

Comparison of Handgrip Strength in Indian Tabla Players with Healthy Individuals

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Abstract

Background: Tabla playing involves repetitive, coordinated finger and upper-limb movements. Although such practice requires considerable motor control and repeated hand activity, its relationship with maximal handgrip strength has not been clearly established.

Objective: To compare dominant-hand grip strength in Indian tabla players with healthy individuals from the general population.

Methods: A cross-sectional study was conducted with 140 participants, comprising 70 tabla players and 70 healthy non-playing individuals. Participants were 18–24 years old. Dominant-hand grip strength was assessed using a digital hand dynamometer in a standardized testing position. Demographic variables included age, height, weight and body mass index (BMI). Data were analyzed using descriptive statistics, Shapiro–Wilk testing, Levene's test, independent-samples t-test, Welch's t-test and Mann–Whitney U test.

Results: Tabla players had a mean dominant-hand grip strength of 36.37 ± 8.07 kg, while healthy controls had a mean of 43.91 ± 8.24 kg. The mean difference was -7.54 kg (95% CI -10.27 to -4.82). The independent-samples t-test demonstrated a statistically significant difference ($t(138) = -5.470$, $p < 0.01$), with a large effect size (Cohen's $d = -0.93$). Age, height, weight and BMI did not differ significantly between groups.

Conclusion: In this study, Indian tabla players demonstrated lower dominant-hand maximal grip strength than healthy non-playing individuals. The finding may reflect the task-specific nature of tabla playing and the repetitive musculoskeletal demands of practice; however, the cross-sectional design does not establish causation.

Keywords: Handgrip strength, tabla players, hand dynamometer, physiotherapy

Introduction

Tabla is a widely used percussion instrument in Indian classical music. It consists of two drums: the smaller wooden-shelled dayan, generally played with the right hand and tuned to a higher pitch, and the larger bayan, generally played with the left hand. Playing requires coordinated and repetitive movements extending from the upper limb to the fingers. Repetitive striking and sustained playing postures may expose musicians to playing-related musculoskeletal problems. The submitted research synopsis describes symptoms and conditions reported among musicians and tabla players, including pain, weakness, numbness, tingling, tenosynovitis, carpal tunnel syndrome, de quervain's syndrome and

overuse-related problems. The prevalence of musculoskeletal injuries among Players ranges from 43 percent to 50 percent, according to prior studies. The coordinated and repetitive striking actions and forces required to play a percussion instrument may result in musculoskeletal issue such as pain. Due to their posture when playing the tabla and the repeated movements of their upper limbs, they also have musculoskeletal issues.[1,2]

Handgrip strength is an objective measure of the force generated during a power grip and is relevant to hand function and clinical assessment. It is influenced by several factors, including age, sex, body size, hand dimensions and hand dominance. The project synopsis also notes that grip strength is commonly greater in the dominant hand among right-handed individuals and is related to anthropometric characteristics such as height and weight. The significance of handgrip strength- For much of our lives handgrip strength is something we take for granted. It gives implicate significance about general muscle strength, endurance and power and for many functions, it is important to maintain the integrity of handgrip. From the time we are born, we use our hands to hold and grasp various objects, beginning with simple items such as pencils and continuing throughout our daily activities. This highlights the importance of hand grip strength, as many activities of daily living and independent functioning largely depend on adequate hand grip strength[11]

