Revamping Men's Jeans Fit

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR AWARD OF DEGREE IN

"BACHELOR OF FASHION TECHNOLOGY"

SUBMITTED BY:

ADITI GALADA

UNDER THE SUPERVISION OF:

DR. D. SAMUEL WESLEY

SUBMITTED TO:

Department of Fashion Technology (2016 – 2020)

National Institute of Fashion Technology, Chennai

July 2020

Acknowledgement

Within the preview of the apparel industry there is much information pertaining to making of garments, disseminated by words in the books. But to see the whole process by your own eyes is a wonderful experience. I would like to extend my sincere gratitude to the management of National Institute of Fashion Technology and Kontoor Brands Pvt. Ltd. for providing me this opportunity to experience and learn the processes practiced in Fashion Industry.

Apart from my own efforts, the success of any project largely depends on the encouragement and guidelines of many others. I take this opportunity to express our gratitude to the people who have been instrumental in the successful completion of this project.
I am highly obliged to our mentors, Mr. Neeraj Kumar and Mr. Vinay Raj for guiding and supporting me throughout our internship research. Their encouragement, time and effort motivated me to work sincerely on this project.

I would like to express our gratitude to our faculty mentor Mr. D. Samuel Wesley for his constant follow-up, support, encouragement, and guidance to complete this project within the allotted time frame.

Moreover, I would like to thank Mr. Gaurav Gupta, head of Product Team for supporting us throughout our graduation project.

I am also grateful to all the employees for sharing information about the procedures and functions of various departments and spending their valuable time with us.

It was a great learning experience throughout to see the working of a globally leading apparel brand.

Last but not the least I would like to thank the almighty for blessing us and making this project our success.

Abstract

With globalization, consumers have myriad choice and are extremely selective while making purchase decisions. With various apparel giants witnessing downfalls in the past few years it is evident that the market changes over time but the only this constant is customer's quest for quality product.

Through a comprehensive analysis it was understood that the customer interest in Lee was decreasing gradually over the past few years. To reveal the reasons for this degrowth, first, a factor analysis was carried out which uncovered five prominent factors that affected sales of a garment.

To improve the fit portfolio of men's jeans, body measurements of around 600 potential customers was collected. K-means clustering was performed to identify 7 exclusive clusters, one for each size. After standard body measurements were established, the size chart of Lee was analyzed for discrepancies and then compared with that of competitor brands. Then feedback was obtained through in-store trial for every fit based on various parameters. As a result, a new size chart was developed which would satisfy the requirements of potential customers.

As a result, the fit portfolio of men's jeans was improved to provide a higher degree of comfort to the wearer. These changes will eventually help the company gain positive customer feedback and thereby, break the trend of dropping sales.

Contents

List of Tables

List of Figures

1. Company Profile

Kontoor Brands is a global lifestyle apparel company, with a portfolio of some of the world's most iconic denim brands: Wrangler®, Lee® and Rock & Republic®, 15,000 employees globally and $2.7 billion in revenue.

In August 2018, it was announced that VF would be splitting into two separate companies. The jeans and outlet stores were spun off as Kontoor Brands and VF maintained the sports apparel and footwear businesses.

Kontoor Brands' business is founded upon a strategic sourcing model and best-in-class supply chain, with industry-leading sustainability standards. With a clear set of investment priorities, Kontoor Brands is committed to aggressively growing its brands' direct-to-consumer distribution and further expanding each brand's global footprint, allowing Kontoor Brands to engage with more consumers in more places.

Kontoor is a purpose-led, performance-driven and value-creating organization. Their relentless pursuit of business success is fueled by their desire to use their scale and resources to improve people's lives and make the world a better place.

Sector	Consumer goods	
Industry	Apparel & Textile Products	
Global presence	50 countries	
Apparels Produced/ Sourced	170 million (2018)	
Employees	15,000	
Revenue	$ 2.7 billion	
Headquarters	Greensbro, North Carolina	
Executive Team	Scott Baxter	President, Chief Executive Officer
	Rustin Welton	EVP & Chief Financial Officer
	Sara Bland	VP & Chief Strategy Officer
	Scott Deitz	VP, Corporate Relations
	Randy Fortenberry	VP, Supply Chain
	Laurel Krueger	EVP, General Counsel & Corporate Secretary
	Scott Shoener	VP & Chief Human Resources Officer
Brands	Lee, Wrangler, Rock & Republic	
Purpose	We are the common thread that inspires people to live with passion and confidence.	
Mission	We grow our iconic brands through innovation, design and sustainable performance to excite more and more consumers.	
Vision	We stand for each other, our consumers, customers, partners, shareholders, community and planet. We earn the respect of others because we do what's right, even when it's hard.	

1.1. Brands

With 200 years of combined heritage, the brands are built on integrity and authenticity, simultaneously on-trend and timeless. Wrangler® and Lee® helped create the denim category and continue to define modern culture. Together these two powerhouse brands are poised to generate long-term global growth through industry innovations, trend-setting design and a commitment to doing the right thing.

1.1.1. Wrangler

Wrangler® has represented genuine style and comfort since it first started making jeans in 1947. With a rich legacy rooted in the American west, Wrangler® commits to offering unmatched quality and timeless design. Its collections for men, women and children look and feel great, inspiring those who wear them to be strong and ready for life, every day. Authenticity, quality and value make Wrangler® one of the most trusted brands in the world.

Sub-Brands

- Rustler
- Wrangler (Riggs Workwear)
- All Terrain Gear x Wrangler
- Wrangler Retro

1.1.2. Lee

Lee® is an iconic American denim and casual apparel brand that has been purposefully designing clothing to inspire you to live a life in motion. Driven by core values of authenticity, integrity and drive, the brand creates products consumers love. Lee's® collections include a uniquely styled range of jeans, t-shirts, pants, shirts and jackets for men, women, and boys.

Collections

- Lee 101+
- Mainline
- Black Label
- Urban Riders

1.1.3. Rock & Republic

Coveted for its fit, distinctive design and quality craftsmanship, the Rock & Republic® brand is made for the spotlight. The brand is a full lifestyle collection rooted in premium denim. It’s a brand that’s known for its glamorous, edgy styles and quality craftsmanship.

1.2. Lee

Lee has a proud history stretching back to 1889, and a heritage of quality clothes that are not only classic, but comfortable too. That’s why today Lee is one of the most popular work and casual brands in the market. Henry David Lee established the H.D. Lee Mercantile Company in Kansas; a business specialized in selling fine goods. H.D. Lee quickly saw the need for reliable work wear. Unhappy with the quality and inconsistent delivery of work wear from Eastern suppliers, Lee was convinced his company can do it better. It is with this venture that Lee started with what became one of the most successful garment companies throughout the 20th century.

Lee is a legendary brand which continues making history by its product innovations, such as the world’s first ever zip fly jeans- 101Z in 1926, iconic “Hair on hide” leather label and “Lazy S back pocket stitching. From the launch of first Lee bib to the 13oz 101 cowboy jeans, Lee demonstrates the passion of innovation, transforming from a practical and durable work-wear maker to a contemporary and trendy fashion giant.

1.2.1. Process Flow

Designers	•Trend Forecasting •Trend Presentation
Merchandiser	•Merchandise planning
Sourcing & Mills	•Swatch Selection
Product & Design Team	•Final Fabric and Trim Selection •Fabric and Trim Ordered
Quality	•Fabric and Trim Checking
Sourcing and PD Team	•Sampling Yardage Ordered
Designer & Wet Process Technician	•Wash Direction •Wash Presentation
Designers & Merchandisers	•Tech Pack Making
Sourcing/PD/Design Team	•Final Sample Making •Sample Washed
Merchandiser/PD Team	•Costing
Merchandiser	•MRP Finalisation •Range Finalisation
Quality Team	•Risk Analysis
Marketing Team	•Product Photoshoot •Catalouge Making
Merchandiser	•Order Form Making • Tagging and Stickering • Roadshow
Merchandiser	•Order Fabric and Trims • Order compilation •BOM Creation
Sourcing & PD Team	•OTB Finalization (open to buy) • Size set Submission •Sample handed over for production(SHO)
Quality	•Inspection
Distribution Chanels	•Stock Allocation to buyer •Stock Dispatched

2. Introduction

Lee has been a pioneer denim brand, inventing the zipper fly in 1927 and today with a customer base of millions of people. Lee provides shirts, t-shirt and denims to people from varied income levels through its four stories, large collection and substantial price range. The mainline story includes basic casual clothing, urban riders includes more athletic and stronger colors, black label includes business casuals and 101+ is the premium range in terms of fabric, quality, dyes and print.

Lee mainly focuses on men's garments. With a sizeable collection of 117 t-shirts, 121 shirts and 81 bottoms in the SS20 collection, Lee is able to provide customers with considerable choice. T-shirts and shirts are available in slim fit only, however, jeans are available in regular, skinny and slim fit with low, medium and high waist.

It goes without saying that the product helps in defining the brand name in the market. Past decades have witnessed the downfalls and rises of various apparel giants worldwide, and it has made it evident that market keeps changing over time but one thing that remains constant is customer's quest for quality product.

Fit is one of the most important factors that influence salability of jeans and design is one of the key factors for t-shirts. Further, price plays a major role as people expect value for money when purchasing garments.

2.1. Need for the Project

As the denim market is flourishing in India, people are becoming more aware of the varieties available to them and cannot be lured into buying the merchandise solely because of the brand name. There are several driving factors that affect consumer's decision making.

During the roadshow of SS20, several buyers indicated that Lee has been witnessing some issues with the fit measurement in Denim category. Conversation with buyers and merchandisers during the road show gave clear indication towards lack of customer satisfaction and the need of modification in fit spectrum. Customer feedback online has also recorded a lot of complaints related to improper fit.

2.2. Title of the Project

Revamping Men's Jeans Fit

2.3. Aim

To revamp the fit portfolio of men's jeans by collection body measurements of potential customers and studying current market trends.

2.4. Objectives

- Uncover factors that affect sales of a garment
    - Factor Analysis
- Revamp the fit to satisfy the needs of customers
    - Consumer Survey
    - K-Means Clustering
    - Comparative Analysis

2.5. Deliverables

- Consumer preference insights
- Modified jeans fit portfolio

3. Literature Review

3.1. Menswear Market in India

With a market size of INR 72000 crore in 2019, menswear is the largest segment in India's apparel market. According to Statista Research Department, activewear segment of men's apparel market had the highest CAGR amongst the other categories from 2018 to 2028 across India. The segment was expected to grow at the rate of about 15 percent annually over the years in the country. Denim and t-shirts segment was also expected to show promising growth over that decade.

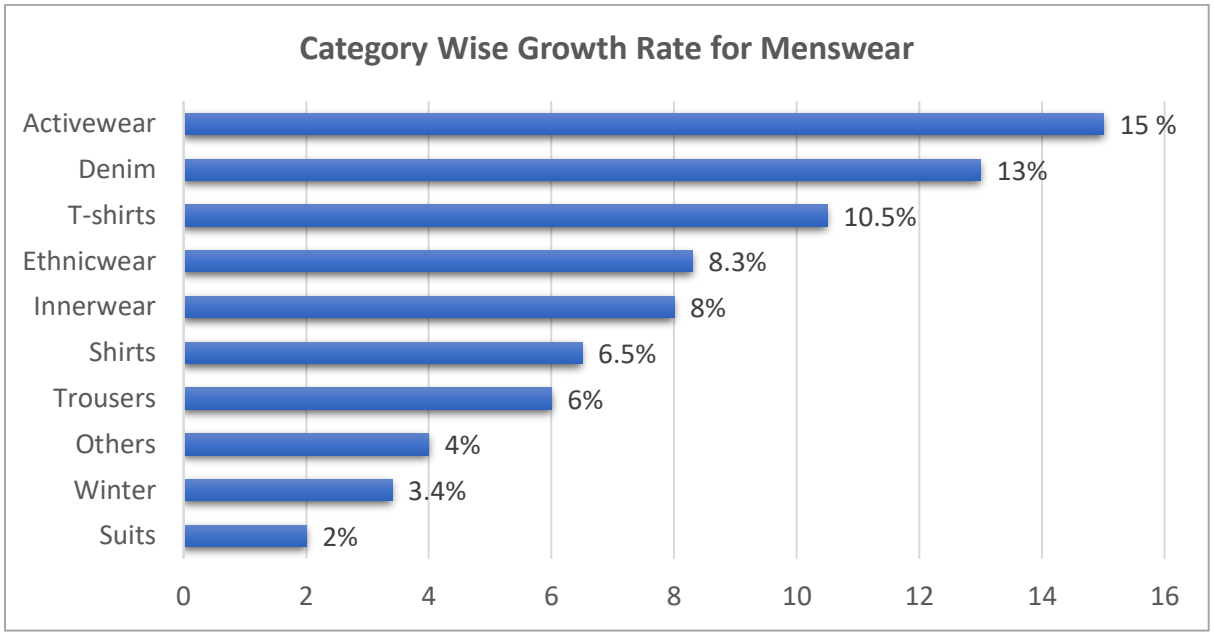


Figure 1: Category Wise Growth Rate for Menswear; Source: Statista Research Department

3.1.1. Denim Market in India

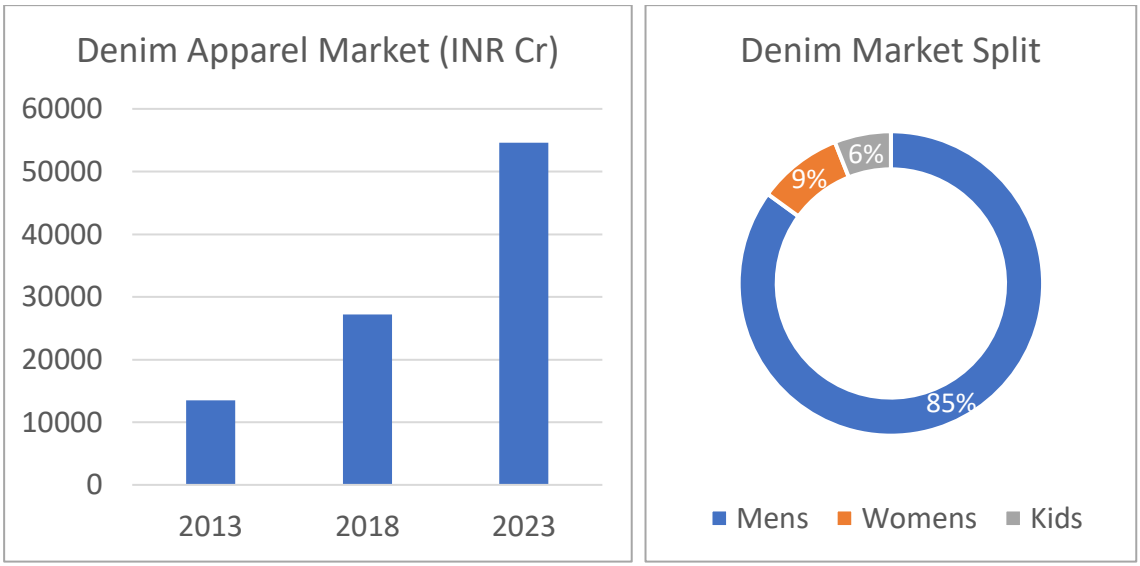


Figure 2: Denim Market in India; Source: Technopak Analysis

Denim is of the most promising category in India's apparel market. In 2017 the denim market of India was worth INR 23,076 Cr. The market is projected to grow at a Compound Annual Growth Rate (CAGR) of 12.7% to become an INR 54,600 Cr by 2023 and 76,258 by 2027.The denim market in India

is skewed towards men's segments with 85% while women's and kids segments contributes 9% and 6 % respectively.

3.1.1.1. Men's Denim Segment

Men's denim enjoy the largest share and are poised to grow at a high CAGR of 14 per cent over the next decade. Until a few years ago, denim was popular with men in the urban cities only, however, it has now gradually become popular in the semi-urban and rural markets also. Growing awareness and an increasing affinity for global fashion have led to this development. Denim is considered the most versatile fabric for men with multiple applications over casual wear, work wear and everyday wear.

3.1.1.2. Denim Trends in the Market

The denim market in India has been evolving fast with introduction of more styles, colours and some distinct trends in the product offering. In the recent times the industry has witnessed entrance of new fabric manufacturers which is expected to make the market for denim fabric more price competitive in the coming years. Cotton remains the fibre of choice in denim apparel. In blended denim fabrics polyester is being used as weft threads. The demand for stretch denim is growing at a faster rate in India market due to its comfort and fit characteristics

Concerns with fit and size of garments as initially introduced by Kim (2008), are defined as "the subjectively determined expectation and amount of risk perceived by a shopper in relation to the fit and size of the garment in contemplating a particular purchase decision" (Kim, 2008). The awareness about garment fit is increasing rapidly.

3.1.1.3. Fit

Fit has always been one of the key areas in apparel research because it is a crucial element of both clothing quality and consumer satisfaction. (Song & Ashdowm, 2010). Since there are a number of characteristics of apparel, researchers have defined apparel fit in multiple dimensions.

LaBat (1987) defined clothing fit as the relationship of clothing with the body. Frost (1988) noted that apparel fit contains 3 factors being, visual satisfaction, physical satisfaction and its function on the body.

The term "good fit" has also been defined in a diverse manner depending on the fashion trends, standardized sizes in the fashion industry and the individuals perception of fit (Fan, Yu & Hunter 2004) as clothing fit is a complex term affected by factors like fashion, style and many other factors.

Size and fit of the garment are the two most important factors while purchasing ready-to-wear garments. (Eckman, Damhorst & Kadolph)

According to Frost (1988), consumers perceive clothing fit from two perspectives: the visual, when looking in a mirror or looking down at themselves, and the tactile, when feeling the clothing as they wear it.

3.1.1.4. Anthropology

Many methods have been developed to measure the body in an effort to capture its dimensions for clothing. Measuring the human body has been important in developing garments to fit the body, and systems have reflected technology, needs of the consumer and focus of the apparel industry. The apparel industry has developed many techniques to measure the body. (Bye, Elizabeth & Labat, Karen & Delong, Marilyn 2006)

According to Kurt Salmon Associates Consumer Outlook, 59% of US shoppers claimed inconsistent fit within one brand, and 57% stated fit problems with standard sizes (Intellifit Corp, 2003). As a result, 40% of the purchased clothing is returned and 28% of consumers are reluctant to order from catalogues because of their concern about getting the right size (Telmat Industrie, 2002). These fit problems are associated with current sizing systems that overlook the diverse ethnicity that encompasses the full range of variation in body shapes existing in the population.

