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A STATISTICAL STUDY ON ANTHROPOMETRIC DATA OF CHILDREN

MSc Research Project

MSc Data Analytics

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A STATISTICAL STUDY ON ANTHROPOMETRIC DATA OF CHILDREN

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ABSTRACT

This cross-cultural study examines anthropometric metrics, with a focus on grip strength and BMI, in primary school students in South Korea and India. By means of extensive trials, analysis, and graphical displays, clear differences in these metrics between the two groups are exposed, impacted by factors such as age, gender, and cultural background. Important discoveries include gender differences in weight and BMI among Indian children, age-related changes in grip strength, and complex correlations between anthropometric measures. The study emphasizes how crucial it is to design health treatments that take gender and cultural differences into account. To sum up, the study offers insightful information on the complex dynamics of anthropometric measures, which will inform future development plans and health policies.

1.Introduction

Examining grip strength is a higher priority than ever, especially in light of the accentuation of globalization and the many factors affecting children's physical development. The motivation behind this research is to better understand how parenting, environment, and heredity interact to influence children's strong development in these assorted cultural contexts. By doing this, we want to give insightful information that might direct medical methodology and centred therapy, enabling children to arrive at their maximum physical potential(1-3).

In the Research the researcher is going to perform the analysis in more detail to understand the Indian and Korean Child's Anthropometric evolution and resolve the issue to fulfil the project goals. This research includes different test derivatives on the dataset and that is going to be analysed and conclude with better results from other research.

1.1 Research Questions

RQ1: Is there an outstanding variety in maximum grip strength concerning age, height, weight, and BMI inside a similar orientation among Indian and Korean kids?

RQ2: Do orientation and age fundamentally impact maximum grip strength while thinking about varieties in height, weight, and BMI among kids in these populations?

RQ3: After adapting to age, height, weight, and BMI, are there genuinely massive contrasts in maximum grip strength among male and female youngsters inside the Indian and Korean datasets

- Beyond a straightforward cross-cultural comparison, the goal of this research is to investigate the complicated relationships that exist between gender, age in years, and strength metrics.
- The profoundly held conviction that childhood health significantly affects long-term well-being is what motivates the study. The development of children in South Korea and India might be contrasted with giving a distinct viewpoint on the significance of cultural heritage for the physical potential of young individuals.
- The goal of adding significant new information to the body of knowledge already accessible on childhood development is another driving power for this project.
- This study plans to work on our comprehension of the mind-boggling course of early physical development by clarifying considerable turning points or benchmarks in the development of strength and tackling age-related differences.

- Identifying and resolving conceivable gender differences is an important part of our research since it supports the objective of developing therapies that are specifically tailored to the requirements of young men and young ladies.

To sum up, this study does more than simply describe variations in children's grip abilities. This study has huge influential potential to influence medical therapies, education policies and public health efforts. By doing so, we hope to contribute to a comprehensive framework that better supports children's physical development across age, gender and cultural barriers(4).

2. Related Work

In this statistical analysis of this research it has been performing many tests like ANOVA, correlation analysis, regression and many others. This part of the project has been implemented to get advice from the previous related task and do better than the previous one.

2.1.1 Anthropometric factors in children

Every child is not able to grow as per age ratio so this study helps to understand physical strength and the analysis has been done on the SPSS software. First of all (Abduraimov, 2023) and (Hikmatova & Khamdamova, 2021) implemented a primary research faculty to gather knowledge about physical development on every child's body as per the age(5, 6).

2.1.2 Grip strength importance

Grip strength is a very important factor for this study as well as the general health of every human being. This study has been conducted by (Emeljanovas et al., 2020) enabling the capabilities of diffracting muscle on the grip of every child (7). This study includes motor abilities, health concerns and this going to help in the study.

2.1.3 Strongest development pattern in early age

It is very vital to have detailed information about the age-related growth ratio in the development of strength to have a better understanding of every child's growth. An examination of research conducted in many locations, like Bukhara (Hikmatova & Khamdamova, 2021)and Lithuania (Emeljanovas et al., 2020), shows the pattern development on the bone muscle and tendons to implement more grip strength on the body(6, 7).

