

## Study to quantify normative values of handgrip strength in adolescents of Gujarat using hand held dynamometer

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### Abstract

**Introduction:** Hand grip strength is an important parameter in evaluation of hand function and it is one of the most reliable clinical measures of human strength. Majority of studies have sampled adults only and those which included adolescents used pneumatic and hydraulic manometer, Martin vigorimeter, etc. The Jamar dynamometer is considered as the 'gold standard' for hand grip strength measurement.

**Aim:** To quantify normative values of hand grip strength in adolescents of Gujarat using Jamar dynamometer.

**Materials and Methods:** 160 children from three schools were included in this observational study after receiving informed written consent. The anthropometric variables and hand dominance were recorded. Hand grip strength was measured using the Jamar dynamometer. The average of three trials was taken as final reading.

**Results:** Optimal grip strength was determined in both genders for dominant and non-dominant hands. Un-paired t-test was used to compare hand grip strength of dominant hand and non-dominant hand which showed that there was not significant grip strength difference between dominant and non-dominant hand.

**Conclusion:** This study has quantified the normative values of grip strength which can be used as a reference measure value for detecting the abnormality in hand grip strength in Gujarati population of same age.

**Keywords:** Adolescent, Dynamometer, Gujarat population, Hand Grip strength, Normative value.

### Introduction

Handgrip strength is a measurement of force applied by several muscles of hand and forearm. Flexor and extensor muscles work together for effective grip and play important role in the resultant grip.<sup>1</sup> Activities of daily living (ADL) are performed by the hand.<sup>2</sup> Grip strength is an accurate parameter in evaluation of hand function and to explore the status of general health<sup>3,4</sup> and nutritional assessment technique<sup>5</sup> as it is sensitive in evaluating short term changes in nutritional status.<sup>6,7</sup> In adults grip strength is used as an indicator of strength in fitness testing<sup>8,9</sup> and also represent the total body strength.<sup>10</sup> The term 'Adolescence' derived from the Latin word *adolescere* means 'to grow'.<sup>11</sup>

According to Jersild, adolescence is a span of life during which boys and girls move from childhood to adulthood.<sup>12</sup> WHO defines adolescence from 10-19 years. During these years there is a rapid physical growth and maturation occurs. Due to this reason there is a chance of changes in the hand grip strength in this population. In a study on hand grip strength, grip strength for 487 healthy children aged between 5 and 15 years was measured. They concluded that there was a clear correlation between age and grip strength.<sup>13</sup>

Hager-Ross and Rösblad<sup>14</sup> measured the grip strength in 530 Swedish children, age range between 4-16 years to provide a normative data compared with data obtained in USA and Australia in 1980. However, these normative data for other populations are considered inappropriate for Indian children because of the changes of the grip strength over different generations and the differences in nutrition type, culture and environmental and physical characteristics according to race and region. Hand held dynamometers are

rather portable, non-invasive, quick, easy to use and do not require specialized technicians. An additional characteristic that makes this device an appealing method is that it has proved to have both low intra and inter observer variability and high test-retest reliability.<sup>6,15</sup> The Jamar Hydraulic Hand Dynamometer recommended by the American Society of Hand Therapists as the 'gold standard' for measurements of grip strength.<sup>16</sup> While comparing Jamar Dynamometer with other hand held dynamometers for its accuracy and reliability it was found that Jamar dynamometer is more reliable ( $r = 0.97$ ) and accurate for measurement of hand grip strength compared to others.<sup>17,18</sup>

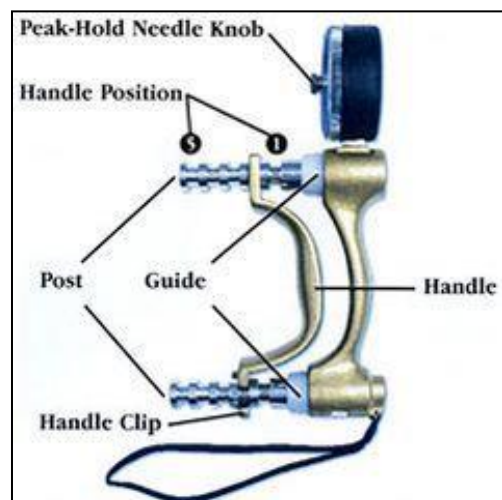


Fig. 1: Jamar dynamometer

**Materials and Methods**

**Subjects**

The study included 160 volunteers (80 Boys, 80 Girls) aged 10- 19 years from different schools of Ahmedabad city of Gujarat. They were divided into four age-range sub groups as 10-12, 12-15, 15-17 and 17-19 years.