Gripping refers to the position and action of the hand while securely and firmly holding or grasping an object. It also describes the ability of an individual to hold objects of different sizes and weights effectively. Handgrip, The muscles of the hand and forearm play an important role in producing hand grip strength. These muscles provide the force required to squeeze, hold, and securely grasp an object when necessary. They are involved in numerous activities of daily living as well as various sporting activities, contributing to effective and coordinated use of the hands.³ Individuals use their hands in different ways to grip and manipulate objects during routine activities such as handling tools, lifting or moving a chair, eating, maintaining personal hygiene, playing the piano or tennis, transferring objects, writing, and typing. Many of these activities require adequate grip strength to perform them effectively.³ There are three major types of power grip: cylindrical grip, spherical grip, and hook grip. Grip can be described as a forceful action involving flexion of the joints of all the fingers, with the thumb acting as a stabilizer to secure the object between the fingers and palm. Grip strength is considered a reliable and valid objective measure for assessing the functional integrity of the hand as a component of the musculoskeletal system. Hand grip strength is a physiological variable influenced by several factors, including age, sex, and body size. Assessment of hand grip strength is particularly important for evaluating the effectiveness of different treatment strategies for hand conditions and for assessing outcomes of hand rehabilitation interventions. Hand grip strength results from the forceful flexion of the finger joints and represents the maximum voluntary force that an individual can generate under normal biomechanical conditions. Previous studies have reported significant associations between grip strength and various anthropometric characteristics, including body weight, height, hand length, and body mass index (BMI) (Malina et al., 1987; Ross and Rosblad, 2002). Grip strength has also been reported to be greater in the dominant hand among right-handed individuals, whereas significant differences between the two hands were not consistently observed among left-handed individuals (Incel et al., 2002). Both right- and left-hand grip strength have been found to show positive associations with body weight, height, and body surface area (Chatterjee and Chaudhuri, 1991). Furthermore, hand grip strength has been associated with anthropometric characteristics such as stature, body weight, arm circumference, calf circumference, and various subcutaneous skinfold measurements. Studies have

reported that males generally demonstrate higher values for these anthropometric characteristics and consequently exhibit greater hand grip strength compared with females.[3,7,16]

Grip strength testing has clinical applications in the assessment of upper-limb impairment, work capacity, treatment effectiveness, fitness and functional status. Previous literature identified in the project has examined normative grip strength in Indian populations, hand dominance, anthropometric associations, wrist pain and upper-limb musculoskeletal risk among tabla players and other Indian musicians. However, the project identified a specific gap regarding comparison of handgrip strength between tabla players and healthy controls. Hand Dynamometer-Grip of the hand is inspected by special equipment called Digital dynamometer. It is an instrument which is used for measuring the maximum isometric strength of the forearm muscles. It is a medical device that is used for rule out an individual strength, measuring the output of power and for the forces that the muscles are use during contraction. Hand dynamometer is used to access a patients grip, and overall body strength. Testing is generally attain by having patients squeeze the digital dynamometer as hard as they can, and the results are needed. They are used for purpose of comparative measurement of both right and left hands. Any kind of hand disorder, trauma or dysfunction, can be easily judged by the help of these device[5]

Aim

To compare handgrip strength of Indian tabla players with healthy individuals from the general population

Objectives

1. To measure the dominant-hand grip strength in tabla players using a hand dynamometer
2. To compare these values with healthy Indian adults

Methodology:

Study Design

A cross-sectional comparative study design was used

Sampling method

Convenience sampling was used

Study Population

The target population was Indian tabla players

Sample size

The study included 140 participants, divided equally into two groups: 70 tabla players and 70 non-playing individuals

Study duration

The sampling duration was six months

Study setup

Samples chosen from music classes in and around Pune

Inclusion Criteria

1. Age 18–24 years,
2. Indian male tabla players
3. At least one year of tabla playing experience
4. Playing at least twice per week

Exclusion criteria

1. Included an upper-limb fracture within the previous six months
2. Playing an instrument other than tabla

Materials

1. Informed consent form
2. Data collection sheet
3. Hand dynamometer

Outcome Measure

Hand Dynamometer

Ethical Considerations

Ethical permission was obtained by TMV's Indutai Tilak College of Physiotherapy, Pune before commencement of the study. Participants were informed about the purpose and procedures of the study. Written informed consent was obtained from all participants before participation. Confidentiality of participant information was maintained throughout the study.

Procedure

Firstly, permission was obtained from the Institutional Ethical Committee of Tilak Maharashtra Vidyapeeth, Department of Physiotherapy, and ethical clearance was obtained before commencing the study. The aim and objectives of the study were explained to all the participants. Participants who fulfilled the predetermined inclusion criteria were included in the study. Tabla players were recruited from music classes in and around Pune. After obtaining Permission from the respective heads of the music classes, and informed consent was obtained from all the participants before data collection. Hand grip strength was measured using a hand dynamometer, which is a reliable and valid instrument for assessing grip strength. The measurement of hand grip strength was performed according to the standardized testing position recommended by the American Society of Hand Therapists (ASHT). The ASHT-recommended standardized position was followed because the position of the upper extremity can influence the measurement of hand grip strength. Hand grip strength was measured in the dominant hand of the tabla players. Hand grip strength was also measured in healthy individuals who met the required eligibility criteria. The obtained hand grip strength values of the tabla players and healthy individuals were then compared to determine the differences between the two groups.