3.2. Factor Analysis

Gagliano and Hathkote (1994) suggested that the perception of the quality of service strongly influences customer preferences. Jackson Donald (1999) identified factors that improve customer satisfaction. Johnson Kurt (1999) performed an elaborative study on making loyalty programs more rewarding in order to increase customer retention. Mattila and Wirtz (2001) showed the importance of enhancing store environment through music and scent to boost impulse buying behavior and satisfaction. Summers and Hebert (2001) studied the influence of lighting on customer behavior. The findings of the research showed that lighting could help attract and retain customers. Baker, Parasuraman, Grewal and Voss (2002) proposed that factors such as music, layout, crowd and convenience affected sales. Solgaard and Hansen (2003) proved that location, quality, clean surroundings, variety, layout and sales assistants were the most important factors. Fox, Montgomery and Lodish (2004) proposed customers are more influenced by variety and advertisement than to prices. Radha Krishna and Shylajan (2007) studied the influences of marketing and demographic factors on consumers' buying behavior towards branded articles. However, factors that attract customers to one exclusive brand outlet more than another remain uncovered. Aamir Hasan and Subhash Mishra (2014) state that shopping experience, store image and value for money are the prominent factors influencing customer shopping behavior.

3.3. K-Means Clustering

Recent attempts to establish standardized systems are prominent in studies from developing countries. Based on statistical data analysis, Gupta and Gangadhar (2012) segregated 95 percent of the Indian population into eleven size charts. They used a total of 21 anthropometric data for Indian women from six metro cities. Multivariate analysis was carried out to identify relationships between variables and principal component analysis was used to identify the key body measurements and create a basis for classifying the population. Gupta et al., also considered the linear programming technique to derive a set of possible sizing system. Locker et al., (2014) describe a variety of size-specific methods based on statistical and visual analysis which can be applied to improve the apparel fit of a sizing system. This was applied to improve an existing sizing system of a garment production company. Lee and Beshah et al., (2014) examined the various sizing systems and specified anthropometric data as well as the fit issue in Korea using inferential statistics.

Saket and Pandya (2016) proposed the clustering technique for exploring information from large quantities of data so as to understand pattern existing in the dataset. Partitioning clustering is a data mining approach useful in garment sizing. It is an unsupervised learning process of grouping similar data points. Its main objective is to divide the data points into 'K' partitions. Zakaria et al., Bagherzadeh et al., and Elfaki and Ali (2016) used principal component analysis to determine key anthropometric measurements and cluster analysis for the sizing system. Rao et al. (2016) clustered 10096 anthropometric datasets of children in 54 districts of Uttar Pradesh into 4 clusters according to their average height and weight. Majumder and Sharma (2018) classified homogenous human body size of 382 men and 391 women of Orissa in India using cluster analysis of self reported age, stature, weight, and percent body fat. Elfaki and Ali (2016) also considered the K-Mean clustering technique for military clothing factory sizing chart.

4. Methodology

First, a detailed review of literature will be performed followed by factor analysis in order to understand factors that affect sales of a garment. In order to do this, a questionnaire will be prepared after an intensive review of literature and discussion with experts in the field. 500 customers will be surveyed to get sufficient data for a reliable result. Then, outliers will be removed,

After that, waist, hip, thigh, knee, length and instep measurements of customers of Lee will be taken in order to create a standard size that would fit majority of the potential customers, thereby increase comfort and overall appearance of the garment when tried on. An exploratory data analysis technique, K-means clustering will be used to identify homogeneous subgroups within the data. Then, the data will be checked for normality in order to reject the null hypothesis. Then, average silhouette value of every cluster will be found to check the validity of clustering. This will be followed by an in-depth analysis of descriptive statistics of each cluster to ensure variance within the cluster is kept to a minimum. Moreover, the position of the standard size developed will be reviewed in the fit spectrum of competitors.

Figure 3: Methodology; Source: Self

4.1. Primary Data Collection

- Consumer survey
- Market survey
  This involves collecting the specification sheets of the following brands:
  - Levi's
  - Jack & Jones
  - Pepe Jeans
  - US Polo
  - United Colors of Benetton
  - American Eagle
  - Celio
  - Calvin Klein
- Interview of store managers

4.2. Secondary Data Collection

- Literature review
  - Study of the documents such as journals, publications and magazines to see the market trends of men's wear industry and consumption rates
- E-commerce website
  - Study the fit offerings of various brands
  - Product review

4.3. Factor Analysis Algorithm

Factor analysis is a useful tool for investigating complex variable relationships. It allows researchers to investigate concepts that are not easily measured directly by collapsing a large number of variables into a few interpretable underlying factors. There are three main steps in a factor analysis:

1. Selecting and measuring set of variables in a given domain
2. Data screening in order to prepare the correlation matrix
3. Factor extraction
4. Factor rotation to increase interpretability
5. Interpretation
6. Reliability and validation

4.4. K-Mean Clustering Algorithm

K-means algorithm is an iterative algorithm that tries to partition the dataset into K pre-defined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the inter-cluster data points as similar as possible while also keeping the clusters as different (far) as possible. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum.

1. Specify number of clusters K.
2. Initialize centroids by first shuffling the dataset and then randomly selecting K data points for the centroids without replacement.
3. Keep iterating until there is no change to the centroids. i.e assignment of data points to clusters isn't changing.
4. Compute the sum of the squared distance between data points and all centroids.
5. Assign each data point to the closest cluster (centroid).
6. Compute the centroids for the clusters by taking the average of the all data points that belong to each cluster.

5. Analyzing Factors that Affect Sales of a Garment

5.1. Objective

To find factors that motivate customer to purchase from one brand more than another through a survey followed by factor analysis.

5.2. Methodology

Factor analysis was used to condense the copious variables into 5 prominent factors by detecting a structure in the relation between the variables.

First, a questionnaire consisting of 16 questions was prepared after a comprehensive review of previous research in the field and discussion with the store managers of the stores where the survey was conducted. Each variable was analyzed based on a 7-point Likert scale ranging from strongly agree to strongly disagree. The questionnaire consisted of two parts; part 1 included questions regarding the demographic characteristics of the customers and the part 2 consisted of variable related to shopping behavior of customers at apparel retail outlets.

Second, 480 customers were surveyed. The participation in the survey was voluntary in order to ensure reliability.

Third, the accuracy of the data was increased. This was done by eliminating the data rows with missing values. Further, the rows with a standard deviation of 0 were identified and removed in order to eliminate outliers. This led to the elimination of 80 data rows.

Fourth, the data was entered in SPSS and factor analysis was carried out. The KMO value was observed to be above 80% which proved that the survey was valid. Further, the rows with values greater than 60% on the diagonal of anti-image correlation matrix were removed. Next, inverse relationships were checked through the identification of negative values in the rotated component matrix. The 16 variables were grouped under 5 factors through factor analysis.

Fifth, the reliability of the factor analysis was checked by analyzing whether Cronbach's alpha > 0.7, AVE > 0.5 and Cronbach's alpha > AVE. The result showed that the factor analysis was reliable.

Lastly, from the factors found through factor analysis a consumer survey was prepared to understand the likings of the customers in terms of fit, style, price and so on.

5.3. Questionnaire

1.	I expect fair price in comparison to similar products in market
2.	I am willing to pay a premium for novel products
3.	I prefer purchasing garments from reputed brands
4.	I buy garments that have a good stitch and fabric quality
5.	I purchase garments with easy wash care
6.	Physical fit (such as tightness, length) carries importance
7.	Aesthetic fit (overall appearance) carries importance
8.	Functional fit (ease of movement) carries importance
9.	Social fit (feedback & fitting in) carries importance
10.	I pay attention to the material used in the garment
11.	I try multiple garments until I can find the right size
12.	I do not buy clothes that would make me stand out from others
13.	I purchase from stores that provide variety
14.	I prefer brands where collection is in corroboration with latest Fashion

15.	I like trying new styles
16.	I buy from stores where garments are available in a variety of colors

Table 1: Questionnaire; Source: Self

Each question was answered based on a 7-point likert scale as mentioned below:

1. Strongly agree
2. Agree
3. Somewhat agree
4. Neutral
5. Somewhat disagree
6. Disagree
7. Strongly disagree

5.4. Analysis

5.4.1. Demographics

Variable	Category	N	n	%
Gender	Male	193	400	48.2
	Female	207	400	51.8
Age Group	20-24	104	400	26.0
	25-29	108	400	27.0
	30-34	98	400	24.5
	Above 35	90	400	22.5
Monthly Income	Less than 1,00,000	64	400	16.0
	1,00,000 - 3,00,000	95	400	23.8
	3,00,001 – 5,00,000	79	400	19.8
	5,00,001 - 7,00,000	91	400	22.8
	Above 7,00,000	71	400	17.8

Table 2: Demographics; Source: Self

The above information shows that there were approximately equal number of male and female respondents. Moreover, there were almost equal number of respondents from every age group, that is, 20-24, 25-29, 30-34 and above 35. Lastly, most respondents were from the income category 1,00,000 – 3,00,000 and 5,00,001 – 7,00,000, followed by 3,00,001 – 5,00,000, above 7,00,000 and less than 1,00,000.

5.4.2. Eliminating missing values & outliers

First, the survey responses with missing data were removed. Second, the standard deviation between the responses of each person surveyed were checked. If the responses has a standard deviation of 0, the response was eliminated from the dataset.

5.4.3. Kaiser Meyer Oklin Test

Kaiser-Meyer-Oklin Measure of Sampling Adequacy	0.815

To ascertain the appropriateness of factor analysis Kaiser-Mayer-Oklin (KMO) measure of sampling adequacy (MSA) was performed. In this study the KMO was found to be 0.815, which indicates that the proportion of variance in the variables might be caused by underlying factors.

5.4.4. Anti-Image Correlation Matrix

As the values on the diagonal for all questions were above 0.600, none of the questions were eliminated from the dataset.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Q1	.869a	-0.443	0.038	-0.211	0.088	-0.140	0.005	-0.059	0.163	-0.094	-0.073	0.114	0.078	-0.198	-0.046	0.084
Q2	-0.443	.852a	-0.423	-0.128	0.116	-0.020	0.191	-0.057	-0.080	0.036	-0.114	0.080	-0.005	-0.089	-0.189	0.127
Q3	0.038	-0.423	.881a	-0.380	-0.172	0.007	-0.215	0.042	0.048	-0.020	-0.006	-0.084	-0.007	0.093	0.037	-0.031
Q4	-0.211	-0.128	-0.380	.897a	-0.193	0.058	-0.272	0.139	-0.066	-0.003	-0.042	-0.076	0.035	0.076	-0.039	-0.009
Q5	0.088	0.116	-0.172	-0.193	.840a	-0.231	0.130	-0.250	-0.028	0.055	-0.110	0.092	-0.064	-0.051	-0.220	0.242
Q6	-0.140	-0.020	0.007	0.058	-0.231	.832a	-0.241	-0.549	0.059	0.028	-0.016	0.098	-0.084	-0.077	0.111	-0.058
Q7	0.005	0.191	-0.215	-0.272	0.130	-0.241	.881a	-0.259	0.056	-0.041	-0.044	0.053	-0.002	-0.047	-0.051	0.049
Q8	-0.059	-0.057	0.042	0.139	-0.250	-0.549	-0.259	.836a	-0.081	-0.022	-0.014	-0.152	0.045	0.164	-0.091	0.041
Q9	0.163	-0.080	0.048	-0.066	-0.028	0.059	0.056	-0.081	.749a	-0.739	-0.313	-0.154	0.113	0.020	0.054	0.012
Q10	-0.094	0.036	-0.020	-0.003	0.055	0.028	-0.041	-0.022	-0.739	.758a	-0.168	0.234	-0.281	0.054	-0.051	0.050
Q11	-0.073	-0.114	-0.006	-0.042	-0.110	-0.016	-0.044	-0.014	-0.313	-0.168	.898a	-0.090	0.267	-0.141	0.105	-0.152
Q12	0.114	0.080	-0.084	-0.076	0.092	0.098	0.053	-0.152	-0.154	0.234	-0.090	.706a	-0.613	-0.425	-0.038	0.099
Q13	0.078	-0.005	-0.007	0.035	-0.064	-0.084	-0.002	0.045	0.113	-0.281	0.267	-0.613	.725a	-0.387	-0.074	-0.016
Q14	-0.198	-0.089	0.093	0.076	-0.051	-0.077	-0.047	0.164	0.020	0.054	-0.141	-0.425	-0.387	.779a	0.068	-0.080
Q15	-0.046	-0.189	0.037	-0.039	-0.220	0.111	-0.051	-0.091	0.054	-0.051	0.105	-0.038	-0.074	0.068	.627a	-0.857
Q16	0.084	0.127	-0.031	-0.009	0.242	-0.058	0.049	0.041	0.012	0.050	-0.152	0.099	-0.016	-0.080	-0.857	.758a

Table 3: Anti-Image Corelation Matrix; Source: Self

5.4.5. Rotated Component Matrix

According to the rotated component matrix, the variables were distributed into five factors.

		Component				
		1	2	3	4	5
Q1	Physical fit (such as tightness, length) carries importance	.854				
Q2	Aesthetic fit (overall appearance) carries importance	.801				
Q3	Functional fit (ease of movement) carries importance	.800				
Q4	Social fit (feedback & fitting in) carries importance	.791				
Q5	I purchase from stores that provide variety		.885			
Q6	I prefer brands where collection is in corroboration with latest fashion		.881			
Q7	I like trying new styles		.727			
Q8	I buy from stores where garments are available in a variety of colors		.705			
Q9	I pay attention to the material used in the garment			.969		
Q10	I give emphasis to the finish of the garment			.963		
Q11	I do not buy clothes that would make me stand out from others			.959		
Q12	I expect fair price in comparison to similar products in market				.936	
Q13	I am willing to pay a premium for novel products				.910	
Q14	I prefer purchasing garments from reputed brands				.757	
Q15	I purchase garments with easy wash care					.959
Q16	I buy garments that have a good stitch and fabric quality					.929

Table 4: Rotated Component Matrix; Source: Self

The first factor, fit, consisted of variables related to the physical fit, aesthetic fit, functional fit and social fit. The second factor, assortment, includes influences such as variety, latest fashion, style and color. The third factor, perceived value, consists of fair price, novel product and value for money. The fourth factor, comfort, consist of material, size and distinction. The last factor, prolongation is influenced by quality and wash care.

In short, the variables and factors can be summarized as,

Factors	Factor Interpretation (% variance explained)	Variables Included in the Factor
Fit	Eigenvalue (37.704)	Physical Fit (0.801)
		Aesthetic Fit (0.854)
		Functional Fit (0.800)
		Social Fit (0.791)
Assortment	Eigenvalue (19.054)	Variety (0.885)
		Latest Fashion (0.881)
		Style (0.727)
		Color (0.705)
Perceived Value	Eigenvalue (10.901)	Fair price (0.969)
		Novel Product (0.963)
		Brand Name (0.959)
Characteristics	Eigenvalue (9.955)	Material (0.936)
		Finish (0.910)
		Distinction (0.757)
Prolongation	Eigenvalue (6.535)	Quality (0.959)
		Wash care (0.929)

Table 5: Summary of Variables & Factors; Source: Self

5.4.6. Ranking of Factors

Rank	Factor	Mean Values
1	Fit	4.79
2	Assortment	4.70
3	Perceived Value	4.69
4	Characteristics	4.31
5	Prolongation	4.14

Table 6: Ranking of Factors; Source: Self

From the above table it is clear that fit is the most influential factor while purchasing a garment. This includes:

- Physical fit: features of fit that are physically perceived when evaluating fit in terms of the relationship between clothing and body, such as tightness and length.
- Aesthetic fit: features of fit that are visually perceived and assessed when looking at an individual's dressed body, such as overall appearance related to the body and attractiveness.
- Functional fit: features of fit that are perceived when the dressed body is moving for activities, related to restriction or lack of restriction of movement.
- Social fit: feeling of well-being resulting from satisfaction with fit attained through feedback from others.

The second most important factor is assortment which includes:

- Variety: number of options the customer can see before making a buying decision
- Latest fashion: garments that corroborate with the current trends in the market
- Style: innovative styles that provide customers with diversity for their wardrobe
- Color: a large number of colors in the collection

The third most influential factor is perceived value which includes:

- Fair price: similar price as compared to the same product of another brand

- Novel product: acceptable premium pricing for a new and original product
- Brand name: perceived value of a brand

The fourth most dominant factor is characteristics of the product such as:

- Material: fiber composition and other properties of the fabric used in the garment
- Finish: finishing process that the fabric or garment was exposed to
- Distinction: garment that makes you stand out from others in a crowd.