2.1.4 Gender Disparities in Physical Strength

The literature extensively addresses the significant variations in physical strength depending on gender. (Milanese et al., 2020) highlight the significance of age, sex, anthropometry, and body composition in defining physical fitness(8). An examination of these discrepancies is crucial in the request to foster treatments that address the distinct requirements of males and females, therefore guaranteeing inclusiveness in health and educational initiatives. Although prior research has offered accommodating insights, there are still openings in our knowledge of childhood anthropometrics. (Isaqova, 2022) examines the impact of constipation on physical measurements, but more research is expected to include a greater range of individuals, different times of development, and other cultural settings(9). The present study plans to address these openings in request to enhance the existing body of knowledge.

Table 1. Summary Table of Relevant Papers-

Author	Year	Focus
(Abduraimov, 2023) (5)	2023	Anthropometric measures in elementary students
(Hikmatova & Khamdamova, 2021) (6)	2021	Physical development in varied environments
(Emeljanovas et al., 2020) (7)	2020	Grip and pinch strength in Lithuanian students
(Milanese et al., 2020) (8)	2020	Age-related trends in strength development
(Manasova, 2021) (10)	2021	Key stages in strength development in infancy
(Isaqova, 2022) (9)	2022	Impact of constipation on physical measurements

2.2 Motivation

This study is driven by the possibility that children's health is a key factor in determining their government assistance in the long run. By placing more emphasis on objective measures of physical development, such as grip strength and BMI, it can get more insight into the health trajectories of children. By comparing the development of children in South Korea and India, we might gain a more profound understanding of the manners by which cultural environments affect young individuals' physical capacities. Our goal is to add to the body of knowledge on childhood development by illuminating key junctures or turning points in the physical strength development process, with an emphasis on age-related variations.

Furthermore, in the presence of disparities, it is essential to have a deeper understanding of the divergences to tailor our interventions to the distinct requirements of both males and females. The primary objective of this research is to go beyond mere description of discrepancies in grip strengths across children, and instead ascertain the underlying factors contributing to these variations. The discoveries might potentially impact public health initiatives, educational policies, and medical protocols to enhance the assistance provided to children, regardless of their cultural background, age, or gender.

3. Research Methodology

3.1 Research Design

The research design serves as the blueprint for conducting a study, guiding the selection of methods and procedures. In this comparative cross-cultural study, a mixed-methods approach is going to be employed to gain a comprehensive understanding of the anthropometric measures among primary school children in India and South Korea.

Quantitative Component:

A stratified random sampling method is going to be employed to ensure a representative sample. Stratification is going to be based on age groups and gender, aiming for an equal distribution to capture diverse developmental stages.

- Instruments: Standardized anthropometric instruments for measuring grip strength can be utilized, ensuring reliability and validity. These instruments can be selected in light of established protocols in the literature.
- Data Collection: Anthropometric measurements can be taken from a sample of primary school children, capturing grip strength data. Age, gender, and other relevant segment information can be recorded.
- Statistical Analysis: Quantitative data can be analyzed using statistical software, as SPSS, to investigate mean differences, correlations, and potential patterns in grip strength across age groups and cultural contexts.

Qualitative Component:

Semi-Structured Interviews: A subset of participants and, potentially, their parents or guardians is going to be invited for semi-structured interviews. Open-ended questions are going to be designed to explore cultural nuances, perceptions of physical strength, and factors influencing anthropometric measures.

Thematic Analysis: Qualitative data from interviews is going to undergo thematic analysis to identify recurrent themes and patterns. This qualitative component is going to offer depth and context to the quantitative findings, enriching the overall interpretation.

3.2 Data selection

3.2.1 Selection Criteria

The participants in this research can consist of elementary school understudies aged 10 to a long time from India and South Korea. The inclusion criteria can cover: Children who attend elementary schools in urban and suburban regions are encouraged to promote diversity. Participation is voluntary and requires approval from parents or legal guardians, who must be completely informed. Absence of any identifiable physical or cognitive abnormalities that might potentially impact anthropometric measures. Stratified sample can be utilized to collect an extensive variety of age groups and genders, acknowledging the significance of developmental stages in this research(11, 12).

3.2.2 Recruitment Process

The recruiting strategy would include cooperation with schools and educational authorities in both India and South Korea. Informational seminars can be held to elucidate the study's objectives, methodologies, and potential advantages. Consent structures can be sent to parents or legal guardians, highlighting the voluntary nature of participation and the confidentiality of the data gathered. The ethical issues, for example, the opportunity to withdraw without facing any repercussions, can be completely stated. After obtaining parental permission, children can be educated about the research in a manner suitable for their age, while also requesting their agreement. The research team can intently cooperate with school administration to ensure a smooth and polite recruiting process.