Statistical Analysis

Data were summarized using means, standard deviations, confidence intervals, medians, interquartile ranges and ranges for continuous variables, and frequencies and percentages for categorical variables.

Normality was assessed using the Shapiro–Wilk test. Levene’s test was used to assess equality of variances. Because dominant-hand grip strength was normally distributed in both groups and variances were equal, an independent-samples t-test was used for the primary comparison; Welch’s t-test and the Mann–Whitney U test were also reported as confirmatory analyses hahhahahaja

TABLE 1. Descriptive statistics of demographic and outcome variables by group

All statistics computed by live Excel formulas over the Data sheets. Height converted from feet/inches to cm. SD = sample SD; SE = SD/√N; 95% CI uses t-distribution.

Group	Variable	N	Mean	SD	SE	95% CI low	95% CI high	Median	IQR	Min	Max	Range	Skewness	Kurtosis
Tabla players	Age (yrs)	70	21.23	1.99	0.24	20.75	21.70	21.00	3.00	18.00	24.00	6.00	-0.11	-1.22
Tabla players	Height (cm)	70	171.48	5.63	0.67	170.13	172.82	170.20	5.10	154.90	185.40	30.50	0.06	1.80
Tabla players	Weight (kg)	70	61.53	7.83	0.94	59.66	63.40	60.00	12.00	48.00	89.00	41.00	0.00	0.88
Tabla players	BMI (kg/m ²)	70	20.99	2.36	0.28	20.42	21.55	20.78	3.68	16.93	27.37	10.44	0.28	-0.49
Tabla players	Handgrip (kg)	70	36.37	8.07	0.96	34.45	38.38	37.00	11.75	20.00	54.00	34.00	8.18	-0.73
Tabla players	Experience (yrs)	70	7.67	4.10	0.49	6.69	8.65	8.00	7.00	1.00	18.00	17.00	0.11	-0.93
Healthy controls	Age (yrs)	70	21.44	1.94	0.23	20.98	21.91	22.00	3.00	18.00	24.00	6.00	-0.35	-1.00
Healthy controls	Height (cm)	70	171.16	5.57	0.66	169.84	172.47	170.20	7.05	154.90	185.40	30.50	0.38	1.05
Healthy controls	Weight (kg)	70	62.54	9.68	1.16	60.24	64.85	64.00	16.75	48.00	79.00	31.00	0.07	-1.25
Healthy controls	BMI (kg/m ²)	70	21.43	3.11	0.37	20.69	22.17	21.62	5.11	16.00	28.11	12.11	0.23	-0.85
Healthy controls	Handgrip (kg)	70	43.91	8.24	0.98	41.95	45.88	43.00	12.00	28.00	60.00	32.00	0.01	-0.74

TABLE 2a. Age distribution — Tabla players (n=70)

Category	Frequency (n)	Percent (%)	Cumulative %
18–20 yrs	20	40.0	40.0
21–22 yrs	19	27.1	67.1
23–25 yrs	23	32.9	100.0
Total	70	100.0	

TABLE 2b. Age distribution — Healthy controls (n=70)

Category	Frequency (n)	Percent (%)	Cumulative %
18–20 yrs	22	31.4	31.4
21–22 yrs	26	37.1	68.6
23–25 yrs	22	31.4	100.0
Total	70	100.0	

TABLE 3a. BMI category — Tabla players (n=70)

Category	Frequency (n)	Percent (%)	Cumulative %
Underweight (<18.5)	12	17.1	17.1
Normal (18.5–22.9)	42	60.0	77.1
Overweight (23–24.9)	14	20.0	97.1
Obese (≥25)	2	2.9	100.0
Total	70	100.0	

TABLE 3b. BMI category — Healthy controls (n=70)

Category	Frequency (n)	Percent (%)	Cumulative %
Underweight (<18.5)	18	25.7	25.7
Normal (18.5–22.9)	30	42.9	68.6
Overweight (23–24.9)	11	15.7	84.3
Obese (≥25)	11	15.7	100.0
Total	70	100.0	