The least important factor is prolongation which includes:

- Quality: the stitch and fabric quality of the garment
- Wash care: ease of maintenance through machine wash

5.4.7. Reliability Test

Factor	Question	R	R2	α	AVE
Fit	Physical Fit	0.854	0.729		
	Aesthetic Fit	0.801	0.641		
	Functional Fit	0.800	0.640		
	Social Fit	0.791	0.625	0.910	0.659
Assortment	Variety	0.885	0.783		
	Latest Fashion	0.881	0.776		
	Style	0.727	0.529		
	Color	0.705	0.497	0.877	0.646
Perceived Value	Fair Price	0.969	0.939		
	Novel Product	0.963	0.928		
	Brand Name	0.959	0.919	0.969	0.929
Characteristics	Material	0.936	0.876		
	Finish	0.910	0.828		
	Distinction	0.757	0.574	0.911	0.759
Prolongation	Quality	0.959	0.919		
	Wash care	0.929	0.863	0.902	0.891

Table 7: Reliability Test; Source: Self

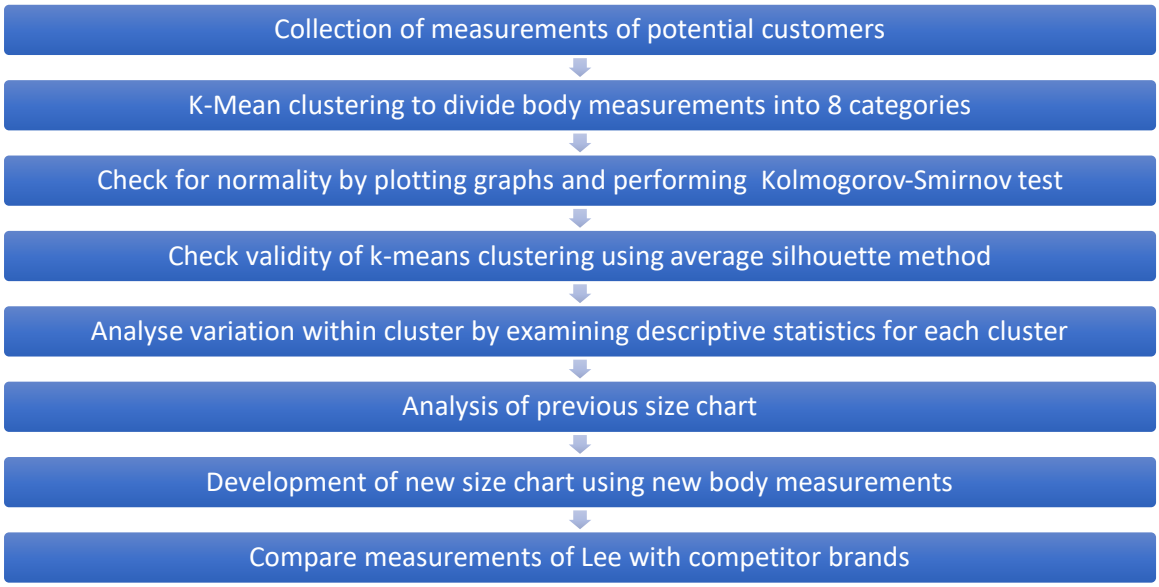
The conditions for reliability were satisfied as follows:

1. $\alpha > 0.7$
2. AVE > 0.5
3. $\alpha >$ AVE

6. Fit Analysis

From the understanding of the consumer survey, mentioned in detail in section 6, it was understood that fit was considered the most important factor while purchasing jeans, however, according to customers perception, Lee did not provide good fits

In this section, we discuss the process of creating a new size chart for denim jeans with an improved fit. In order to do this, first, we collected measurements of potential customers. By using k-mean clustering algorithm we divided the body measurements into 8 categories. Then, we checked for normality and further examined the validity of k-means clustering using Kolmogorov–Smirnov test. Moreover, descriptive statistics were examined for each cluster identified to ensure variability within cluster was minimal. Then, a new size chart was developed for every fit based on the body measurements obtained. Lastly, these measurements were compared with that of the competitors.



6.1. Data Collection

In every company owned Lee showroom, a tailor is hired to perform the required alterations. In order to gain relevant body measurements, that is, measurements of potential customers, store managers of every company owned showroom were contacted and informed to instruct the tailor to collect measurements of customers entering the store with their approval by explaining the reason for measurement collection.

Specific instructions were given to the tailors as to which body measurements were to be collected and method. The format shown below was sent to every store. Through this method, 596 measurements were collected from 20 Lee showrooms across India. Stores from where measurements were collected, and number of measurements collected from each store are mentioned in *annexure 2*.

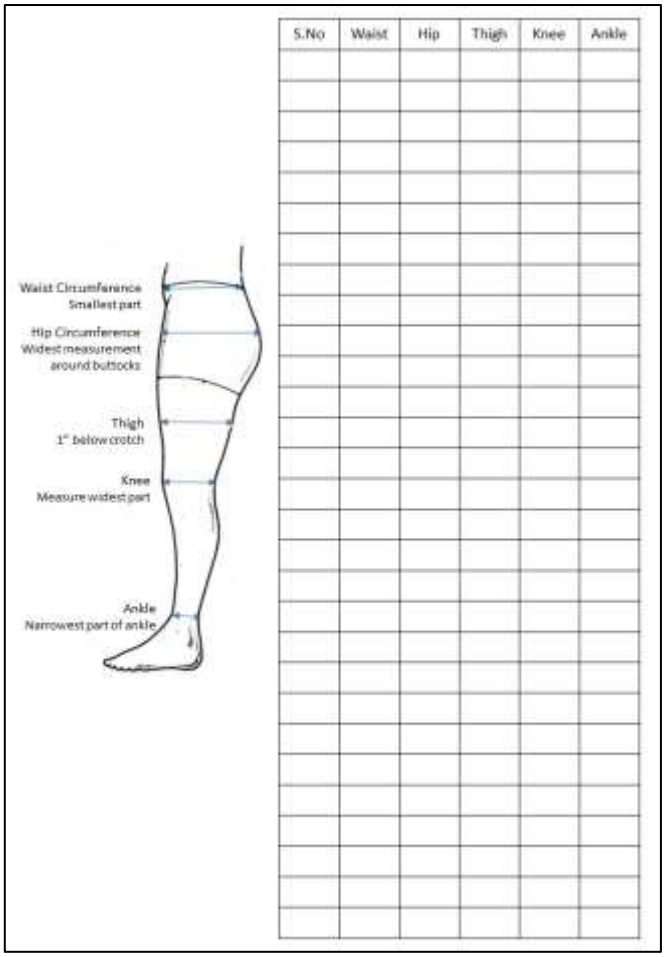


Figure 4: Format for Data Collection; Source: Self

Demographics

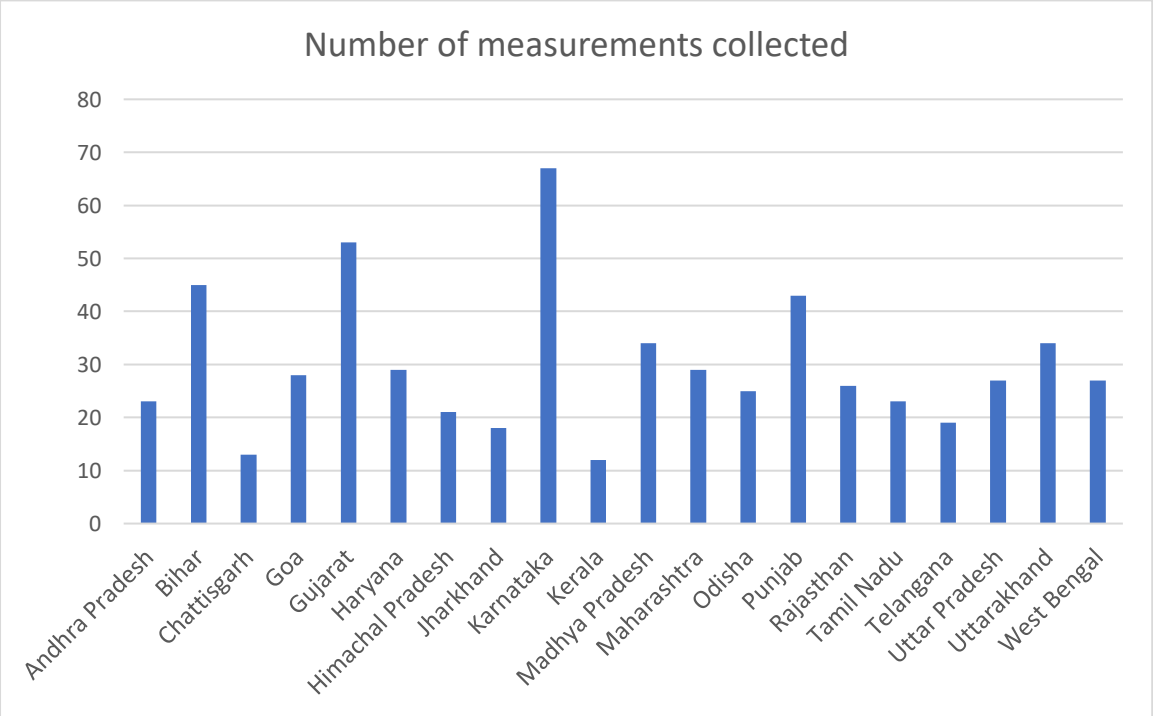


Figure 5: Number of Measurements Collected; Source: Self

6.2. K-Means Clustering

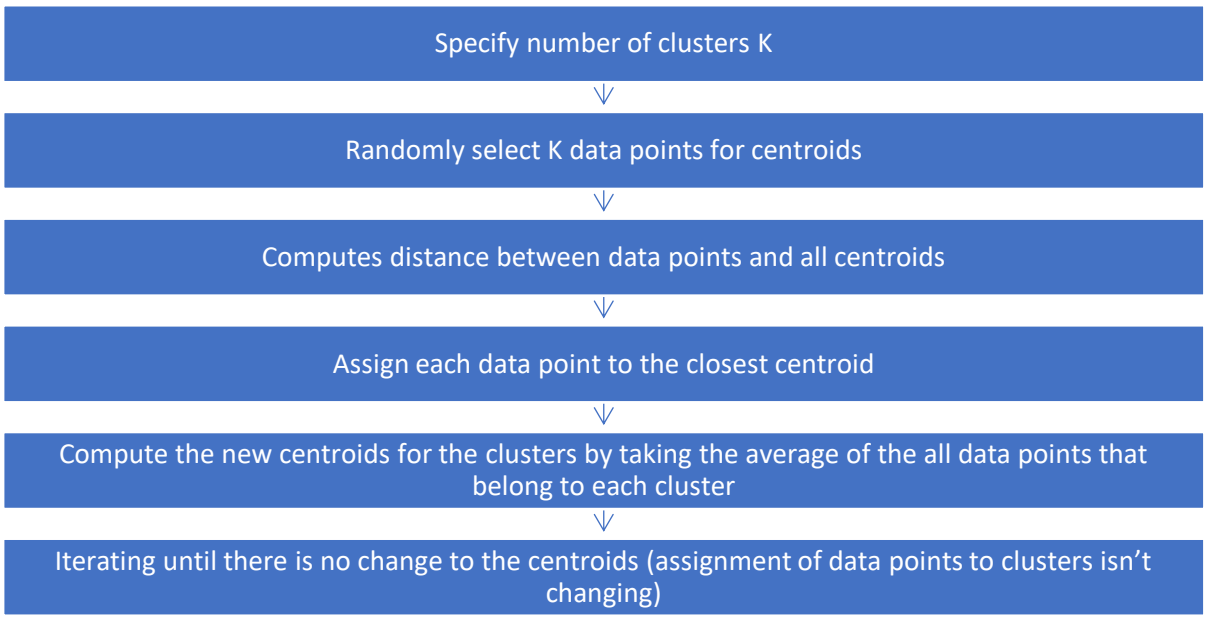
6.2.1. Clustering

Clustering is one of the most common exploratory data analysis technique used to get an intuition about the structure of the data. It can be defined as the task of identifying subgroups in the data such that data points in the same subgroup (cluster) are very similar while data points in different clusters are very different. In other words, it finds homogeneous subgroups within the data such that data points in each cluster are as similar as possible according to a similarity measure such as euclidean-based distance.

6.2.2. K-Means Clustering

K-means algorithm is an iterative algorithm that tries to partition the dataset into K pre-defined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the inter-cluster data points as similar as possible while also keeping the clusters as different (far) as possible. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster.

6.2.2.1. Algorithm



K-means clustering is an unsupervised machine learning algorithm. The target number k, which refers to the number of centroids needed in the dataset is entered first. A centroid is the imaginary or real location representing the center of the cluster.

Every data point is allocated to each of the clusters through reducing the in-cluster sum of squares. In other words, the K-means algorithm identifies k number of centroids, and then allocates every data point to the nearest cluster, while keeping the centroids as small as possible. The 'means' in the K-means refers to averaging of the data; that is, finding the centroid.

6.2.2.2. Running K-Mean Clustering in SPSS

The data set created from measurements collected (mentioned in *annexure 3*) was fed into SPSS. K-means clustering algorithm was used in order to divide the data set into 8 categories for 8 sizes.

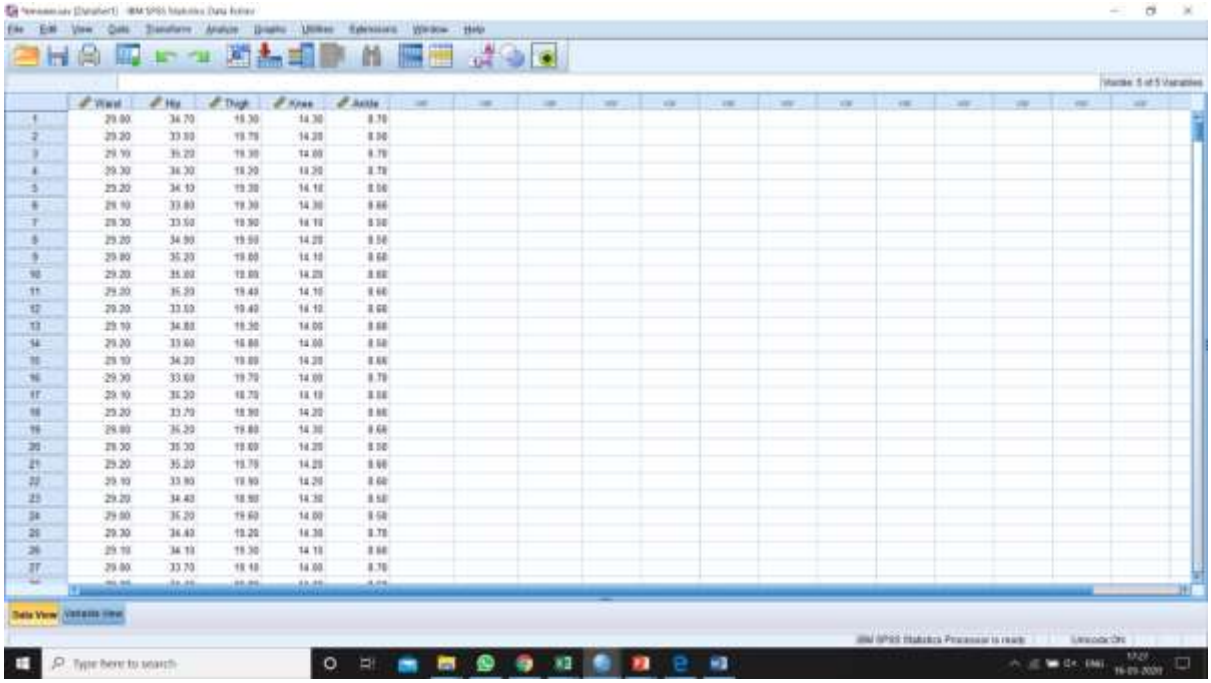


Figure 6: Dataset entered into SPSS; Source: Self

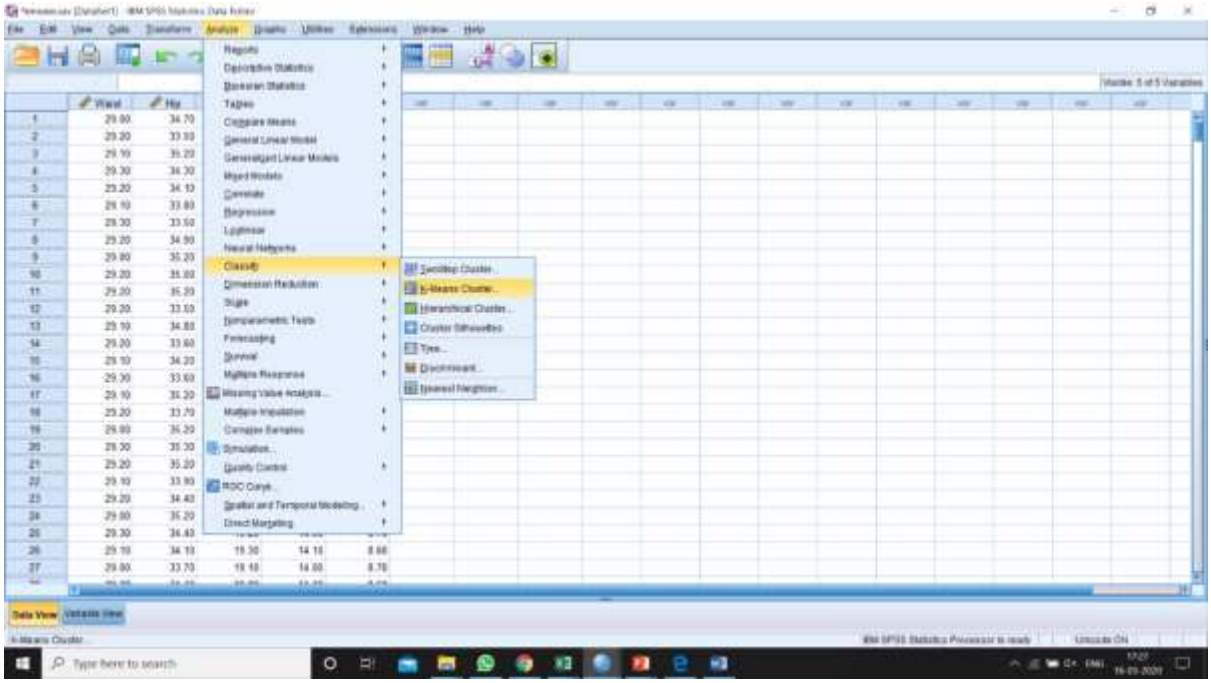


Figure 7: Selecting k-means clustering; Source: Self

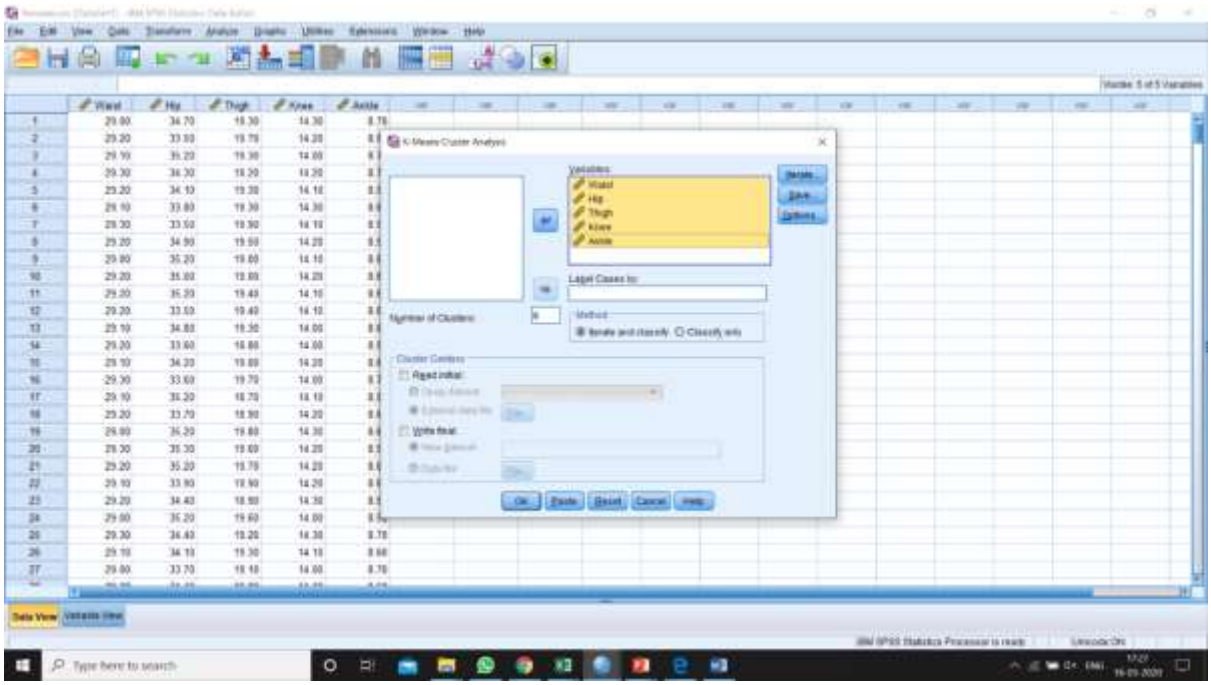


Figure 8: Setting number of clusters to 8 and running the algorithm; Source: Self