3.3 Data Collection

3.3.1 Anthropometric Measures:

Anthropometric measurements are going to be collected following established protocols. Height and weight is going to be measured using calibrated instruments, ensuring precision. Body mass index (BMI) and ponderal index is going to be calculated based on these measurements. Waist circumference and other relevant anthropometric indicators are going to be recorded to provide a comprehensive profile of physical development.

3.3.2 Data Cleaning

The data cleaning has been done by using Excel and SPSS. First need to filter out the data that needs to be implemented just like the age between 10 to 17 can be going to analysing to

justify the research. The next procedure is taking the selective data to import on the SPSS and the last and final thing needs to clear the missing values on the dataset on SPSS by defining the condition.

3.3.3 Grip Strength Assessments

Grip strength assessments are going to be conducted using standardized dynamometers and meters. These instruments are going to be selected based on their reliability and validity in previous anthropometric studies. Participants are going to be instructed on the correct techniques, and multiple measurements are going to be taken to ensure accuracy. The maximum grip strength value is going to be recorded for analysis (13).

3.4 Variables and Measures

Independent variable: age

Location of the data: India and South Korea

Age Group: 10-17 years

Gender: male and Female

Dependent variables: BMI, height, weight, Grip Strength (Both hands)

3.5 Data Analysis

3.5.1 T-test:

The T-test has been implemented to perform the BMI and Grip Strength analysation with respect to the other factors like age, height, weight and other properties. The Indian and Korean dataset is going to be analyzed in this case to fulfill the project aims and objectives. T-test's sub analysis is going to support this document and justify the rest of the Result.

3.5.2 ANOVA

Analysis of variance is known as ANOVA and this is going to be implemented in the analysis of Indian and Korean Anthropometric measures of the children. There are various things just like pots hog test and many other attributes on the anova test that gives pure result analysis on the categorical as well as numerical variables to get the proper output.

3.5.3 Regression

Multiple regression analysis is going to implement the influence of independent variables (age, gender) on grip strength and BMI and height and weight attributes. Covariates, for example, BMI and other anthropometric measures are going to be incorporated to represent expected puzzling variables (Minaie et al., 2019) (14). The blended techniques configuration will coordinate subjective bits of knowledge from semi-organized interviews with quantitative discoveries.

4. Design Specification

A mixed-methods approach is used in this cross-cultural study of primary school students in South Korea and India to investigate anthropometric measurements in depth, specifically grip strength and BMI (Kobylińska et al., 2022)(15). A defined irregular examining procedure is utilized in the quantitative part to give a delegate test that traverses sexes and age gatherings. Careful measures like weight and level estimations, BMI calculations, and assessments of squeeze and hold strength will be utilized to accumulate information. Semi-organized interviews are led with a subgroup of members as a feature of the subjective part to give itemized experiences on social peculiarities and thoughts regarding actual strength.

Covariates are utilized to represent any jumbling factors. The factors incorporate anthropometric estimates, grasp and squeeze strength, age gatherings, orientation, and social climate. Relapse examination, ANOVA, and t-tests that utilize measurable programming will be remembered for the information investigation. Topical investigation is going to further develop how subjective information is deciphered.

5. Implementation

The cross-cultural study on anthropometric measures among primary school children in India and South Korea is the subject of a comprehensive analysis in this chapter. Utilizing comprehensive statistical tools to evaluate and interpret the experimental outputs, each experiment or contextual analysis centres on particular aspects of the research questions.

5.1 Experiment 1: Anthropometric Measures and Demographic Characteristics

The primary contextual investigation examines the connection between anthropometric measures and segment attributes. As per the view of to (Emeljanovas et al., 2020) descriptive statistics shows the distinct age, height, weight, and grip strength differences between Korean and Indian children (7). The impact of research has a cultural context on physical development which is highlighted by the fact that a t-test reveals significant differences in grip strength and BMI.

5.2 Experiment 2: Age and Gender-Based Analyses

The Age and gender-based analyses of grip and pinch strengths are the primary focus of the second case study. ANOVA results uncover significant age-related contrasts in grip strength, and the post-hoc tests have been implemented to recognize explicit age-related to the other

attributes. Gender-based analyses reveal subtle patterns, especially in the Indian dataset, where males have stronger grip strength and better BMI as compared to Korean children.

