	Mean difference	Standard error	*p*-Value
MD - dominant	25–34	3.422	0.121	< 0.001[a]
	35–44	2.000	0.111	< 0.001[a]
	45–54	3.169	0.145	< 0.001[a]
	55–64	2.012	0.117	< 0.001[a]
MD - nondominant	25–34	3.458	0.122	< 0.001[a]
	35–44	2.000	0.111	< 0.001[a]
	45–54	3.169	0.145	< 0.001[a]
	55–64	2.446	0.117	< 0.001[a]
MD - both	25–34	2.289	0.106	< 0.001[a]
	35–44	1.928	0.123	< 0.001[a]
	45–54	3.024	0.146	< 0.001[a]
	55–64	1.060	0.115	< 0.001[a]
MD - assembly	25–34	2.964	0.371	< 0.001[a]
	35–44	1.747	0.393	< 0.001[a]
	45–54	1.181	0.469	0.013[a]
	55–64	1.193	0.449	0.009[a]
Grip strength - dominant	25–34	1.508	0.105	< 0.001[a]
	35–44	1.080	0.111	< 0.001[a]
	45–54	1.183	0.092	< 0.001[a]
	55–64	0.998	0.064	< 0.001[a]
Grip strength - nondominant	25–34	1.416	0.087	< 0.001[a]
	35–44	1.161	0.062	< 0.001[a]
	45–54	1.317	0.043	< 0.001[a]
	55–64	0.719	0.047	< 0.001[a]
Pinch strength - dominant	25–34	−0.183	0.020	< 0.001[a]
	35–44	−0.085	0.038	0.028[a]
	45–54	−0.230	0.050	< 0.001[a]
	55–64	−0.076	0.037	0.042[a]
Pinch strength - nondominant	25–34	−0.084	0.017	< 0.001[a]
	35–44	0.052	0.041	0.199
	45–54	−0.018	0.041	0.664
	55–64	−0.089	0.043	0.040[a]

Abbreviation: MD, manual dexterity.
[a]Highly significant.

dexterous tasks helps maintain the strength of the small hand muscles, particularly in the dominant hand. Moreover, when comparing the nondominant hand, beedi rollers exhibited greater strength across all four subgroups, indicating that consistent use of both hands may lead to enhanced strength preservation even with advancing age.

This study reaffirmed previous findings indicating a decline in hand dexterity and strength with advancing age.[1,13] Participants in group A (across all subgroups) exhibited greater dexterity and strength compared with age-matched counterparts in group B. This notable discovery could play a pivotal role in shaping exercise regimens for healthy individuals in early adulthood, potentially mitigating the decline in hand performance associated with aging.

The observed preservation of hand performance in this study may be attributed to the functional plasticity of the brain, which occurs through sustained engagement in hand movements over time. Kobayashi-Cuya et al noted that dexterity-related activities could induce alterations in distinct brain regions.[16] The individuals showing a lesser decline in performance, such as beedi rollers, may experience selective maintenance, which results from regular practice of

Table 4 Post hoc analysis across four age groups for manual dexterity, grip, and pinch strength for beedi rollers and nonbeedi workers

Variables	Age (y)		Beedi roller Mean difference	Beedi roller *p*-value	Nonbeedi worker Mean difference	Nonbeedi worker *p*-value
MD - dominant	25–34	35–44	2.096	< 0.001[a]	0.675	< 0.001[a]
		45–54	3.542	< 0.001[a]	3.289	< 0.001[a]
		55–64	5.530	< 0.001[a]	4.120	< 0.001[a]
	35–44	45–54	1.446	< 0.001[a]	2.614	< 0.001[a]
		55–64	3.434	< 0.001[a]	3.446	< 0.001[a]
	45–54	55–64	1.988	< 0.001[a]	0.831	< 0.001[a]
MD - nondominant	25–34	35–44	2.096	< 0.001[a]	0.639	< 0.001[a]
		45–54	3.542	< 0.001[a]	3.253	< 0.001[a]
		55–64	5.096	< 0.001[a]	4.084	< 0.001[a]
	35–44	45–54	1.446	< 0.001[a]	2.614	< 0.001[a]
		55–64	3.000	< 0.001[a]	3.446	< 0.001[a]
	45–54	55–64	1.554	< 0.001[a]	0.831	< 0.001[a]
MD - both hands	25–34	35–44	1.277	< 0.001[a]	0.916	< 0.001[a]
		45–54	2.470	< 0.001[a]	3.205	< 0.001[a]
		55–64	4.241	< 0.001[a]	3.012	< 0.001[a]
	35–44	45–54	1.193	< 0.001[a]	2.289	< 0.001[a]
		55–64	2.964	< 0.001[a]	2.096	< 0.001[a]
	45–54	55–64	1.771	< 0.001[a]	−0.193	1.000
MD - assembly	25–34	35–44	2.759	< 0.001[a]	1.542	< 0.002[a]
		45–54	4.566	< 0.001[a]	2.783	< 0.001[a]
		55–64	10.253	< 0.001[a]	8.482	< 0.001[a]
	35–44	45–54	1.807	< 0.001[a]	1.241	< 0.026[a]
		55–64	7.494	< 0.001[a]	6.940	< 0.001[a]
	45–54	55–64	5.687	< 0.001[a]	5.699	< 0.001[a]
Grip strength - dominant	25–34	35–44	1.90	< 0.001[a]	1.47	< 0.001[a]
		45–54	4.06	< 0.001[a]	3.73	< 0.001[a]
		55–64	5.92	< 0.001[a]	5.41	< 0.001[a]
	35–44	45–54	2.16	< 0.001[a]	2.27	< 0.001[a]
		55–64	4.03	< 0.001[a]	3.95	< 0.001[a]
	45–54	55–64	1.86	< 0.001[a]	1.68	< 0.001[a]
Grip strength - nondominant	25–34	35–44	1.47	< 0.001[a]	1.21	< 0.001[a]
		45–54	4.05	< 0.001[a]	3.95	< 0.001[a]
		55–64	5.53	< 0.001[a]	4.83	< 0.001[a]
	35–44	45–54	2.58	< 0.001[a]	2.74	< 0.001[a]
		55–64	4.06	< 0.001[a]	3.62	< 0.001[a]
	45–54	55–64	1.48	< 0.001[a]	0.88	< 0.001[a]
Pinch strength - dominant	25–34	35–44	0.366	< 0.001[a]	0.268	< 0.001[a]
		45–54	0.625	< 0.001[a]	0.672	< 0.001[a]
		55–64	1.773	< 0.001[a]	1.667	< 0.001[a]
	35–44	45–54	0.259	< 0.001[a]	0.404	< 0.001[a]
		55–64	1.408	< 0.001[a]	1.398	< 0.001[a]
	45–54	55–64	1.149	< 0.001[a]	0.995	< 0.001[a]