Initial Cluster Centers

	Cluster							
	1	2	3	4	5	6	7	8
Waist	32.80	35.20	39.40	43.40	29.20	31.10	41.40	37.30
Hip	37.20	41.20	45.40	49.40	33.60	36.30	47.50	43.40
Thigh	22.40	23.46	26.57	28.20	18.80	20.10	27.30	24.60
Knee	15.10	15.70	16.80	17.40	14.00	14.20	17.10	15.50
Ankle	9.90	10.20	11.00	12.10	8.50	9.30	11.80	10.80

Iteration History[a]

	Change in Cluster Centers							
Iteration	1	2	3	4	5	6	7	8
1	1.510	.717	.978	.588	1.073	.777	.770	1.054
2	.000	.058	.000	.000	.000	.000	.000	.025
3	.000	.000	.000	.000	.000	.000	.000	.000

a. Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is .000. The current iteration is 3. The minimum distance between initial centers is 2.933.

Final Cluster Centers

	Cluster							
	1	2	3	4	5	6	7	8
Waist	33.37	34.75	39.06	43.24	29.18	31.23	41.25	36.67
Hip	38.34	40.59	44.84	48.84	34.50	36.24	46.77	42.83
Thigh	21.70	23.37	25.85	28.10	19.35	20.75	27.26	24.20
Knee	15.11	15.60	16.60	17.36	14.15	14.57	17.10	15.99
Ankle	9.50	10.19	11.11	12.10	8.60	9.15	11.60	10.62

Figure 9: Output of k-means clustering; Source Self

6.2.3. Cluster Centroids

The final cluster centroids generated as a result of the k-means clustering were used as standard body measurements for each size.

Final Cluster Centers								
	Cluster							
	1	2	3	4	5	6	7	8
Waist	33.37	34.75	39.06	43.24	29.16	31.23	41.25	36.67
Hip	38.34	40.59	44.84	48.84	34.50	36.24	46.77	42.83
Thigh	21.70	23.37	25.85	28.10	19.35	20.75	27.26	24.20
Knee	15.11	15.60	16.60	17.36	14.15	14.57	17.10	15.99
Ankle	9.50	10.19	11.11	12.10	8.60	9.15	11.60	10.62
Unit = Inches								

Table 8: Final Cluster Centroids after k-means Clustering; Source: Self

Number of Cases in each Cluster		
Cluster	1	88.000
	2	78.000
	3	66.000
	4	48.000
	5	81.000
	6	85.000
	7	76.000
	8	74.000
Valid		596.000
Missing		.000

Table 9: Number of cases in each cluster; Source: Self

6.3. Normality

H_0 = There is no significant difference between the measurements of the population

H_a = There is significant difference between measurements of the population

In order to check for normality, we plot a scatter plot and a histogram and then perform Kolmogorov-Smirnov test.

6.3.1. Histogram & Scatter Plot

For a normal distribution of data, the histogram forms bell-shape with all the randomness removed. It represents an ideal data set that has lots of numbers concentrated in the middle of the range, with the remaining numbers trailing off symmetrically on both sides.

For a normal distribution of data, the scatter plot appears as a straight line, the closer the points to a perfect straight line, the certainty of the normal being normally distributed increases.

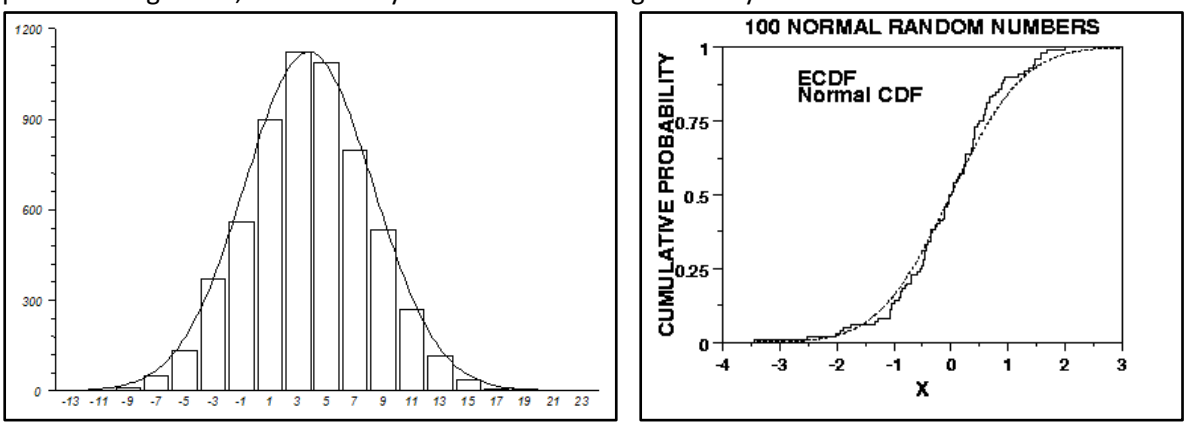


Figure 10: Normal distribution of data represented as a histogram (left) and scatter plot (right)

Graphs inserted below are the representation of the data collected for each parameter measured, that is, waist, hip, thigh, knee and ankle.

6.3.1.1. Analysis of Distribution of Waist Measurement

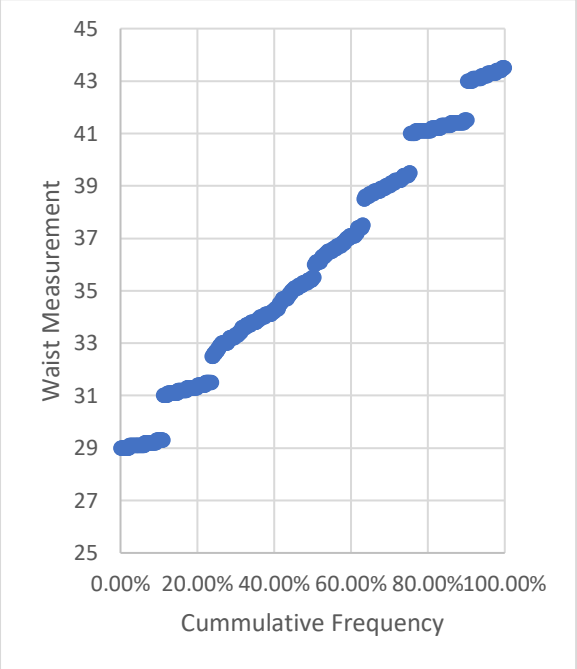


Figure 11: Scatter Plot for waist measurements; Source: Self

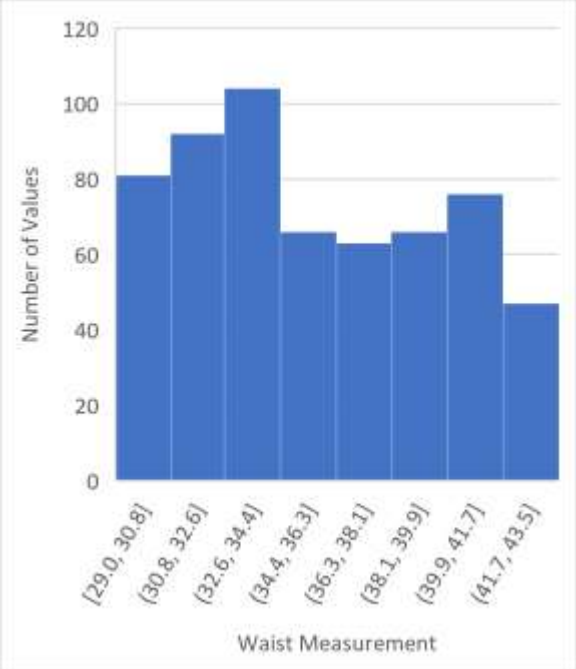


Figure 12: Histogram for waist measurements; Source: Self

6.3.1.2. Analysis of Distribution of Hip Measurement

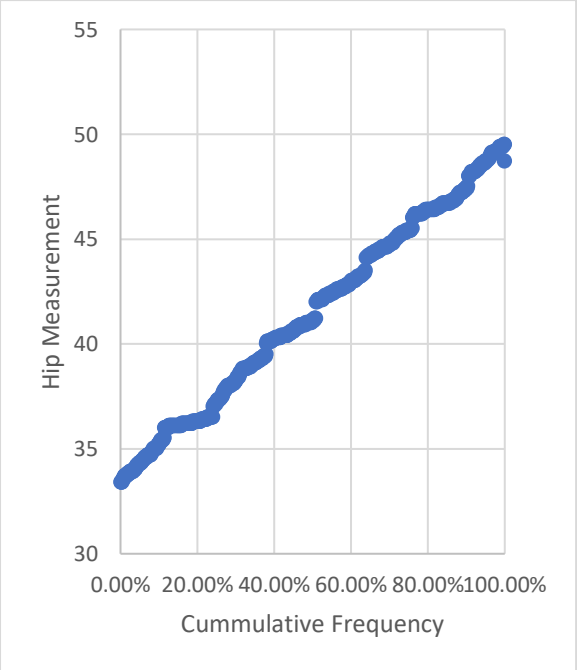


Figure 13: Scatter Plot for hip measurements; Source: Self

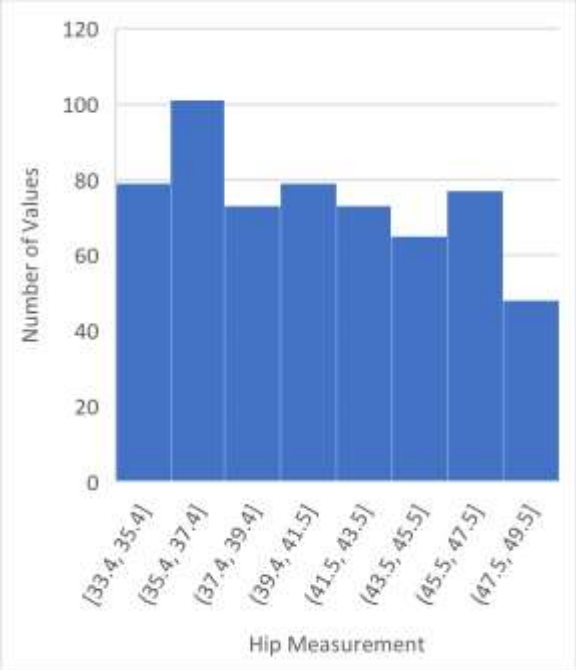
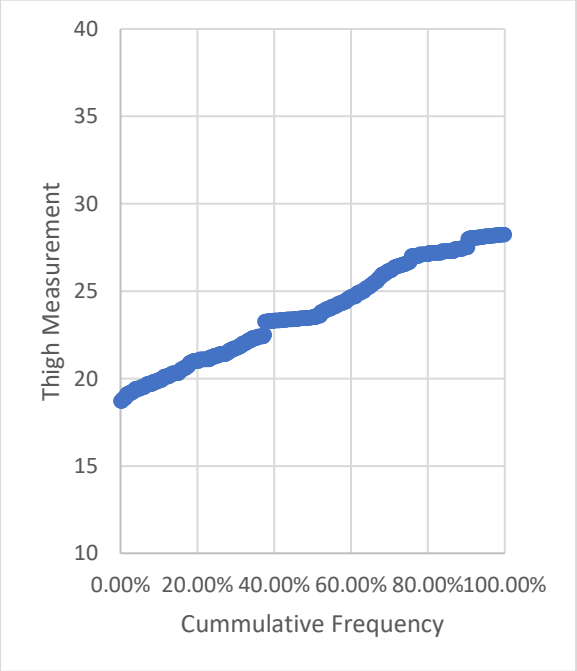


Figure 14:Histogram for hip measurements; Source: Self

6.3.1.3. Analysis of Distribution of Thigh Measurement



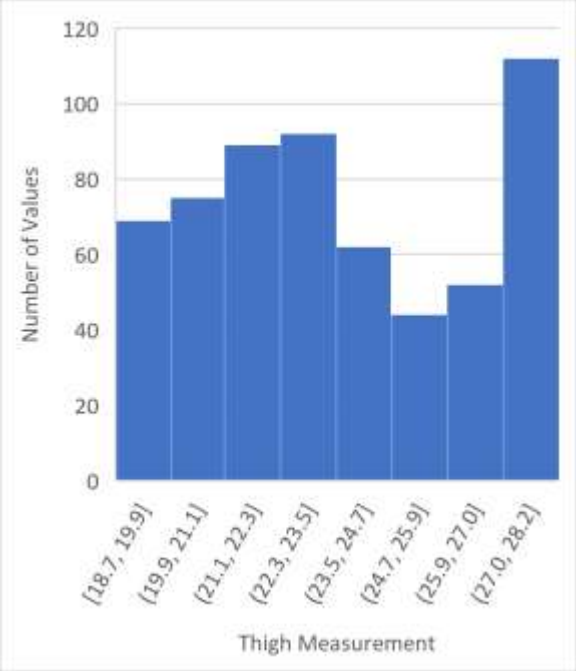
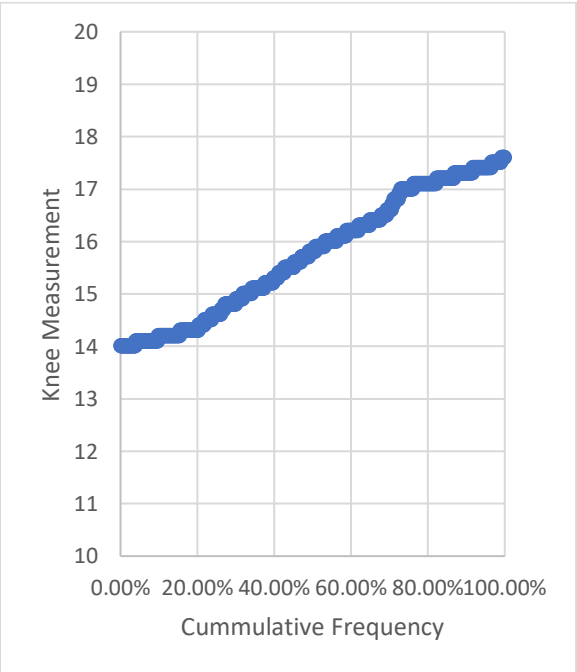


Figure 15: Scatter Plot for thigh measurements; Source: Self *Figure 16: Histogram for thigh measurements; Source: Self*

6.3.1.4. Analysis of Distribution of Knee Measurement



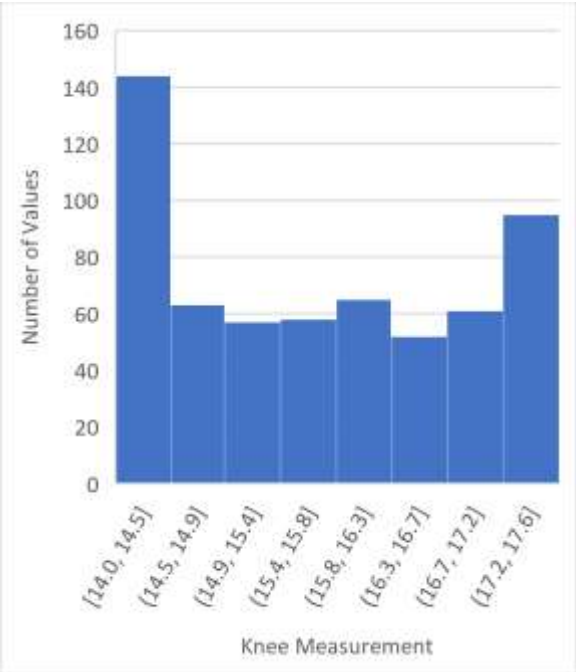


Figure 17: Scatter Plot for knee measurements; Source: Self *Figure 18: Histogram for knee measurements; Source: Self*