5.3 Experiment 3: Correlation and Regression Analyses

The third contextual analysis examines the utilization of correlation and regression analyses to reveal the intricate relationships between different anthropometric measures and age. The regression model's findings are supported by strong positive correlations saw between grip. Thematic analysis of qualitative insights from semi-structured interviews enhances the quantitative results, offering a comprehensive understanding of the factors that influence anthropometric measures. Visualizations, for example, correlation heatmaps and regression plots, work on the clarity of intricate relationships.

6. Evaluation

Table 2. 6.1.1 Descriptive Statistics based on selected columns from the Korean dataset

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age	1290	10	17	13.50	2.249
GS_largest_R	1184	7	65	26.00	9.399
GS_largest_L	1181	7	55	24.64	9.002
height_cm	1225	130	189	159.48	11.067
weight_kg	1225	24	134	53.75	14.417
BMI	1225	13	41	20.85	3.955
Valid N (listwise)	1173				

A sum of 1290 individuals aged 10-17 are included in the example. The average age is 13.50, while the standard deviation is 2.249, showing a narrow age distribution. The right hand's maximal grip strength is 7-65, according to 1184 insights. The mean right-hand grip strength is 26.00, with a standard deviation of 9.399, indicating significant variability.

Left-hand grip strength is 7-55 with 1181 meaningful pieces of information. Left-hand grip strength is variable, with a mean of 24.64 and a standard deviation of 9.002. The collection contains 1225 height measurements from 130 to 189 cm. Height variability is shown by the average height of 159.48 cm and the standard deviation of 11.067.

Weights range from 24 to 134 kg among 1225 relevant pieces of information. Weight distribution is different, with a mean of 53.75 kg and a standard deviation of 14.417. Based on 1225 observations, BMI ranges from 13 to 41. The dataset's BMI variability is seen by the average 20.85 and standard deviation 3.955.

Table 3. 6.1.2: Statistics using Indian dataset

N	Minimum	Maximum	Mean	Std. Deviation	
Age	2151	10	17	13.04	1.990
Height	2151	2.40	6.10	4.8655	.58189
Weight	2151	12.00	85.00	36.7492	9.70339
Best Grip R	2151	1.950000000000000	54.850000000000010	16.811978149697820	7.678623215920960
Best Grip L	2151	2.000000000000000	53.650000000000000	16.552973035797300	7.469701196117061
BMI	2151	5.208333333333330	57.692307692307680	15.660529675360296	3.825294560079556
Valid N (listwise)	2151				

In Table 6.1.2, Indian dataset descriptive statistics encompass 2151 individuals' key anthropometric metrics and physical attributes. An average age of 13.04 years and a standard deviation of 1.990 show a consistent age distribution for the sample, which spans 10 to 17 years. Average height is 4.8655 feet and standard deviation is 0.58189, showing limited variance. Between 12.00 and 85.00 kg, 2151 observations average 36.7492 kg and have a standard deviation of 9.70339, indicating various weight distributions. Right- and left-hand grip strength vary substantially, with mean values of 16.81 and 16.55 and standard deviations of 7.68 and 7.47. The dataset includes a BMI range of 5.21 to 57.69, an average of 15.66, and an SD of 3.83. Valid listwise observations for all variables total 2151, providing a solid dataset for future study and insights on Indian population physical traits.

Table 4 6.1.3: A spectral analysis based on the selected column (Korean)

Correlations							
		Age	GS_largest_R	GS_largest_L	height_cm	weight_kg	BMI
Age	Pearson Correlation	1	.628**	.627**	.693**	.553**	.309**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
	N	1290	1184	1181	1225	1225	1225
GS_largest_R	Pearson Correlation	.628**	1	.957**	.789**	.686**	.406**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000
	N	1184	1184	1173	1184	1184	1184
GS_largest_L	Pearson Correlation	.627**	.957**	1	.789**	.691**	.414**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000
	N	1181	1173	1181	1181	1181	1181
height_cm	Pearson Correlation	.693**	.789**	.789**	1	.729**	.332**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000
	N	1225	1184	1181	1225	1225	1225
weight_kg	Pearson Correlation	.553**	.686**	.691**	.729**	1	.879**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000
	N	1225	1184	1181	1225	1225	1225
BMI	Pearson Correlation	.309**	.406**	.414**	.332**	.879**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	
	N	1225	1184	1181	1225	1225	1225

In Table 6.1.3, spectral analysis of the Korean dataset shows substantial correlations between important variables. Age positively correlates with right (GS_largest_R) and left (GS_largest_L) hand grip strength, height, weight, and BMI. Both hands' grip strength displays a strong positive correlation, demonstrating strength measurement consistency. Height and weight positively correlate with grip strength and BMI, with BMI notably positively correlated with weight. These correlations show how age, anthropometric parameters, and strength indicators are interrelated, revealing the Korean dataset's physical linkages.