TABLE 4. Playing frequency — Tabla players (n=70)

Category	Frequency (n)	Percent (%)	Cumulative %
2 times/week	23	32.9	32.9
3–3 times/week	16	22.9	55.7
4–6 times/week	31	44.3	100.0
Total	70	100.0	

TABLE 5. Constant categorical variables (both groups, N=140)

Category	Frequency (n)	Percent (%)	Cumulative %
Hand dominance — Right	140	100.0	100.0
Occupation — Student	140	100.0	100.0
Previous deformity/pathology — No	140	100.0	100.0

TABLE 6. Shapiro–Wilk test of normality by group

Variable	Group	N	Shapiro–Wilk W	p-value	Distribution
Age (yrs)	Tabla players	70	0.9173	0.00020	Non-normal
Age (yrs)	Healthy controls	70	0.9172	0.00011	Non-normal
Height (cm)	Tabla players	70	0.9127	0.00013	Non-normal
Height (cm)	Healthy controls	70	0.9356	0.00136	Non-normal
Weight (kg)	Tabla players	70	0.9356	0.00142	Non-normal
Weight (kg)	Healthy controls	70	0.9358	0.00140	Non-normal
BMI (kg/m ²)	Tabla players	70	0.9732	0.11843	Normal
BMI (kg/m ²)	Healthy controls	70	0.9698	0.00936	Normal
Handgrip strength (kg)	Tabla players	70	0.9688	0.00815	Normal
Handgrip strength (kg)	Healthy controls	70	0.9672	0.06330	Normal

Interpretation: The primary outcome (handgrip strength) is normally distributed in BOTH groups, so a parametric independent-samples t-test is appropriate for the main comparison. Age, height and weight are non-normal, so those group comparisons use the Mann–Whitney U test.

TABLE 7. PRIMARY ANALYSIS — Handgrip strength: Tabla players vs Healthy controls

	Tabla players (n=70)	Healthy controls (n=70)		
Mean ± SD (kg)	36.37 ± 8.07	43.91 ± 8.24		
Median (Min–Max)	37 (28–54)	43 (28–60)		
95% CI of mean	34.45 to 38.38	41.95 to 45.88		
t-test / statistics	Value	df	p-value	Interpretation
Independent-samples t-test (Student’s)	-3.609	138	0.000407	Significant — group differ
Welch’s t-test (unequal variances)	-5.405	137.66	0.000007	Significant — group differ
Levene’s test (equality of variances)	0.009	1, 138	0.933040	p>0.05 = variance equal
Mann–Whitney U (non-parametric) (rank)	1289.5	—	1.000006	variance with 5 sig
Mean difference (Tabla – Healthy), kg	-7.54	—	—	95% CI = -18.27 to +3.19 kg
Cohen’s d (effect size)	-0.935	—	—	Large effect
Hedges g (non-overlapping)	-0.939	—	—	Large effect
Rank-sum test (Mann–U)	-6.472	—	—	Large effect

TABLE 8. Group comparability on demographic variables

Variable	Tabla (mean±SD)	Healthy (mean±SD)	Test	Statistics	p-value
Age (yrs)	21.23 ± 1.99	21.44 ± 1.94	Mann–Whitney U	3301.3	0.010
Height (cm)	171.48 ± 5.63	171.16 ± 5.57	Mann–Whitney U	1671.8	0.048
Weight (kg)	61.53 ± 7.83	62.54 ± 9.68	Mann–Whitney U	1087.6	0.002

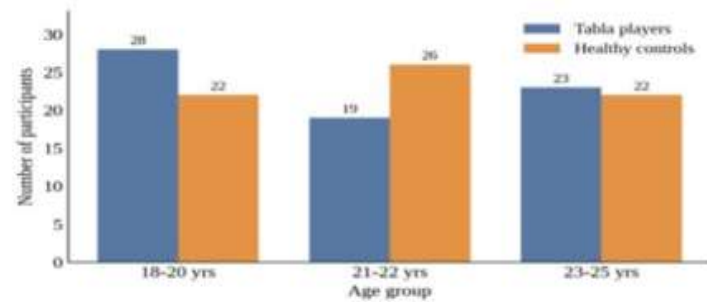
Results

A total of 140 participants were included, with 70 tabla players and 70 healthy controls. The groups were closely matched for age, height, weight and BMI. All participants were reported as right-hand dominant students without previous upper-limb deformity or pathology in the project results. Data were compiled in Microsoft Excel and analyzed using SPSS Version 26.0.