6.3.1.5. Analysis of Distribution of Ankle Measurement

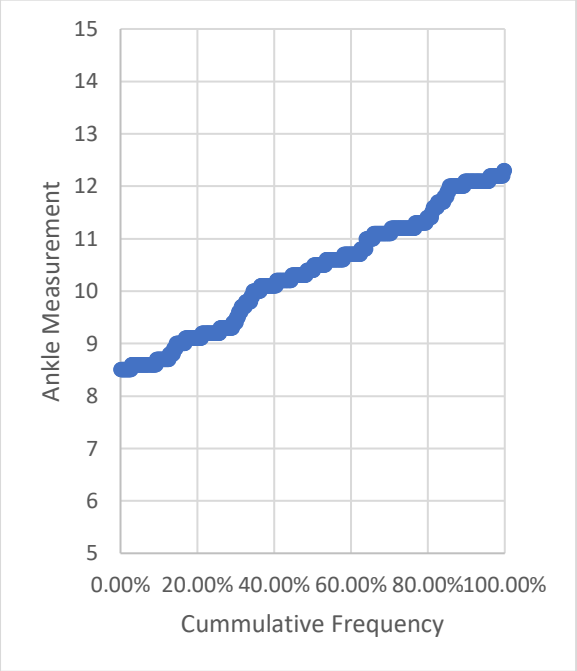


Figure 19: Scatter Plot for ankle measurements; Source: Self

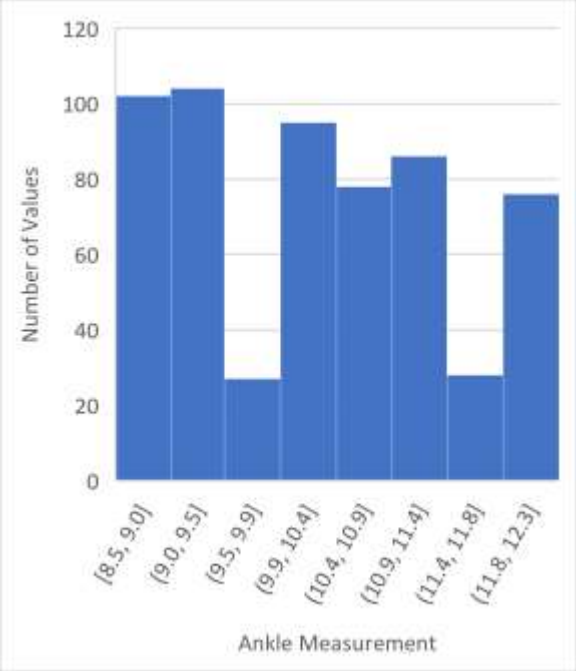


Figure 20: Histogram for ankle measurements; Source: Self

From the above graph it is evident that none of the measurements are normally distributed. Lastly, to gain certainty normality is check through Kolmogorov-Smirnov Test

Kolmogorov-Smirnov Test				
Attribute	Test Statistics	Critical Value	P Value	Remark (Alpha=5%)
Waist	.101	0.05	0.000	Reject Normality
Hip	.113	0.05	0.000	Reject Normality
Thigh	.101	0.05	0.000	Reject Normality
Knee	.106	0.05	0.000	Reject Normality
Leg Open	.135	0.05	0.000	Reject Normality

Table 10: Kolmogorov-Smirnov Test; Source: Self

The Kolmogorov-Smirnov Goodness of Fit Test (K-S test) tests normality by comparing given data to a normal distribution with the same mean and standard deviation of the given sample. The test statistics are all above the critical value, 0.05. Moreover, the p value for all parameters are <0.001. Therefore, normality is rejected for every parameter.

6.4. Validity

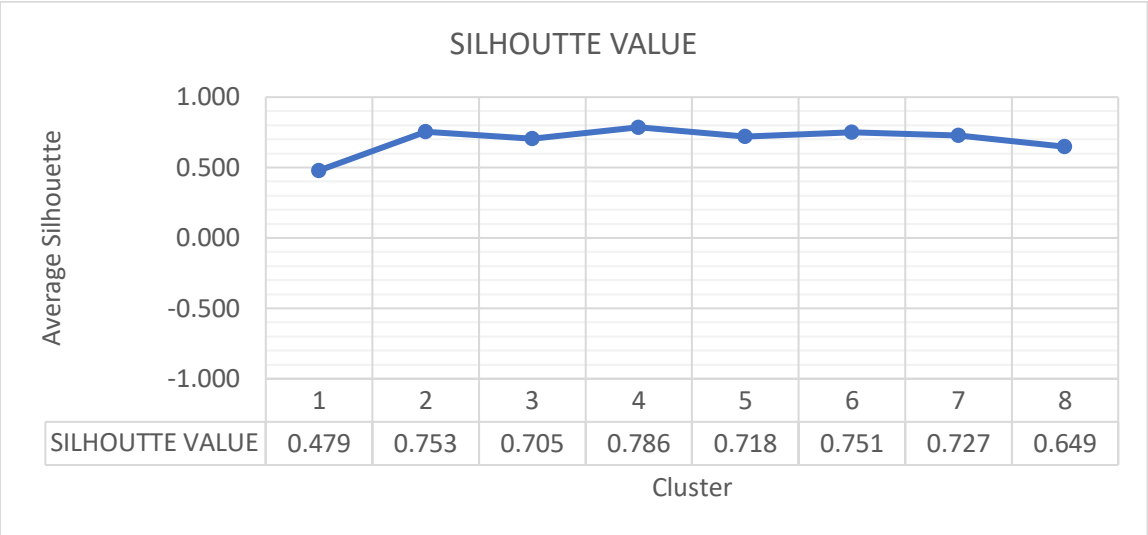
The average silhouette method measures the quality of a clustering. It determines how well each object lies within its cluster. The silhouette value is a measure of how similar an object is to its own cluster (cohesion) compared to other clusters (separation). It can be used to study the separation distance between the resulting clusters.

The Silhouette Coefficient is calculated using the mean intra-cluster distance (a) and the mean nearest-cluster distance (b) for each sample.

$$S(i) = (b - a) / \max(a, b)$$

- If silhouette value is close to 1, sample is well-clustered and already assigned to a very appropriate cluster.

- If silhouette value is about to 0, sample could be assign to another cluster closest to it and the sample lies equally far away from both the clusters. That means it indicates overlapping clusters
- If silhouette value is close to –1, sample is misclassified and is merely placed somewhere in between the clusters.



	1	2	3	4	5	6	7	8
SILHOUTTE VALUE	0.479	0.753	0.705	0.786	0.718	0.751	0.727	0.649

Figure 21: Average Solhoutte Value for each cluster; Source: Self

From the above graph, it is evident that the average silhouette values are close to 1 which proves that the k-means clustering is valid.

6.5. Descriptive Statistics

Mean

- Average of the numbers, that is, sum divided by the count

Variance

- Measures how far a set of data is spread out
- Average of the squared distances from each point to the mean
- The higher the number, higher the spread of the data

Standard Deviation

- Standard deviation shows how much variation from the mean exists
- Square root of variance
- The higher the number, higher the spread of the data

Standard Error

- SE tells you how far your sample mean deviates from the actual population mean
- standard deviation divided by the square root of the sample size
- The higher the number, higher the spread of the data

Median

- Middle number in a sorted, ascending or descending, list of numbers

Confidence Interval of Mean

- Lower 95% CL mean and upper 95% CL mean are the lower and upper bound of the confidence interval for the mean
- Add and subtract the standard of error from the mean
- Specifies a range of values within which the mean, may lie

Interquartile Range

- Measure of variability, based on dividing a data set into quartiles
- How spread out the "middle" values are

Mean Absolute Deviation

- Helps us get a sense of how "spread out" the values in a data set are
- Average distance between each data point and the mean.
- The higher the number, higher the spread of the data

Coefficient of Variation

- Statistical measure of the dispersion of data points in a data series around the mean
- Ratio of the standard deviation to the mean
- The higher the number, higher the spread of the data

Skewness

- Skewness refers to distortion or asymmetry in a normal distribution, in a set of data
- Positive value means that the right tail of the distribution is longer than the left. Negative value indicates that that the left tail is longer.

Kurtosis

- Defines how heavily the tail of a distribution differ from that of a normal distribution
- Value greater than +1 indicates the distribution is too peaked. Value less than –1 indicates the distribution is flat.

6.5.1. Cluster 1

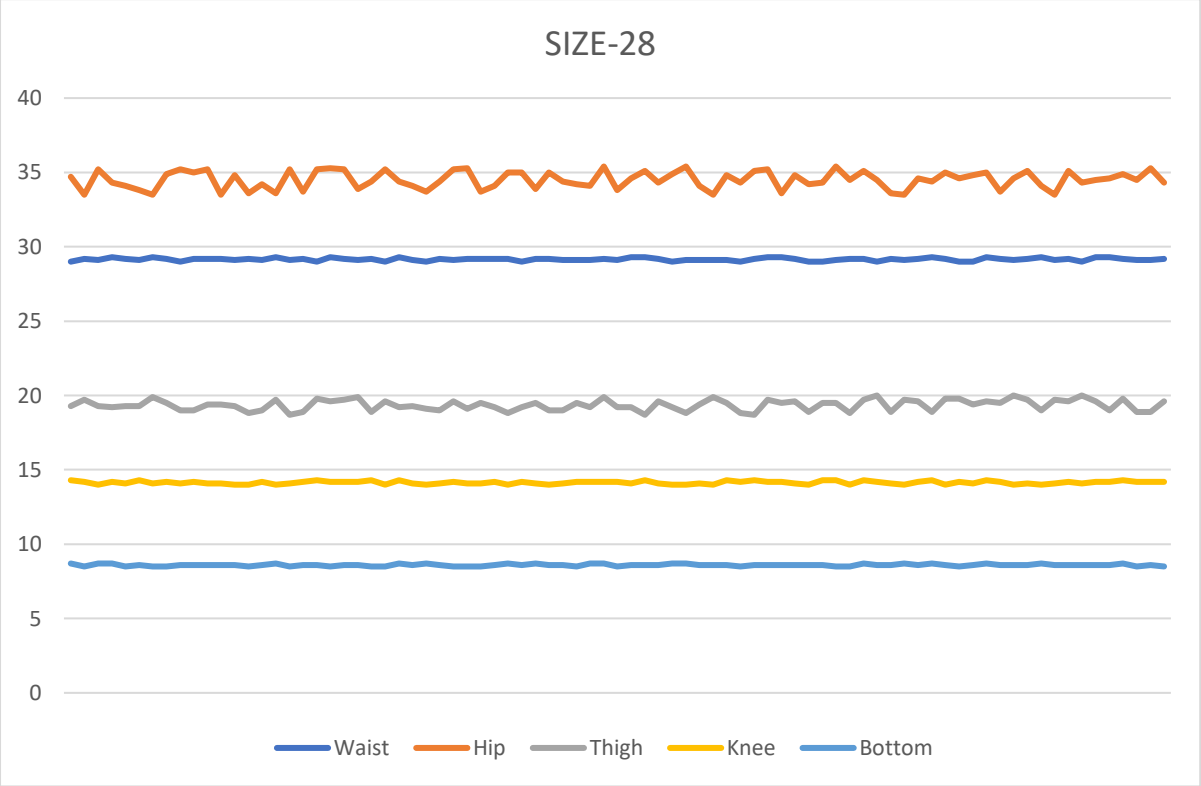


Figure 22: Measurements for size 28; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	0.3	1.9	1.3	0.3	0.2
Minimum	29	33.5	18.7	14	8.5
Maximum	29.3	35.4	20	14.3	8.7
Mean	29.16	34.50	19.35	14.15	8.60
Variance	0.01	0.35	0.13	0.01	0.00
Standard Deviation	0.10	0.59	0.36	0.10	0.07
Standard Error	0.02	0.13	0.08	0.02	0.02
Median	29.2	34.5	19.4	14.2	8.6
Upper 95% CL Mean	29.17	34.57	19.51	14.16	8.61
Lower 95% CL Mean	28.94	34.43	19.21	13.99	8.49
Interquartile Range	0.10	0.90	0.60	0.10	0.00
25th Percentile	29.10	34.10	19.00	14.10	8.60
50th Percentile	29.20	34.50	19.40	14.20	8.60
75th Percentile	29.20	35.00	19.60	14.20	8.60
Mean Absolute Deviation	0.08	0.50	0.31	0.09	0.05
Coefficient of Variation	0.00	0.02	0.02	0.01	0.01
Skewness	-0.16	-0.23	-0.10	-0.09	0.03
Kurtosis	-0.93287	-1.17035	-1.08769	-1.07809	-0.84422

Table 11: Descriptive statistics for size 28; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.2. Cluster 2

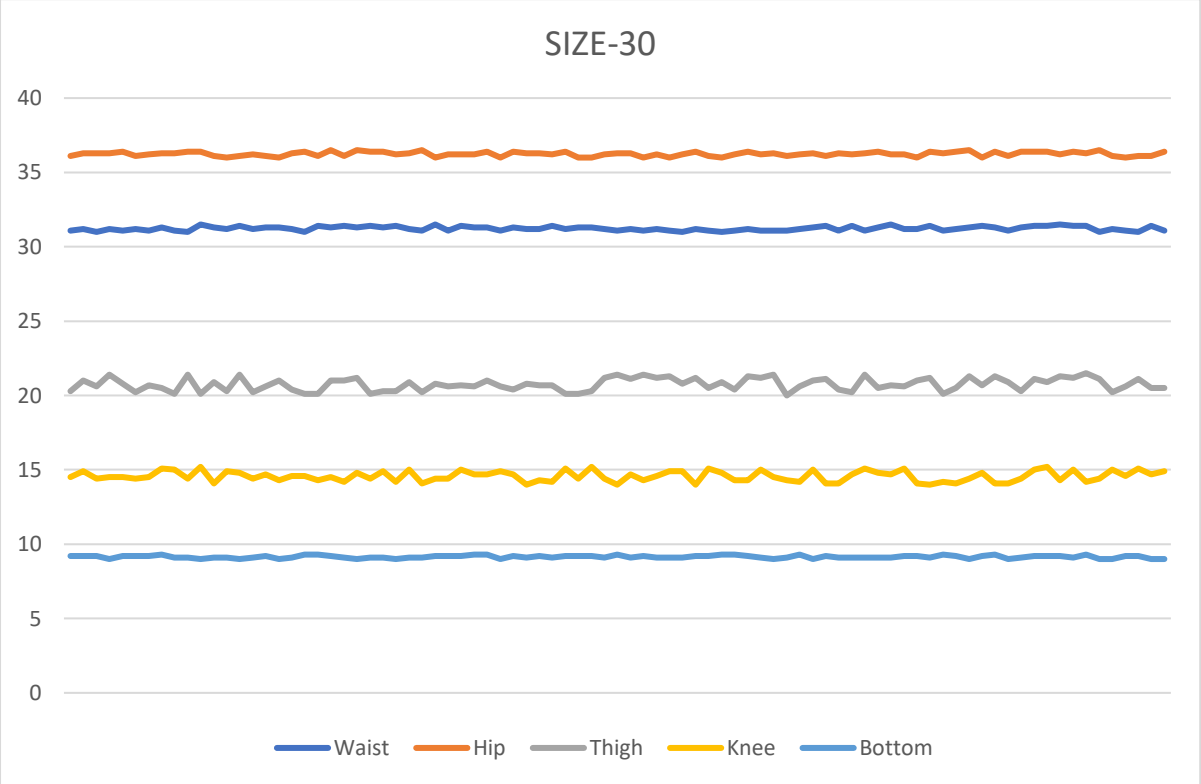


Figure 23: Measurements for size 30; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	0.5	0.5	1.5	1.2	0.3
Minimum	31	36	20	14	9
Maximum	31.5	36.5	21.5	15.2	9.3
Mean	31.23	36.24	20.75	14.57	9.15
Variance	0.02	0.02	0.18	0.12	0.01
Standard Deviation	0.14	0.15	0.43	0.35	0.09
Standard Error	0.03	0.03	0.09	0.08	0.02
Median	31.2	36.2	20.7	14.5	9.1
Upper 95% CL Mean	31.25	36.56	20.80	14.62	9.16
Lower 95% CL Mean	30.85	36.22	20.70	14.53	8.87
Interquartile Range	0.20	0.30	0.70	0.60	0.10
25th Percentile	31.10	36.10	20.40	14.30	9.10
50th Percentile	31.20	36.20	20.70	14.50	9.10
75th Percentile	31.30	36.40	21.10	14.90	9.20
Mean Absolute Deviation	0.12	0.13	0.37	0.31	0.08
Coefficient of Variation	0.00	0.00	0.02	0.02	0.01
Skewness	0.13	-0.11	-0.01	0.12	-0.01
Kurtosis	-0.92279	-1.08412	-1.21524	-1.18726	-0.87982

Table 12: Descriptive statistics for size 30; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.3. Cluster 3