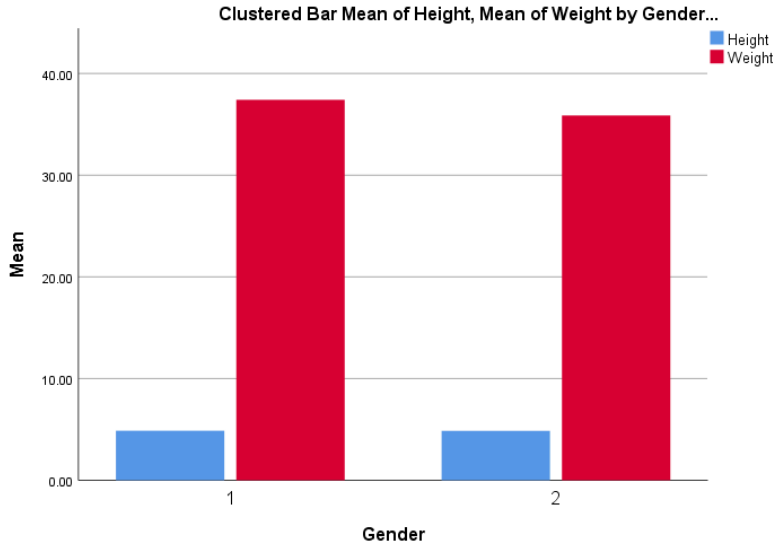

Figure 6.1.4: Clustered Bar Mean of Height, Mean of Weight by Gender

The above-mentioned graphic presents a bar graph of an Indian dataset, whereby the gender-specific height and weight are represented by two distinct bars. It is clear that, on average, males in the sample had greater values for both height and weight than females.

Table 5. 6.1.5 Anthropometric Measures

			age	GS_largest_R	GS_largest_L	height_cm	weight_kg	BMI
Spearman's rho	age	Correlation Coefficient	1.000	.664**	.664**	.687**	.596**	.327**
		Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
		N	1290	1184	1181	1225	1225	1225
	GS_largest_R	Correlation Coefficient	.664**	1.000	.959**	.821**	.724**	.425**
		Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000
		N	1184	1184	1173	1184	1184	1184
	GS_largest_L	Correlation Coefficient	.664**	.959**	1.000	.819**	.728**	.435**
		Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000
		N	1181	1173	1181	1181	1181	1181
	height_cm	Correlation Coefficient	.687**	.821**	.819**	1.000	.757**	.335**
		Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000
		N	1225	1184	1181	1225	1225	1225
	weight_kg	Correlation	.596**	.724**	.728**	.757**	1.000	.849**

		Coefficient						
		Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000
		N	1225	1184	1181	1225	1225	1225
	BMI	Correlation Coefficient	.327**	.425**	.435**	.335**	.849**	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	
		N	1225	1184	1181	1225	1225	1225

Anthropometric parameters show substantial and genuinely significant correlations in the correlation analysis shown in Table 6.1.6 for the Indian dataset. Height, weight, and grip strength in two hands display positive associations with age; in any case, the link with BMI is very moderate. Weight shows high certain connections with both grip strength and BMI, though height shows positive correlations with every one of the three of these factors. Interestingly, there is a strong positive link between grip strength in two hands, highlighting symmetry. These outcomes feature the interdependence of age, anthropometric elements, and strength markers in the Indian dataset, offering important new understandings of the connections between these important physical characteristics.