Table 1. Descriptive characteristics and dominant-hand grip strength

Variable	Tabla players (n=70)	Healthy controls (n=70)
Age (years), mean ± SD	21.23 ± 1.99	21.44 ± 1.94
Height (cm), mean ± SD	171.48 ± 5.63	171.16 ± 5.53
Weight (kg), mean ± SD	61.53 ± 7.83	62.54 ± 9.68
BMI (kg/m ²), mean ± SD	20.99 ± 2.36	21.43 ± 3.11
Dominant-hand grip strength (kg), mean ± SD	36.37 ± 8.07	43.91 ± 8.24

Frequency Distribution



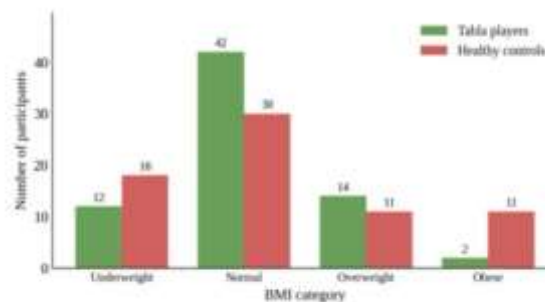
Graph 1. Age-group distribution of tabla players and healthy controls.

The age-group distribution of the two groups is presented in Table 1 and Graph 1. Participants in both groups were spread across the 18–25-year range with a broadly similar profile.

Table 1. Age-group distribution of participants by group.

Age group	Tabla players, n (%)	Healthy controls, n (%)
18–20 yrs	28 (40.0)	22 (31.4)
21–22 yrs	19 (27.1)	26 (37.1)
23–25 yrs	23 (32.9)	22 (31.4)
Total	70 (100.0)	70 (100.0)

Key: n = number of participants; percentage within the group (n/70).



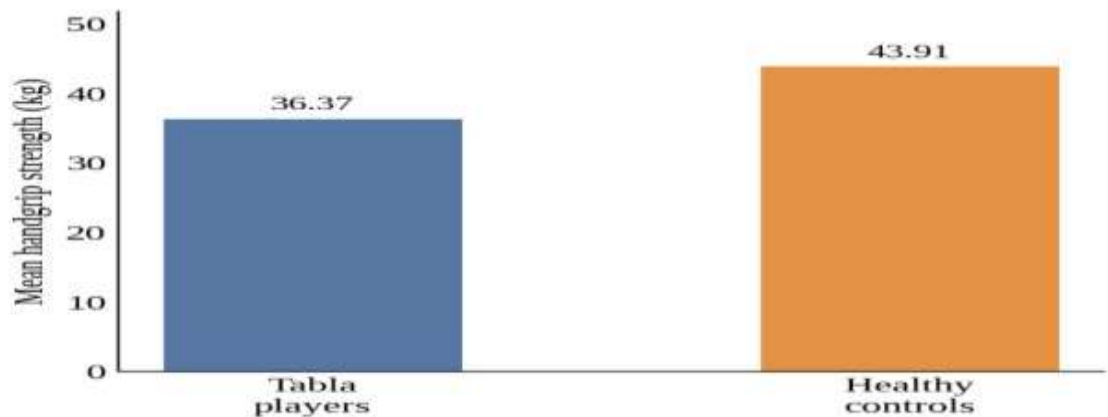
Graph 2. BMI category distribution of tabla players and healthy controls.

The distribution of body mass index categories (Asian cut-offs) is shown in Table 2 and Graph 2. Most participants in both groups fell within the normal BMI range.

Table 2. Body mass index (BMI) category distribution by group.