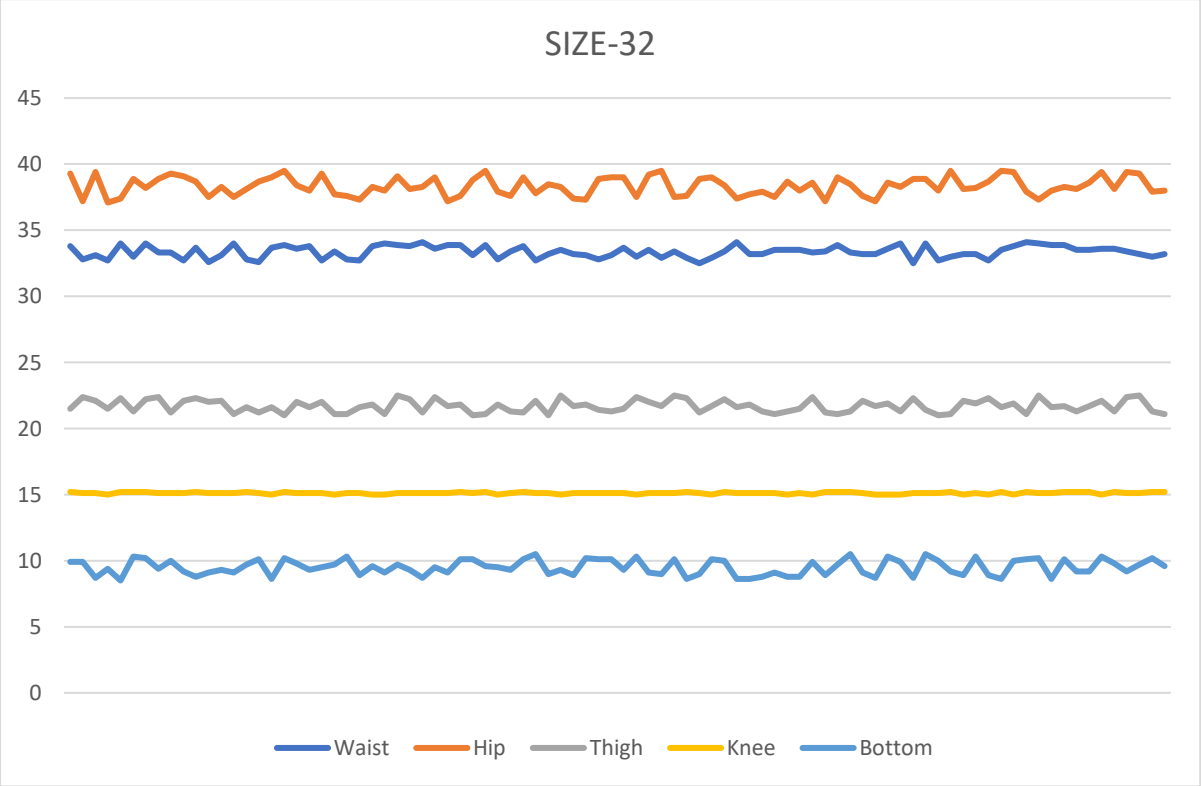


Figure 24: Measurements fo size 32; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	1.6	2.4	1.5	0.2	2
Minimum	32.5	37.1	21	15	8.5
Maximum	34.1	39.5	22.5	15.2	10.5
Mean	33.37	38.34	21.70	15.11	9.50
Variance	0.20	0.51	0.22	0.00	0.34
Standard Deviation	0.45	0.72	0.47	0.07	0.58
Standard Error	0.10	0.16	0.10	0.02	0.13
Median	33.4	38.3	21.7	15.1	9.5
Upper 95% CL Mean	33.39	38.52	22.06	15.12	9.57
Lower 95% CL Mean	32.96	38.33	21.64	14.89	9.43
Interquartile Range	0.80	1.30	0.80	0.10	1.10
25th Percentile	33.00	37.70	21.30	15.10	9.00
50th Percentile	33.40	38.30	21.70	15.10	9.50
75th Percentile	33.80	39.00	22.10	15.20	10.10
Mean Absolute Deviation	0.38	0.62	0.41	0.05	0.52
Coefficient of Variation	0.01	0.02	0.02	0.00	0.06
Skewness	-0.13	0.01	0.19	-0.09	-0.02
Kurtosis	-1.08733	-1.20891	-1.26073	-0.86843	-1.31688

Table 13: Descriptive statistics for size 32; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.4. Cluster 4

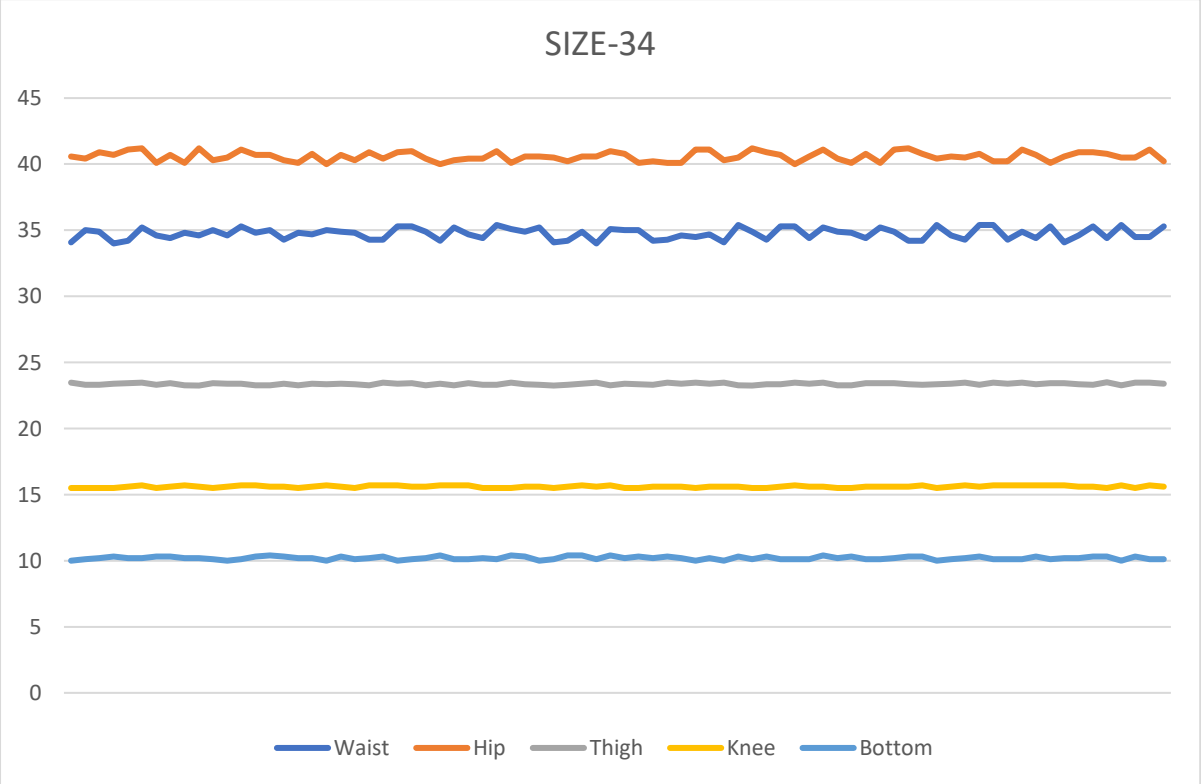


Figure 25: Measurements for size 34; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	1.4	1.2	0.24	0.2	0.4
Minimum	34	40	23.25	15.5	10
Maximum	35.4	41.2	23.49	15.7	10.4
Mean	34.73	40.58	23.36	15.59	10.19
Variance	0.17	0.14	0.01	0.01	0.01
Standard Deviation	0.41	0.37	0.08	0.07	0.12
Standard Error	0.09	0.08	0.02	0.02	0.03
Median	34.8	40.6	23.37	15.6	10.2
Upper 95% CL Mean	35.09	40.63	23.37	15.60	10.21
Lower 95% CL Mean	34.73	40.47	23.22	15.48	9.89
Interquartile Range	0.65	0.60	0.12	0.10	0.20
25th Percentile	34.35	40.30	23.29	15.50	10.10
50th Percentile	34.80	40.60	23.37	15.60	10.20
75th Percentile	35.00	40.90	23.41	15.60	10.30
Mean Absolute Deviation	0.35	0.31	0.06	0.06	0.10
Coefficient of Variation	0.01	0.01	0.00	0.00	0.01
Skewness	-0.13	0.10	0.25	0.13	0.07
Kurtosis	-1.16322	-1.14318	-1.13445	-1.16985	-0.94628

Table 14:Descriptive statistics for size 34; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.5. Cluster 5

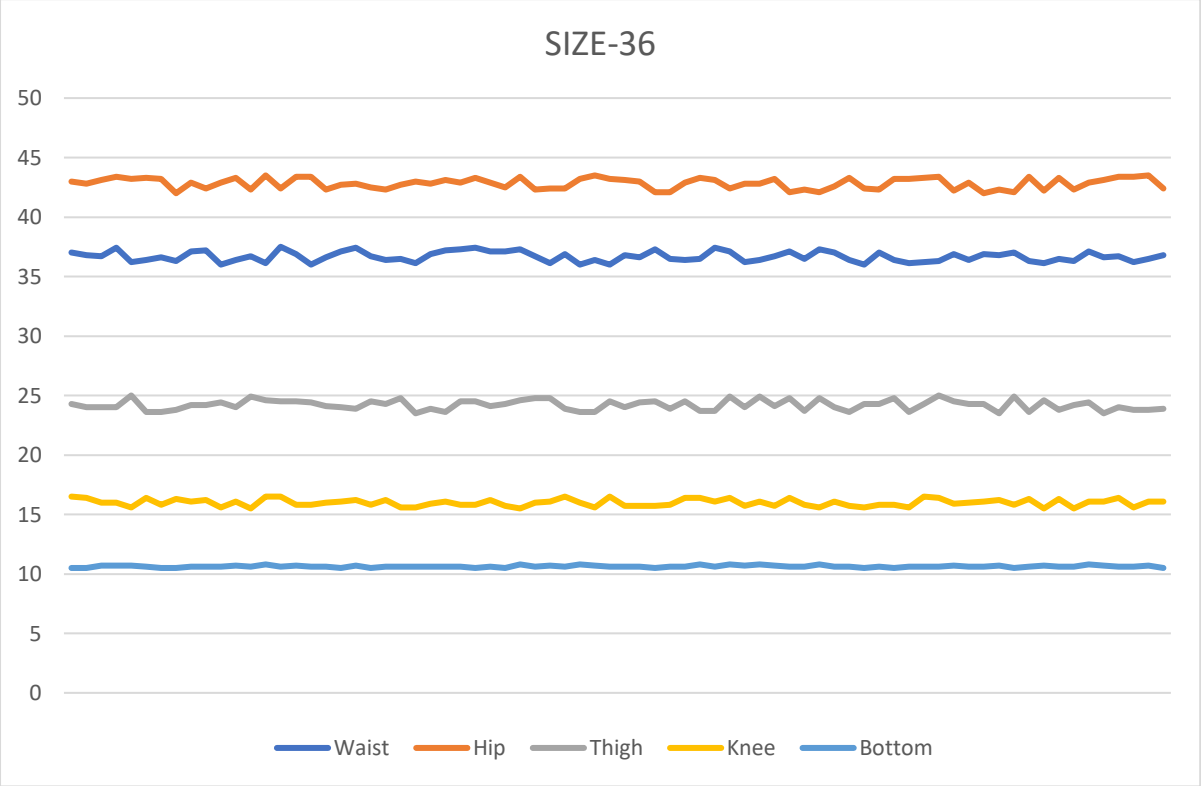


Figure 26: Measurements of size 36; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	1.5	1.5	1.5	1	0.3
Minimum	36	42	23.5	15.5	10.5
Maximum	37.5	43.5	25	16.5	10.8
Mean	36.67	42.83	24.20	15.99	10.62
Variance	0.18	0.21	0.19	0.09	0.01
Standard Deviation	0.43	0.46	0.43	0.31	0.09
Standard Error	0.09	0.10	0.09	0.07	0.02
Median	36.65	42.9	24.2	16	10.6
Upper 95% CL Mean	37.08	42.88	24.55	16.03	10.64
Lower 95% CL Mean	36.62	42.77	24.15	15.95	10.49
Interquartile Range	0.60	0.80	0.60	0.50	0.10
625th Percentile	36.40	42.40	23.90	15.70	10.60
50th Percentile	36.65	42.90	24.20	16.00	10.60
75th Percentile	37.00	43.20	24.50	16.20	10.70
Mean Absolute Deviation	0.36	0.40	0.37	0.26	0.07
Coefficient of Variation	0.01	0.01	0.02	0.02	0.01
Skewness	0.15	-0.23	0.11	0.11	0.52
Kurtosis	-1.0541	-1.34017	-1.03455	-1.17568	-0.25032

Table 15: Descriptive Statistics for size 36; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.6. Cluster 6

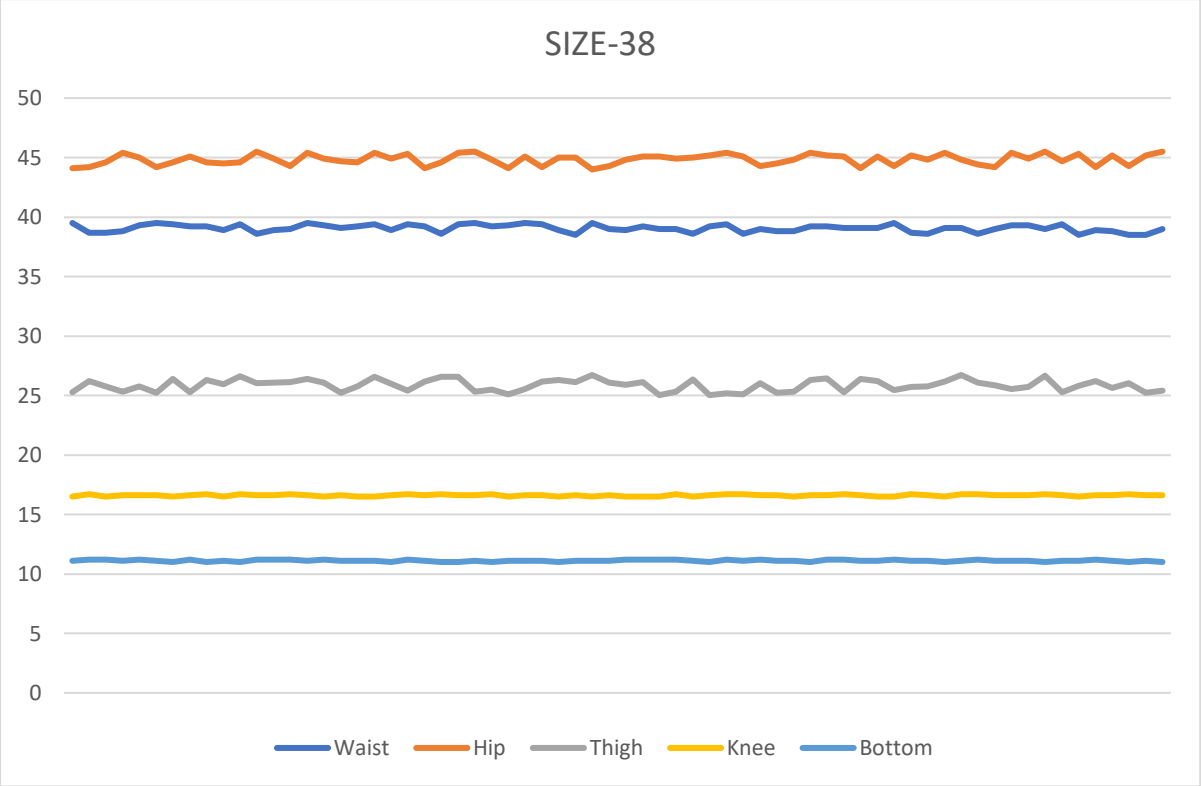


Figure 27: Measurements for size 38: Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	1	1.5	1.69	0.2	0.2
Minimum	38.5	44	25.03	16.5	11
Maximum	39.5	45.5	26.72	16.7	11.2
Mean	39.06	44.84	25.85	16.60	11.11
Variance	0.09	0.20	0.24	0.01	0.01
Standard Deviation	0.31	0.45	0.49	0.07	0.07
Standard Error	0.07	0.10	0.11	0.02	0.02
Median	39.1	44.9	25.925	16.6	11.1
Upper 95% CL Mean	39.10	44.85	25.88	16.60	11.12
Lower 95% CL Mean	38.96	44.48	25.73	16.49	10.08
Interquartile Range	0.48	0.70	0.87	0.10	0.10
25th Percentile	38.83	44.50	25.35	16.50	11.10
50th Percentile	39.10	44.90	25.93	16.60	11.10
75th Percentile	39.30	45.20	26.22	16.60	11.20
Mean Absolute Deviation	0.26	0.38	0.43	0.05	0.06
Coefficient of Variation	0.01	0.01	0.02	0.00	0.01
Skewness	-0.28	-0.24	-0.05	0.07	-0.14
Kurtosis	-1.00737	-1.1652	-1.19068	-1.09745	-1.01044

Table 16: Descriptive statistics for size 38; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.7. Cluster 7

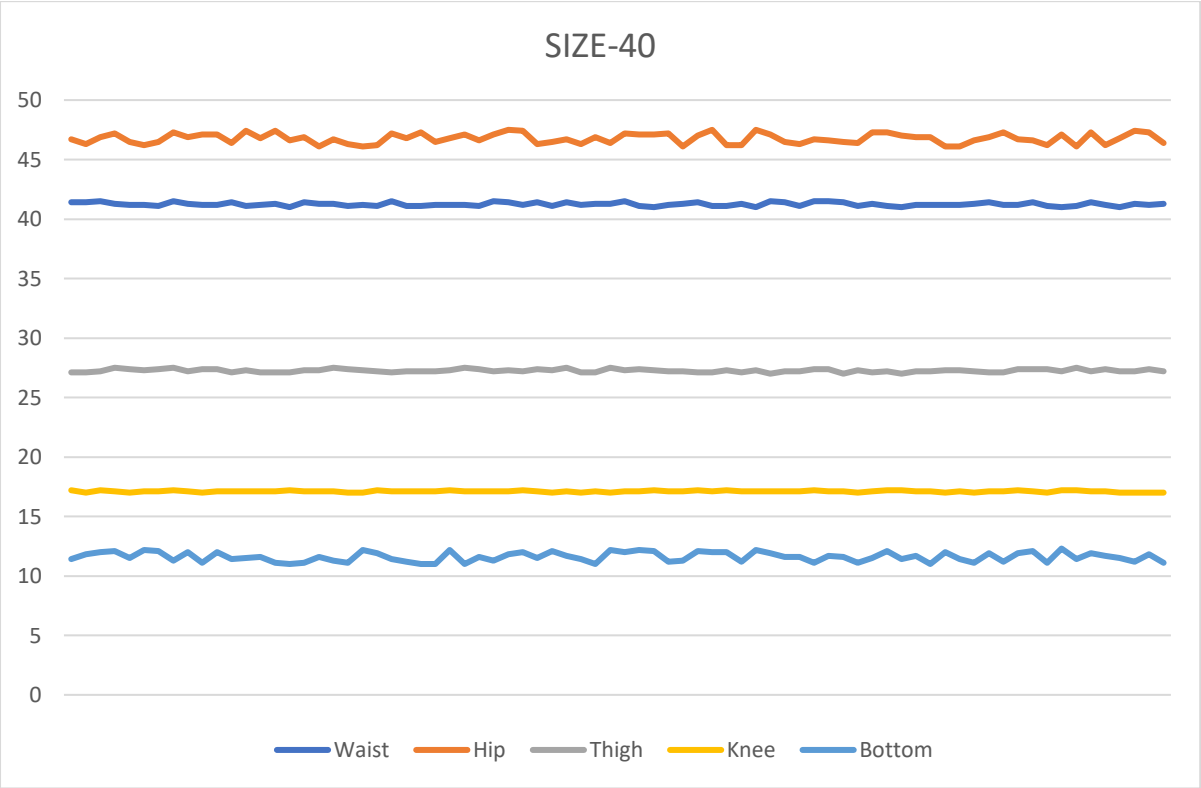


Figure 28: Measurements for size 40; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	0.5	1.4	0.5	0.2	1.3
Minimum	41	46.1	27	17	11
Maximum	41.5	47.5	27.5	17.2	12.3
Mean	41.25	46.77	27.26	17.10	11.60
Variance	0.02	0.19	0.02	0.00	0.16
Standard Deviation	0.15	0.43	0.14	0.07	0.40
Standard Error	0.03	0.09	0.03	0.01	0.09
Median	41.2	46.8	27.2	17.1	11.6
Upper 95% CL Mean	41.26	46.81	27.28	17.11	11.65
Lower 95% CL Mean	40.97	46.42	26.99	17.00	11.45
Interquartile Range	0.30	0.70	0.20	0.00	0.80
25th Percentile	41.10	46.40	27.20	17.10	11.20
50th Percentile	41.20	46.80	27.20	17.10	11.60
75th Percentile	41.40	47.10	27.40	17.10	12.00
Mean Absolute Deviation	0.12	0.37	0.12	0.04	0.35
Coefficient of Variation	0.00	0.01	0.00	0.00	0.03
Skewness	0.17	0.00	0.13	0.00	0.03
Kurtosis	-0.92509	-1.24156	-0.87829	-0.58485	-1.36584

Table 17: Descriptive statistics for size 40; Source: Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution.