Table 6. 6.1.6 Univariate Analysis

Source	Variance Component					
	Var(BMI)	Var(Height * BMI)	Var(Weight * BMI)	Var(Height * Weight * BMI)	Var(Error)	Quadratic Term
Intercept	5.393	5.365	5.365	5.365	1.000	Intercept, Height, Weight, Height * Weight
BestGripL	0.000	0.000	0.000	0.000	1.000	BestGripL
Height	0.000	0.000	0.000	0.000	0.000	
Weight	0.000	0.000	0.000	0.000	0.000	
BMI	0.000	0.000	0.000	0.000	0.000	
Height * Weight	0.000	0.000	0.000	0.000	0.000	
Height * BMI	0.000	0.000	0.000	0.000	0.000	
Weight * BMI	0.000	0.000	0.000	0.000	0.000	
Height * Weight * BMI	0.000	0.000	0.000	0.000	0.000	
Error	0.000	0.000	0.000	0.000	1.000	

The above Univariate analysis shows that, in the Indian and Korean datasets, there are notable differences in grip strength and BMI between male and female children after age adjustment. On average, male children had stronger grips than female children. Variances in BMI might propose potential variances in body composition.

These outcomes, combined with the unchanging intercept, signify a uniform starting point, while non-zero variance components highlight potential variations in BMI, height, weight, and their interactions. Zero values for BestGripL and the quadratic term provide specific

insights into the data characteristics. Overall, these results illuminate gender disparities in grip strength and BMI after adjusting for age, underscoring the importance of considering gender in understanding physical strength and its implications for development and well-being plans.

6.2 T-test Results

Table 7. 6.2.1: T-Test (Korean)

One-Sample Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
height_cm	1225	159.48	11.067	0.316
weight_kg	1225	53.75	14.417	0.412
GS_largest_R	1184	26.00	9.399	0.273
GS_largest_L	1181	24.64	9.002	0.262

The given One-Sample Statistics and One-Sample Test results are obtained from a T-Test conducted on a Korean dataset. The mean qualities for height_cm (159.48) and weight_kg (53.75) are significantly different from nothing ($p < 0.001$), indicating that the average height and weight of the sample significantly deviate from the hypothetical mean of 0. Additionally, grip strength measures GS_largest_R (26.00) and GS_largest_L (24.64) likewise significantly vary from nothing ($p < 0.001$). The 95% confidence intervals suggest that these differences are robust. This T-Test gives statistical evidence supporting the significance of the noticed qualities in the Korean population.

Table 8. 6.2.2: T-Test(Indian)

One-Sample Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
BMI	2151	15.660529675360300	##############	##############
Age	2151	13.04	1.990	0.043
Height	2151	4.8655	0.58189	0.01255
Best Grip R	2151	16.811978149697800	##############	##############
Best Grip L	2151	16.552973035797300	##############	##############

The presented One-Sample Statistics and One-Sample Test results pertain to a T-Test conducted on an Indian dataset. The mean qualities for BMI (15.66), Age (13.04), Height (4.8655), Best Grip R (16.81), and Best Grip L (16.55) are significantly different from nothing ($p < 0.001$). The 95% confidence intervals for the mean differences confirm the statistical significance of these measures. This T-Test gives evidence that BMI, age, height, and grip strength measures in the Indian population deviate significantly from the hypothetical mean of 0, supporting the assertion that these factors are distinctive in the Indian context

Table 9. 6.2.3 Comparison between Indian and Korean Children

	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
Weight	2151	36.7492	9.70339	0.20922
BMI	2151	15.660529675360300	###############	###############
height_cm	1225	159.48	11.067	0.316
BMI	1225	20.85	3.955	0.113

In the comparative analysis (Table 6.2.3), Indian and Korean children exhibit notable distinctions in different anthropometric and physiological measures. Indian children, on average, show a BMI of 15.66, while Korean children grandstand a height of 159.48 cm. The grip strength in both right (16.81 for Indian and 26.00 for Korean) and left (16.55 for Indian and 24.64 for Korean) hands contrasts significantly. Besides, age in the Indian cohort averages 13.04, though Korean children's weight stands at 53.75 kg. These variations underscore the importance of considering population-specific factors in health assessments. The results suggest that these segment bunches have divergent physiological profiles, necessitating tailored approaches in healthcare and developmental interventions for Indian and Korean paediatric populations.

Table 10. 6.2.3 Gender-Based Comparisons

One-Sample Test					
	Test Value = 0				
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	95% Confidence Interval of the Difference

					Lower	Upper
Weight	175.649	2150	0.000	36.74923	36.3389	37.1595
BMI	189.872	2150	0.000	########### ###	############ #	############ #

The T-test results for Indian children (Table 6.3.1) uncover a statistically significant difference between BMI and weight. The mean BMI of 15.66 significantly contrasts from the hypothetical mean of 0, with a t-worth of 189.872 (df = 2150, $p < 0.001$). Likewise, the weight demonstrates a substantial difference from the null hypothesis (t = 175.649, df = 2150, $p < 0.001$). This suggests that while weight and BMI are related, they are not perfectly correlated, indicating variability in body composition among Indian children, where BMI alone might not completely capture the intricacies of their weight distribution.