BMI category	Tabla players, n (%)	Healthy controls, n (%)
Underweight (<18.5)	12 (17.1)	18 (25.7)
Normal (18.5–22.9)	42 (60.0)	30 (42.9)
Overweight (23–24.9)	14 (20.0)	11 (15.7)
Obese (≥25)	2 (2.9)	11 (15.7)
Total	70 (100.0)	70 (100.0)

Key: BMI categories use Asian cut-offs — underweight < 18.5, normal 18.5–22.9, overweight 23–24.9, obese ≥ 25 kg/m². n = number of participants; % = percentage within the group.



Graph 3. Mean dominant-hand grip strength (kg) in tabla players versus healthy controls.

The primary comparison demonstrated lower dominant-hand grip strength in tabla players than in healthy controls. The mean difference was -7.54 kg (95% CI -10.27 to -4.82 kg). The independent-samples t-test was statistically significant ($t(138) = -5.470$, $p < 0.01$), and the Mann–Whitney U test also confirmed a statistically significant difference ($U = 1294.5$, $p < 0.01$). The reported Cohen’s d was -0.93 , representing a large standardized effect.

Table 2. Inferential comparison of dominant-hand grip strength

Test	Statistic	p-value	Interpretation
Levene’s test	0.050	0.824	Equal variances
Independent-samples t-test	-5.470 (df=138)	<0.01	Significant
Welch’s t-test	-5.470 (df=137.94)	<0.01	Confirms result
Mann–Whitney U	1294.5	<0.01	Confirms result

No statistically significant between-group differences were found for age, height, weight or BMI, with all reported p-values greater than 0.05. This supports comparability of the groups on the measured demographic variables.

Discussion

The present cross-sectional study compared dominant-hand grip strength between 70 Indian tabla players and 70 healthy, non-playing individuals matched for age, height, weight and body mass index. Contrary to the intuitive expectation that musicians who use their hands intensively would develop stronger grips, tabla players demonstrated a significantly lower mean grip strength (36.37 ± 8.07 kg) than the healthy controls (43.91 ± 8.24 kg). The mean difference of 7.54 kg was statistically significant on the independent-samples t-test ($t(138) = -5.47$, $p = 2.06 \times 10^{-7}$) and corresponded to a large effect size (Cohen’s $d = -0.93$). Because the two groups did not differ on any demographic variable (all $p > 0.05$), this difference is unlikely to be explained by differences in body size or age, and more plausibly reflects the specific demands and consequences of tabla playing itself. The following sections interpret this finding in the light of hand physiology, motor-learning theory and the wider literature on playing-

related health in instrumental musicians, and then consider the clinical implications, methodological strengths and limitations of the work.

Grip strength as a measure and why the finding is noteworthy. Grip strength measured by hand-held dynamometry is a well-established, reliable and inexpensive indicator of overall muscular strength and of the functional integrity of the hand, and is increasingly regarded as a broader biomarker of general health and physical function. Beyond the hand itself, reduced grip strength has been shown in large multinational cohorts to predict all-cause mortality, cardiovascular events and disability, which is why it is now used as a simple screening measure of global musculoskeletal capacity rather than merely of forearm function. The measure primarily reflects the maximal voluntary force generated during a power grip: the forceful, sustained flexion of all the finger joints against a fixed resistance, produced chiefly by the extrinsic finger flexors with stabilizing contributions from the intrinsic hand muscles and the wrist extensors. When it is recorded under standardized testing conditions a calibrated dynamometer, a seated posture with the elbow flexed to ninety degrees, and the best of repeated trials, it is highly reproducible and comparable across studies. Because a power grip is precisely the capacity that an intensive hand-dominant activity would be expected to enhance, the lower values observed in tabla players are counter-intuitive and require explanation rather than being dismissed as measurement error.[4,8,9,14] Task specificity as the primary explanation, The first and most likely explanation lies in the task-specific nature of tabla technique. Playing the tabla does not require a sustained, maximal power grip; instead, it demands rapid, finely graded and individuated strokes of the fingers and wrist to produce the various bols on the dayan and bayan. The hand is used as a precision instrument, not as a clamp. Musicians characteristically acquire highly refined, task-specific fine-motor coordination and dexterity rather than gross maximal strength,¹⁶ and the neuromuscular adaptations that accumulate over years of practice are therefore directed towards speed, timing, independence and precision of individual digits rather than towards whole-hand force production. This is a direct expression of the principle of training specificity often summarized as the SAID principle, that the body adapts specifically to the demands imposed on it. Because dynamometry captures maximal gross power grip, a capacity that tabla playing does not specifically load, the absence of any strength advantage, and indeed a relative deficit, is entirely consistent with this principle. This interpretation is reinforced by an exploratory within-group observation in the present data. Grip strength did not rise progressively with weekly playing frequency; the players who practiced most often (four to six times per week) were not the strongest, and no clear dose-response gradient emerged between playing exposure and maximal grip. If tabla practice acted as a strengthening stimulus for the power grip, one would expect greater cumulative exposure to be associated with greater strength, and the absence of any such trend argues against a simple dose-dependent strengthening effect. It is more consistent with the view that additional practice refines fine control while leaving maximal force capacity essentially untrained, or even, as discussed below, progressively compromised[10]. Playing-related musculoskeletal load and pain A second, complementary explanation is the well-documented burden of playing-related musculoskeletal disorders (PRMDs) in instrumentalists, of which tabla players are a clear example. The repetitive striking actions, combined with the prolonged cross-legged sitting posture with a flexed shoulder, an extended elbow and a repeatedly deviated wrist, place the upper limb under sustained and biomechanically unfavorable stress. Sustained non-neutral wrist positions and thousands of repetitive impacts per practice session load the flexor tendons, the tendon sheaths and the intrinsic muscles in a way that ordinary daily activity does not.[1,11,19]