**Procedures**

Informed written consent was signed by their parents. Technique of the test performance was explained prior to the test. Measurement was done using Jamar dynamometer and handle was kept at second position for measurement of grip strength. The standard position recommended by American society of hand therapists (ASHT) was used for the measurement of grip strength. The positioning during the evaluation was seated in a chair without armrests, with the feet resting fully on the ground and the hip against the back of the chair. Shoulder adducted, elbow flexed at 90 degrees, forearm in neutral position, wrist between 0 -30 degrees of extension and 0-15 degrees of ulnar deviation. The participants were asked to hold the dynamometer and asked to use maximum force of hand squeeze around the dynamometer. The test was done on Right limb and then the Left limb. Three trials were performed, with 15 seconds rest between each trial. Average of the three trials was considered as final reading.



Fig. 2: Test position side view



Fig. 3: Test position front view

**Results**

85% participants were right handed and 15% were left handed out of 160 participants. As left handed subjects were less compared to right handed, it was not feasible to provide different values for Right handed and Left handed subjects. It was decided to use the dominant hand instead of the side. The other side was automatically the non-dominant side. The Grip Strength are presented in Tables according to age and gender.

**Table 1: Normal hand grip strength in male adolescents (n = 80) measured by the Jamar hand held dynamometer**

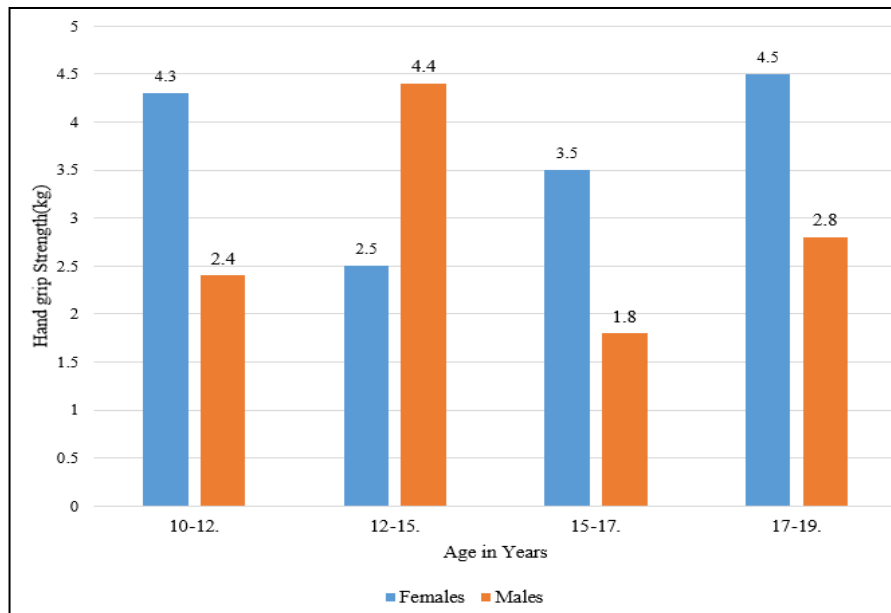
Age group (years)	Dominant hand grip strength(kg)		Non-dominant hand grip strength(kg)	
	Mean	SD	Mean	SD
10-12	16.95	3.99	15.96	3.12
12-15	24.7	6.1	24.4	6.3
15-17	31.2	4.91	29.36	4.88
17-19	36.06	3.4	34.3	3.8

(N=20 in each age group)

**Table 2: Normal hand grip strength in female adolescents (n = 80) measured by the Jamar hand held dynamometer**

Age group (years)	Dominant hand grip strength(kg)		Non-dominant hand grip strength(kg)	
	Mean	SD	Mean	SD
10-12	14.97	2.68	14.35	2.97
12-15	19.6	4.7	17.81	4.18
15-17	23.19	4.83	21.97	4.57
17-19	29.6	4.2	27.04	3.8

(N=20 in each group)



**Fig. 4: Difference between genders in hand grip strength of the non-dominant side in adolescent male (n=80) and female (n= 80)**

This study provided normative data of hand grip strength in subjects aged 10-19 years. Quantification of hand grip strength is necessary in framing goals in hand rehabilitation and to monitor prognosis. The values obtained in this study are markedly different from reference value given in user's guide of the Jamar® smart hand dynamometer. When comparing the grip strength of males and females it was evident that it was greater in males as compared to females for the same age group. The greater hand grip strength in males than females of same age group suggests that in the younger age group gender difference is evident. Comparing hand grip strength between dominant hand and non-dominant hand, no significant difference was observed.

#### Limitations

Small sample size.

**Conflict of Interest:** Nil.

**Funding:** Nil.

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