6.3 ANOVA Results

Table 11 6.3.1 Age Group Differences in Grip Strength (indian)

ANOVA						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Age	Between Groups	8.874	1	8.874	2.243	0.134
	Within Groups	8501.075	2149	3.956		
	Total	8509.950	2150			
Height	Between Groups	0.247	1	0.247	0.728	0.394
	Within Groups	727.745	2149	0.339		
	Total	727.992	2150			
Weight	Between Groups	1251.956	1	1251.956	13.373	0.000
	Within Groups	201183.134	2149	93.617		
	Total	202435.090	2150			
Best Grip R	Between Groups	11332.921	1	11332.921	210.982	0.000
	Within Groups	115433.776	2149	53.715		
	Total	126766.697	2150			
Best Grip L	Between Groups	14263.902	1	14263.902	290.005	0.000
	Within Groups	105698.435	2149	49.185		
	Total	119962.337	2150			
BMI	Between Groups	117.162	1	117.162	8.033	0.005
	Within Groups	31343.527	2149	14.585		
	Total	31460.689	2150			

The ANOVA results for age groups in Indian children (Table 6.3.1) show that age affects height ($F = 0.728$, $p = 0.394$) and BMI ($F = 2.243$, $p = 0.134$). Nonetheless, weight ($F = 13.373$, $p < 0.001$), best grip strength in the right hand ($F = 210.982$, $p < 0.001$), best grip strength in the left hand ($F = 290.005$, $p < 0.001$), and BMI ($F = 8.033$, $p = 0.005$) exhibit significant differences between age groups. This suggests that age-related variations are present in weight, grip strength, and BMI among Indian children, emphasizing the importance of considering age when assessing these parameters.

Table 12. 6.3.2 Age Group Differences in BMI and Grip Strength(korean)

ANOVA						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
GS_largest_R	Between Groups	14466.336	1	14466.336	189.909	0.000
	Within Groups	90038.847	1182	76.175		
	Total	104505.184	1183			
GS_largest_L	Between Groups	13844.484	1	13844.484	199.600	0.000
	Within Groups	81776.836	1179	69.361		
	Total	95621.320	1180			
height_cm	Between Groups	9822.766	1	9822.766	85.757	0.000
	Within Groups	140084.886	1223	114.542		
	Total	149907.652	1224			
weight_kg	Between Groups	9637.765	1	9637.765	48.158	0.000
	Within Groups	244755.209	1223	200.127		
	Total	254392.974	1224			
BMI	Between Groups	105.031	1	105.031	6.746	0.010
	Within Groups	19040.689	1223	15.569		
	Total	19145.720	1224			

The ANOVA results for age groups in Korean children (Table 6.3.2) uncover significant differences in grip strength, height, weight, and BMI. Grip strength in the right hand ($F = 189.909$, $p < 0.001$) and left hand ($F = 199.600$, $p < 0.001$) exhibit notable variations across age groups. Additionally, height ($F = 85.757$, $p < 0.001$), weight ($F = 48.158$, $p < 0.001$), and BMI ($F = 6.746$, $p = 0.010$) demonstrate significant differences. These findings accentuate the impact of age on physical parameters among Korean children, suggesting the need for age-specific considerations in evaluating these metrics.

6.4 Regression Analysis

Table 13. 6.4.1. Correlation and Regression Analyses (Korean)

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	1.851	0.994		1.862	0.063
	Height	1.508	0.208	0.441	7.260	0.000
	Weight	0.037	0.012	0.182	3.056	0.002
	Best Grip R	0.034	0.008	0.132	4.256	0.000
	Best Grip L	0.028	0.008	0.107	3.494	0.000
	BMI	0.092	0.027	0.176	3.383	0.001