6.5.8. Cluster 8

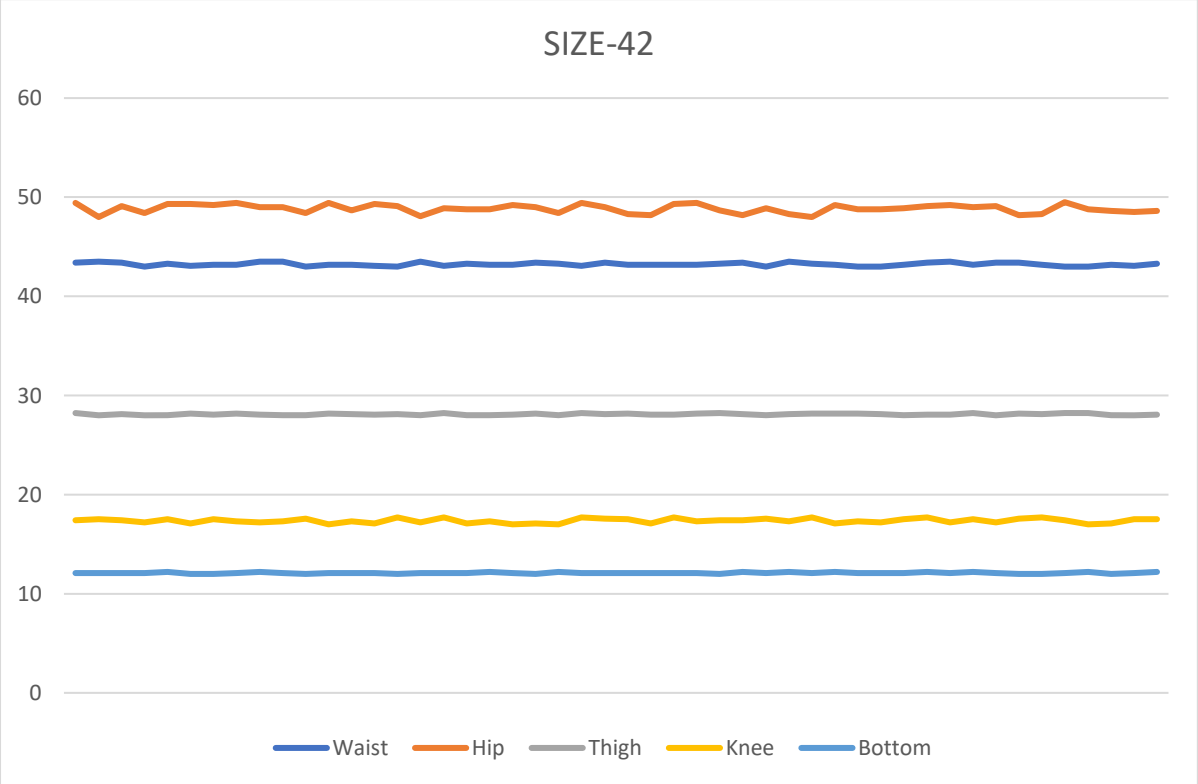


Figure 29: Measurements for size 42; Source: Self

	Waist	Hip	Thigh	Knee	Ankle
Range	0.5	1.5	0.23	0.7	0.2
Minimum	43	48	28	17	12
Maximum	43.5	49.5	28.23	17.7	12.2
Mean	43.24	48.84	28.10	17.36	12.10
Variance	0.03	0.19	0.01	0.05	0.00
Standard Deviation	0.16	0.43	0.07	0.22	0.07
Standard Error	0.04	0.09	0.02	0.05	0.01
Median	43.2	48.9	28.1	17.35	12.1
Upper 95% CL Mean	43.26	48.90	28.28	17.56	12.11
Lower 95% CL Mean	42.96	48.46	28.09	17.33	11.06
Interquartile Range	0.30	0.73	0.14	0.30	0.00
25th Percentile	43.10	48.48	28.03	17.20	12.10
50th Percentile	43.20	48.90	28.10	17.35	12.10
75th Percentile	43.40	49.20	28.17	17.50	12.10
Mean Absolute Deviation	0.13	0.36	0.06	0.19	0.04
Coefficient of Variation	0.00	0.01	0.00	0.01	0.01
Skewness	0.08	-0.40	0.11	0.03	-0.04
Kurtosis	-0.98439	-0.97273	-1.42281	-1.18384	-0.5258

Table 18: Descriptive statistics for size 42; Source; Self

The low values of variance, standard deviations, interquartile range, mean absolute deviation and coefficient of variation for all parameters shows that the data within the cluster is similar (not spread out). Minimal values of standard errors show that the sample is representative of the population. Non-zero skewness indicates the data is not normally distributed and negative kurtosis shows that the distribution is flatter than normal distribution

6.6. Standard Body Measurements

In order to achieve measurements with standard grading, measurements were directed such that the grading at waist and hip were 2", thigh was 1 ½" and knee and ankle were ½".

Measurement	Grading
Waist	2"
Hip	2"
Thigh	1 ½"
Knee	½"
Ankle	½"

Table 19: Standard Body Measurements; Source:

By making slight adjustments, within the confidence interval of the mean, standardized body measurements were devised.

	28	30	32	34	36	38	40	42
Waist	29.00	31.00	33.00	35.00	37.00	39.00	41.00	43.00
Hip	34.50	36.50	38.50	40.50	42.50	44.50	46.50	48.50
Thigh	19.50	20.75	22.00	23.25	24.50	25.75	27.00	28.25
Knee	14.00	14.50	15.00	15.50	16.00	16.50	17.00	17.50
Ankle	8.50	9.00	9.50	10.00	10.50	11.00	11.50	12.00
								Unit = Inches

Table 20: Revised Measurements, Source:Self

6.7. Fits Offered at Lee

BRUCE
Skinny fit jeans with mid-rise waist

ANTON
Slim tapered fit jeans with mid-rise waist

TRAVIS
Slim straight jeans with mid-rise

RODEO
Regular fit jeans with mid-rise waist

Figure 30: Fits Offered at Lee; Source: Google

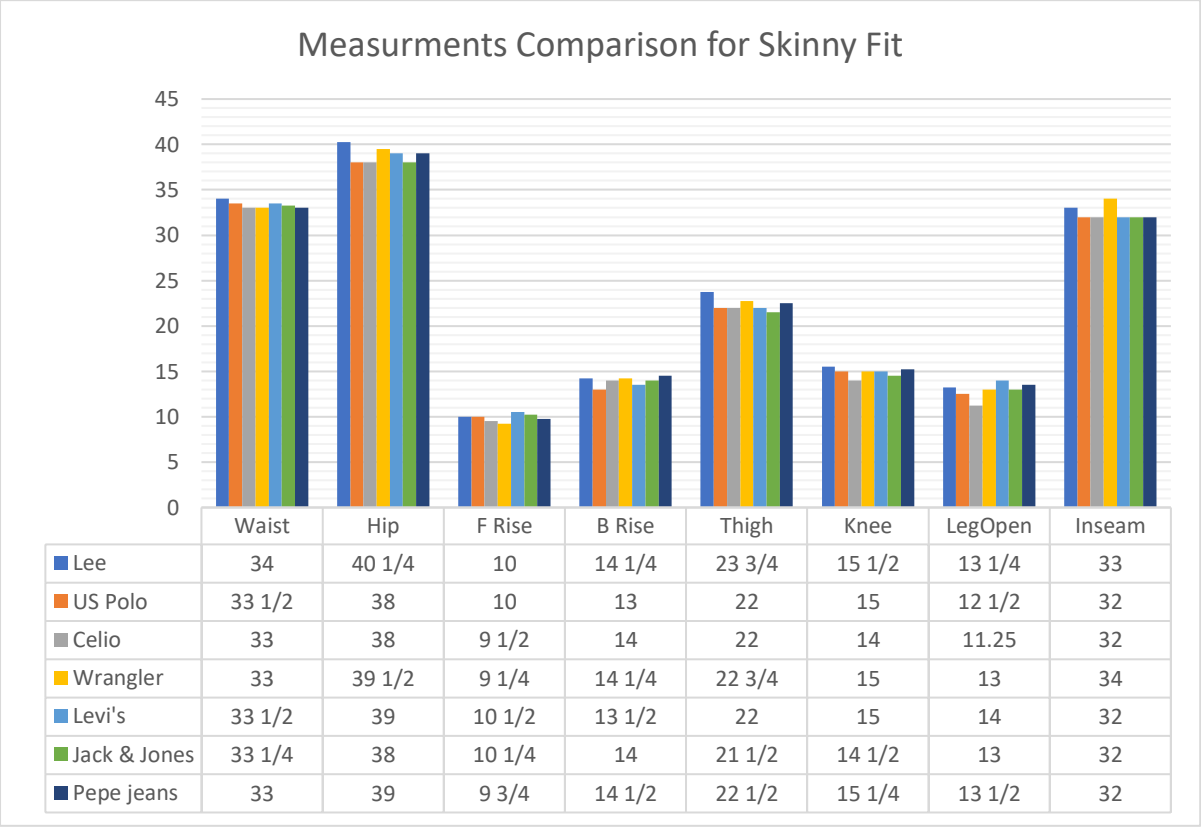
6.8. Analysis of Existing Size Chart

Fit	Rise	Waist	Hip	F Rise	B Rise	Thigh	Knee	LegOpen	Inseam
SKINNY									
Bruce	Mid-Rise	34	40 1/8	10	14 1/4	23 3/4	15 1/2	13 1/4	33
SLIM TAPERED									
Anton	Mid-Rise	33 1/2	41	10 3/4	14 3/4	23 1/2	16	12 3/4	31
SLIM STRAIGHT									
Travis	Mid-Rise	33 1/2	40 7/8	10 3/8	13 7/8	23 5/8	16 1/8	14	33
REGULAR									
Rodeo	Mid-Rise	34	40 1/2	10 1/2	14 5/8	24 3/4	16 1/2	16	33

Table 21: Existing Size Chart; Source: Self

- An acute discrepancy is seen the waist measurement of skinny fits (Bruce) when compared to slim fit. The waist of skinny fit (34”) is higher than that of slim fit (33 ½”).
- A similar discord is seen in the thigh measurement of slim fit jeans. The thigh of skinny fit (23 ¾”) is higher than that of slim fit (23 ½”).
- The hip measurement of slim tapered fit (41”), Anton, is larger than that of regular fit, Rodeo (40 ½”).
- A similar disparity is seen in the hip measurement of slim straight fit, Travis, where the hip (40 7/8”) is larger than that of regular fit, Rodeo (40 ½”).

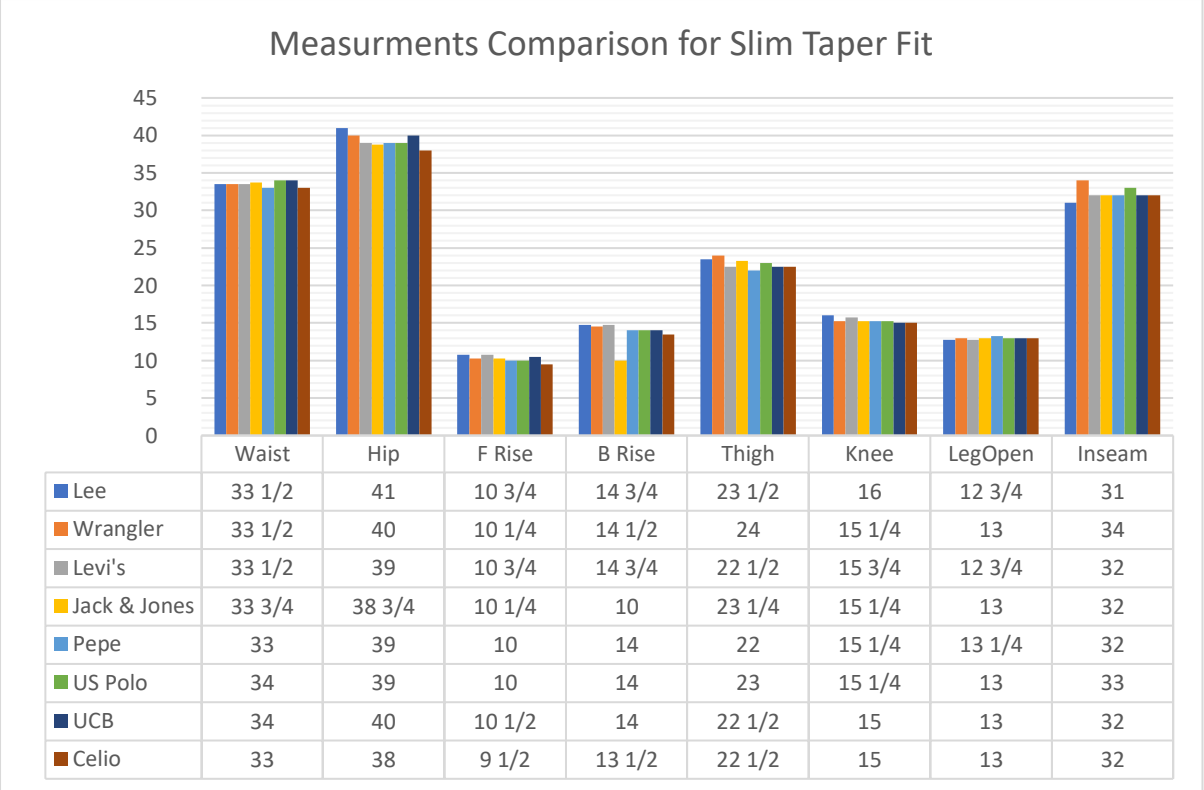
6.9. Comparative Analysis



	Waist	Hip	F Rise	B Rise	Thigh	Knee	LegOpen	Inseam
Lee	34	40 1/4	10	14 1/4	23 3/4	15 1/2	13 1/4	33
US Polo	33 1/2	38	10	13	22	15	12 1/2	32
Celio	33	38	9 1/2	14	22	14	11.25	32
Wrangler	33	39 1/2	9 1/4	14 1/4	22 3/4	15	13	34
Levi's	33 1/2	39	10 1/2	13 1/2	22	15	14	32
Jack & Jones	33 1/4	38	10 1/4	14	21 1/2	14 1/2	13	32
Pepe jeans	33	39	9 3/4	14 1/2	22 1/2	15 1/4	13 1/2	32

Figure 31: Measurements Comparison for Skinny Fit; Source: Self

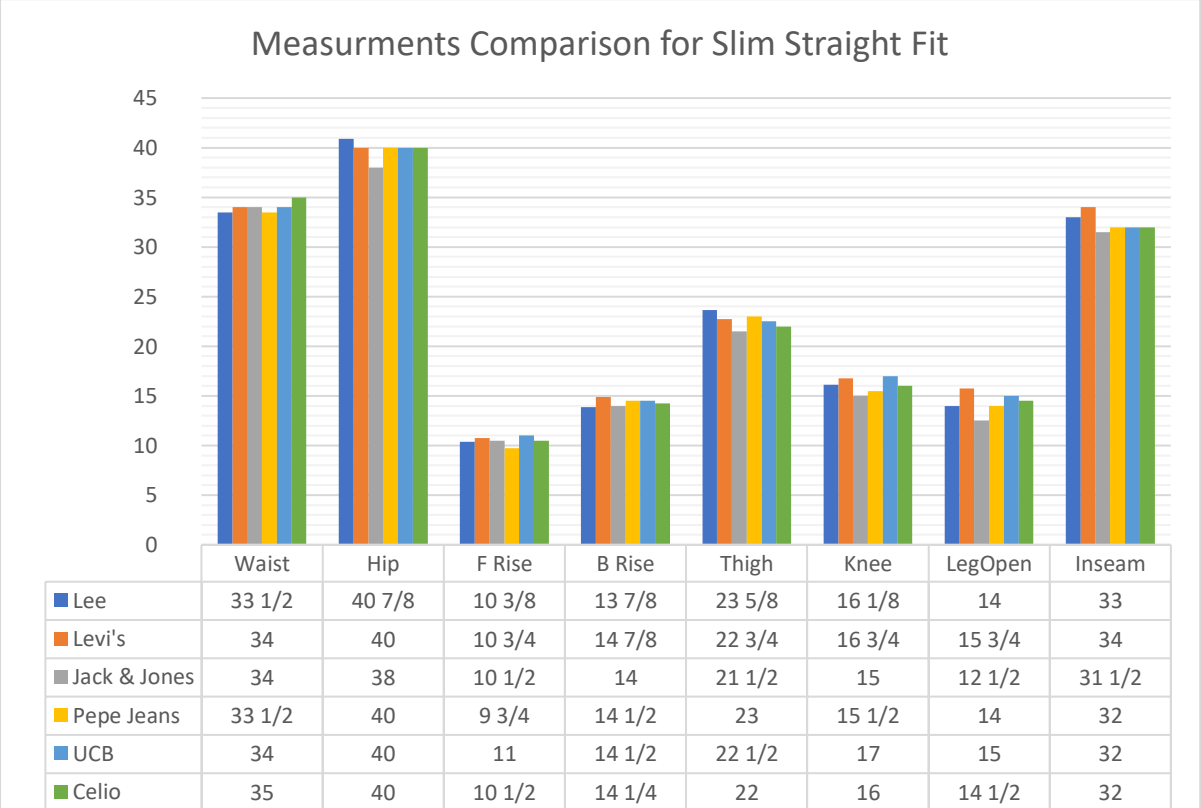
Waist, hip, thigh, knee and inseam measurements of Lee are greater than all competitor brands.