(*Continued*)

Table 4 (*Continued*)

Variables	Age (y)		Beedi roller Mean difference	Beedi roller *p*-value	Nonbeedi worker Mean difference	Nonbeedi worker *p*-value
Pinch strength - nondominant	25–34	35–44	0.435	< 0.001[a]	0.298	< 0.001[a]
		45–54	0.834	< 0.001[a]	0.768	< 0.001[a]
		55–64	1.767	< 0.001[a]	1.772	< 0.001[a]
	35–44	45–54	0.399	< 0.001[a]	0.469	< 0.001[a]
		55–64	1.333	< 0.001[a]	1.474	< 0.001[a]
	45–54	55–64	0.934	< 0.001[a]	1.004	< 0.001[a]

Abbreviation: MD, manual dexterity.
Note: ‘a’ highly significant, Statistical test - post hoc Bonferroni test.

similar movements. Conversely, this was not seen among nonbeedi workers in group B, who did not engage in repeated hand movement practice. This implies that expertise may significantly contribute to decelerating age-related declines in skill, as suggested by Solveig et al.[17–19]

The nature of one’s occupation may significantly influence the preservation of dexterity, as evidenced by a study conducted by Popević et al, which found that individuals engaged in vibration-intensive work experienced diminished dexterity.[20] However, in contrast, the current study observed enhancements in hand function among workers involved in beedi rolling. This suggests that the mechanoreceptors in the fingers might contribute to manual dexterity, thereby helping to mitigate the decline in hand function.[21]

Over time, repetitive movements associated with dexterous activities could lead to neuroplastic changes in the brain and adaptations in muscle structure and function. Thus, individuals involved in dexterity-based occupations may experience immediate improvements in hand function and also long-term benefits due to the neuromusculoskeletal adaptations induced by sustained practice. This phenomenon suggests that consistent engagement in tasks requiring intricate hand movements can lead to the development and maintenance of robust hand performance, regardless of age.

This study highlights the need to consider occupational factors in age-related hand function changes. While age impacts hand performance, understanding how job demands can preserve or enhance function is crucial. By examining the interplay between occupational activities, age-related changes, and hand function, future research can provide valuable insights into effective strategies for maintaining optimal hand health and function throughout the lifespan.

The study had certain drawbacks. First, the assessments were not conducted at the same time for all participants, which may have introduced diurnal fluctuations in strength. Second, individuals were not stratified according to years of experience, which could have been a significant confounding factor. Future research should include stratifying participants by years of experience and including people from other occupations that require dexterity. Cohort studies that follow persons in dexterity-based activities across time may be useful in determining the time points of relative risk or protective effects on dexterity function compared with those in nondextrous occupations. Furthermore, greater sample numbers might improve the generalizability of the study findings.

Conclusion

Notably, the finding of greater dexterity scores among beedi rollers aged 25 and above highlights the potential role of dexterity-focused employment in preserving hand function as people age. This study not only emphasizes the immediate benefits of such activities but also shows long-term benefits in terms of general hand health and functionality over the lifespan.

Authors’ Contributions
All researchers contributed to the conception and design, acquisition of data or analysis, interpretation of data, drafting, and revising of the paper, and each agreed to be responsible for all aspects of this work. S.D. contributed to the conception, design, acquisition of data or analysis, interpretation of data, drafting, and revising of the paper. The manuscript was prepared and shared with all researchers for their suggestions and modifications, which were incorporated into the final version. S.B. and M.N. both contributed to the design (methodology), data analysis, interpretation of data, drafting, and revising of the research paper.

Statement of Institutional Review Board Approval and/or Statement of Conforming to the Declaration of Helsinki
Approval from the Scientific Review Board of Yenepoya Physiotherapy College and Ethics Committee, Yenepoya (Deemed to be University), was obtained.

Conflict of Interest
None declared.

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