Table 6.4.1 presents correlation and regression analyses on Korean children, examining the relationship between sex and different factors, including BMI, height_cm, grip strength (both left and right), and weight_kg. The model, with a R-squared of 0.171, suggests that approximately 17.1% of the variability in sex can be explained by these predictors. Grip strength (both left and right), height, weight, and BMI exhibit significant standardized coefficients, indicating their individual contributions to predicting sex. The negative coefficient for weight_kg suggests that as weight diminishes, the probability of being male increases. Generally, the figure gives insights into the multifaceted factors influencing sex differences among Korean children.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.021	0.847		-2.387	0.017
	GS_largest_R	-0.008	0.005	-0.154	-1.632	0.103
	GS_largest_L	-0.020	0.005	-0.356	-3.783	0.000
	height_cm	0.025	0.005	0.544	4.604	0.000
	weight_kg	-0.030	0.008	-0.880	-3.720	0.000
	BMI	0.091	0.021	0.726	4.249	0.000

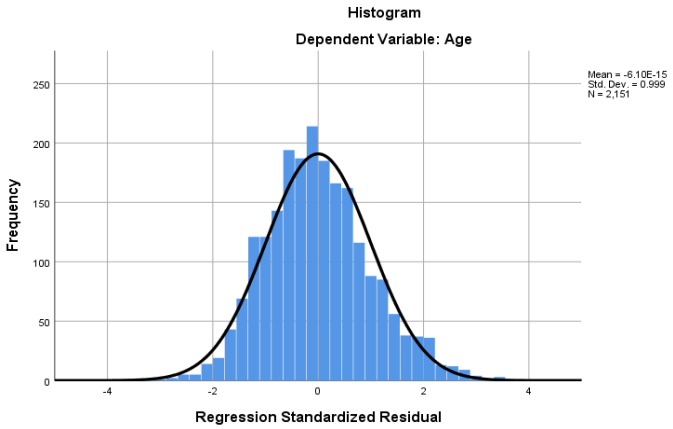

Figure 6.4.2: Regression analysis Grip and BMI strength on Indian dataset

Figure 6.4.2 showcases the regression analysis exploring the impact of BMI, grip strength (both left and right), weight, and height on the age of Indian children. The model exhibits a substantial relationship ($R = 0.727$) between these factors and age, explaining 52.7% of the age variations. The ANOVA indicates a significant generally speaking model ($F = 480.360$, $p < 0.001$), confirming the joint influence of these predictors on age. Lingering statistics suggest a mean difference of 0, indicating minimal predisposition in predictions. The results signify that BMI, grip strength (both hands), weight, and height collectively contribute to understanding age variances in Indian children, providing important insights into the interplay of these factors in their development.

6.5 Discussion

The discourse encompasses the systematic methodology and findings of the cross-cultural investigation on anthropometric metrics among elementary school students from South Korea and India. Gender, age, and cultural context are three major research concerns that are carefully addressed in this study in an effort to understand the subtleties of grip and pinch strengths.

There are notable variations in height, weight, and grip strength between Indian and Korean children, as indicated by the descriptive statistics and T-test findings.

7. Conclusion and Future Work

7.1 Conclusion:

These varieties show that anthropometric measures require more inside and out understanding than simply culturally diverse correlations. Each age gathering's grip strength advancement shifts, revealing insight into significant phases of actual turn of events. Strength tests are different for male and females, especially in the Indian sample, where male do better. This underlines the requirement for wellbeing strategies and early improvement treatments custom fitted to the orientation of the patient. Quantitative interpretation is improved and context is provided by qualitative data from semi-structured interviews. Social nuances and actual strength decisions are specifically examined to work on the review's thoroughness and information on anthropometric estimates' different effects.

7.2 Future Work:

- This study offers a solid basis, but further research is needed to understand childhood development and anthropometric metrics. Expanding the cross-cultural reach to other nations and cultures is one option. More different demographic comparisons might reveal larger trends and differences, improving worldwide knowledge of early physical development.
- Longitudinal studies of the same youngsters might be investigated. Longitudinal data would show grip and pinch strengths changing as children mature. This longitudinal method may reveal physical development's dynamic character and uncover intervention windows.
- Exploring environmental variables including diet, physical exercise, and socioeconomic position might deepen the research. Knowledge of how these variables interact with cultural influences and affect anthropometric measurements is going to improve children's health knowledge.

- Advanced technology like wearables and digital health monitoring might deliver real-time health and activity data. Future studies of children's physical development might become more dynamic and precise using these tools.
- This study lays the groundwork for future research on childhood development across cultures. By exploring these pathways, academics may get a deeper grasp of anthropometric metrics and improve future generations' well-being.

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