Comparison with normative values-The grip-strength values recorded here are internally credible, which strengthens confidence that the between-group difference is real rather than an artefact of an unusual sample. The mean of approximately 44 kg in the young, predominantly male control group is consistent with, and appropriately higher than, the all-age Indian normative values reported by Walankar and colleagues, who documented that Indian grip strength is generally lower than Western reference data and varies systematically with age, sex and hand dominance.⁶ A healthy young-adult male sample would be expected to sit above the pooled all-age mean, which is exactly what the control group does. Against this backdrop, the tabla players' mean of approximately 36 kg represents a meaningful shortfall from the value expected for their age and sex, rather than an artefact of an unusually strong comparison group. The comparison group therefore behaves as a valid reference, and the players' lower values stand out as a genuine, population-specific deficit that is most plausibly attributable to the demands and consequences of playing.[7]

Clinical Implications

- Supplementary grip and forearm strengthening may be considered alongside tabla practice
- Physiotherapists can incorporate intrinsic hand-muscle exercises, forearm conditioning and upper-limb strengthening into musician conditioning programs
- Periodic grip-strength assessment using a dynamometer may provide an objective method for monitoring hand function
- Education regarding sitting posture, wrist alignment, ergonomic positioning, practice progression and rest breaks may help reduce excessive musculoskeletal loading
- Preventive physiotherapy strategies may be incorporated into tabla training to support long-term hand function

Limitations

- The cross-sectional design can identify an association but cannot establish a cause-and-effect relationship between tabla playing and grip strength
- Pain, playing-related musculoskeletal disorders, fine-motor performance and muscle activity were not directly assessed
- Playing frequency was self-reported and may therefore be subject to recall or reporting error
- The study was conducted in one geographic area and included predominantly male participants
- Only maximal grip strength was assessed, limiting the assessment of other aspects of hand function

Future Scope

1. Conduct longitudinal or prospective studies to examine changes in grip strength over time among tabla players
2. Assess both hands, pinch strength and grip endurance for a more complete evaluation of hand function
3. Measure playing-related pain and musculoskeletal disorders using standardized tools and correlate them with grip strength
4. Stratify analyses by sex, years of experience and weekly playing frequency and recruit larger multicentre samples

5. Compare tabla players with musicians playing other instruments and with age- and sex-specific Indian normative data

Conclusion

The study demonstrated that Indian tabla players had significantly lower dominant-hand grip strength than healthy non-playing individuals in the investigated sample. The findings may reflect the task-specific nature of tabla performance, in which precision and fine motor control are emphasized, together with possible effects of repetitive loading and playing-related musculoskeletal stress. However, these mechanisms remain hypotheses because the study design was cross-sectional and the relevant factors were not directly measured. The findings support consideration of supplementary strengthening, ergonomic education and periodic musculoskeletal screening within tabla training and physiotherapy practice.

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