	Waist	Hip	F Rise	B Rise	Thigh	Knee	LegOpen	Inseam
Lee	33 1/2	41	10 3/4	14 3/4	23 1/2	16	12 3/4	31
Wrangler	33 1/2	40	10 1/4	14 1/2	24	15 1/4	13	34
Levi's	33 1/2	39	10 3/4	14 3/4	22 1/2	15 3/4	12 3/4	32
Jack & Jones	33 3/4	38 3/4	10 1/4	10	23 1/4	15 1/4	13	32
Pepe	33	39	10	14	22	15 1/4	13 1/4	32
US Polo	34	39	10	14	23	15 1/4	13	33
UCB	34	40	10 1/2	14	22 1/2	15	13	32
Celio	33	38	9 1/2	13 1/2	22 1/2	15	13	32

Figure 32: Measurements Comparison for Slim Taper Fit; Source: Self

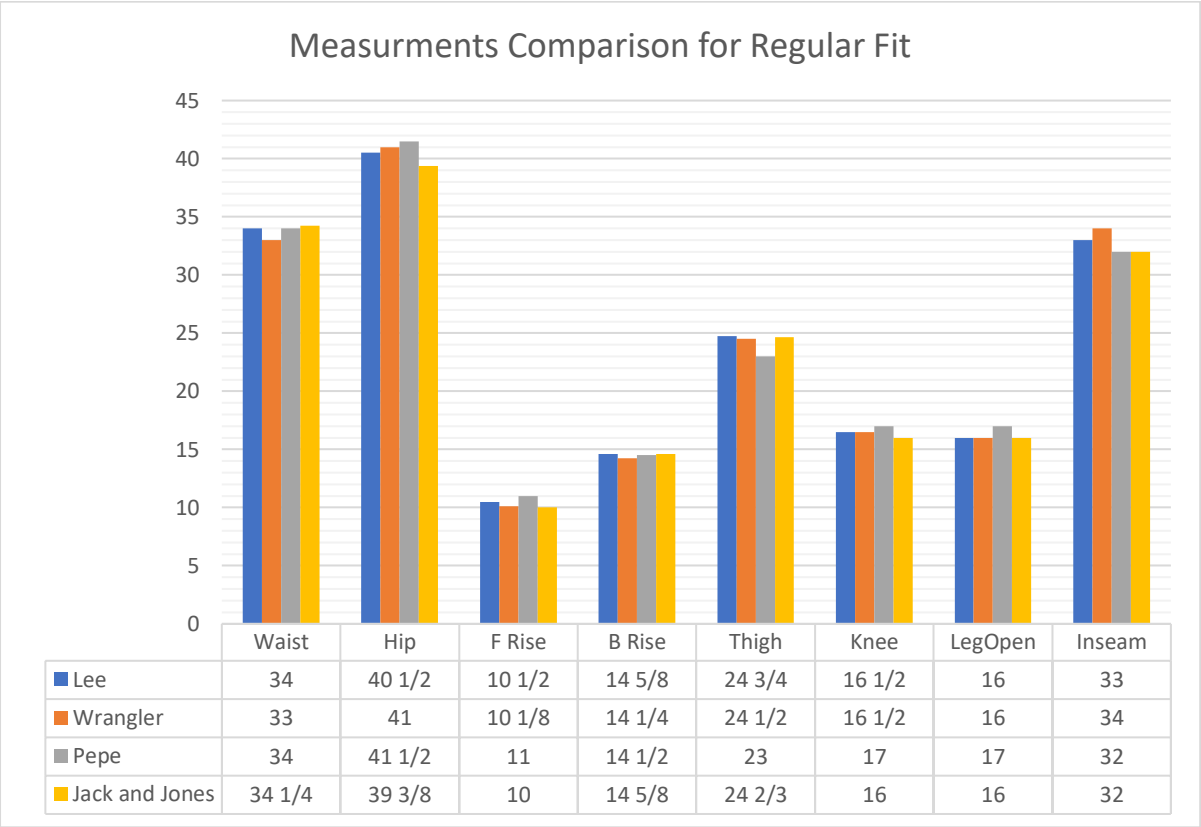
Hip, thigh and knee measurement of Lee are greater than most competitor brands. Further, inseam measurement is lesser than all competitors.



	Waist	Hip	F Rise	B Rise	Thigh	Knee	LegOpen	Inseam
Lee	33 1/2	40 7/8	10 3/8	13 7/8	23 5/8	16 1/8	14	33
Levi's	34	40	10 3/4	14 7/8	22 3/4	16 3/4	15 3/4	34
Jack & Jones	34	38	10 1/2	14	21 1/2	15	12 1/2	31 1/2
Pepe Jeans	33 1/2	40	9 3/4	14 1/2	23	15 1/2	14	32
UCB	34	40	11	14 1/2	22 1/2	17	15	32
Celio	35	40	10 1/2	14 1/4	22	16	14 1/2	32

Figure 33: Measurements Comparison for Slim Straight Fit; Source: Self

Hip, thigh and inseam measurements of Lee are greater than all competitor brands. Further, the back-rise measurement of Lee is lesser than all competitors.



	Waist	Hip	F Rise	B Rise	Thigh	Knee	LegOpen	Inseam
Lee	34	40 1/2	10 1/2	14 5/8	24 3/4	16 1/2	16	33
Wrangler	33	41	10 1/8	14 1/4	24 1/2	16 1/2	16	34
Pepe	34	41 1/2	11	14 1/2	23	17	17	32
Jack and Jones	34 1/4	39 3/8	10	14 5/8	24 2/3	16	16	32

Figure 34: Measurements Comparison for Regular Fit; Source: Self

Hip measurement of Lee is lesser and inseam measurement is larger than most competitor brands.

6.10. Customer Feedback

In order to understand requirements of customers, first, online feedback was analyzed. Second, 60 potential customers were asked to try on the jeans and their feedback for every parameter, that is, waist, hip, thigh, knee and ankle were categorized into loose, good fit and tight.

6.10.1. Bruce (Skinny Fit)

6.10.1.1. Online Reviews

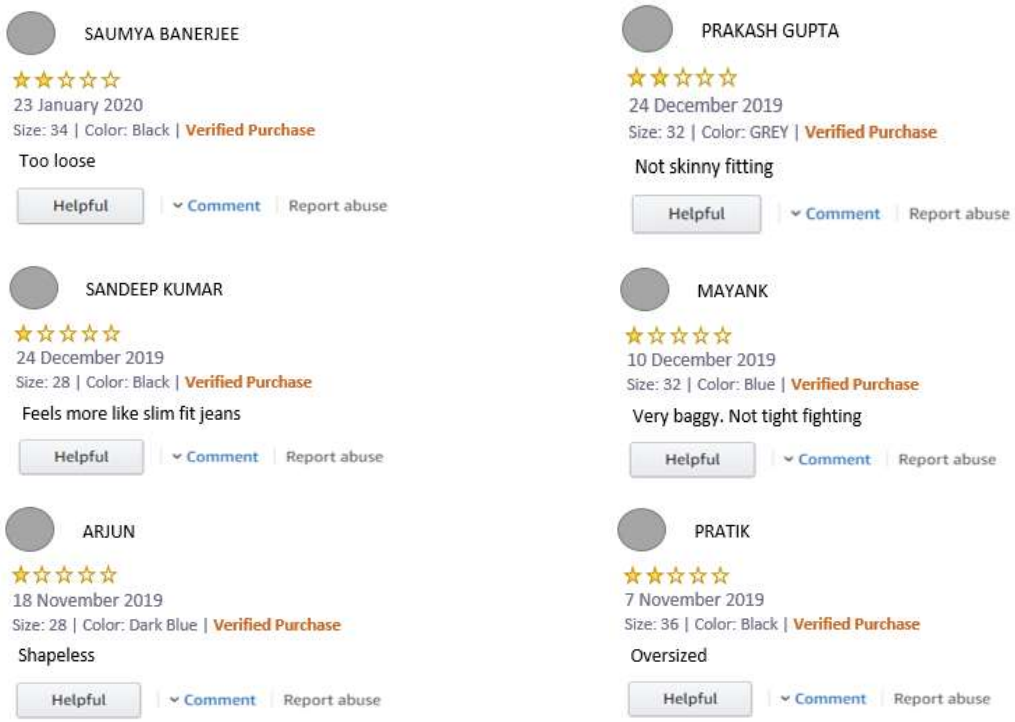


Figure 35: Online Review for Bruce (Skinny Fit); Source: Amazon

6.10.1.2. In-store Trial

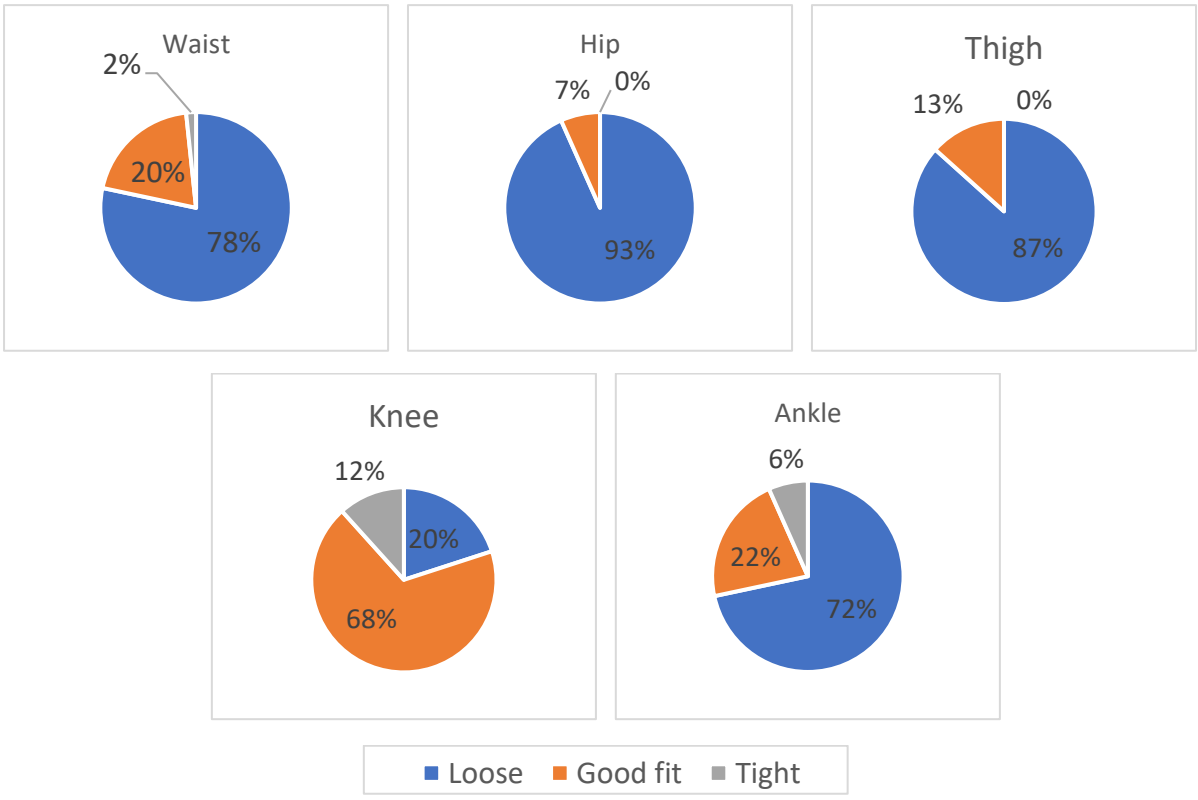


Figure 36: In-store Trial Feedback; Source: Self

According to customer feedback, the skinny fit of Lee had excess measurement for every parameter except knee measurement and thereby, was baggier than expected.

6.10.2. Anton (Slim Taper)

6.10.2.1. Online Review

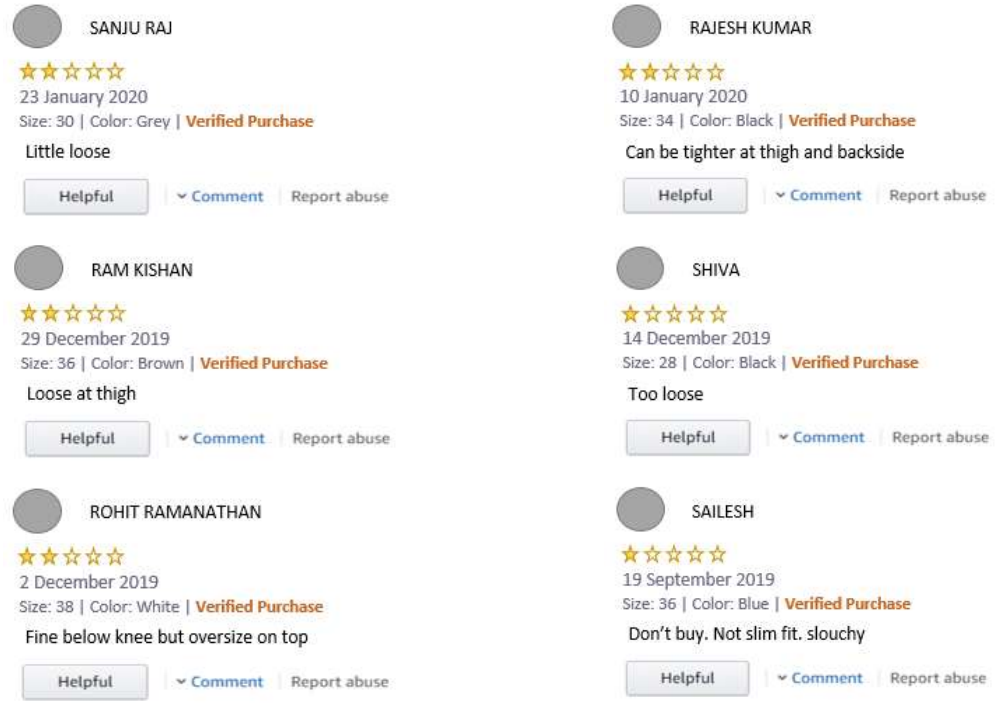


Figure 37: Online Review for Anton (Slim Taper); Source: Amazon

6.10.2.2. In-store Trial

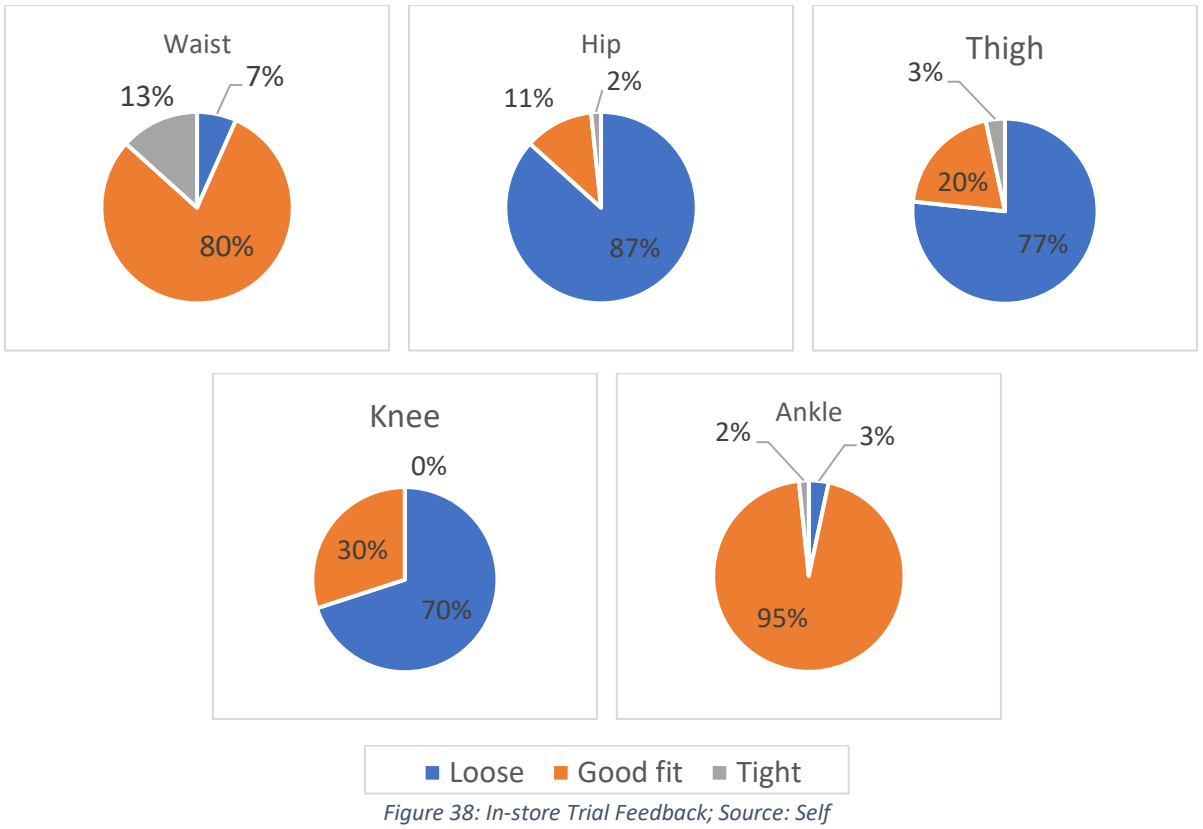


Figure 38: In-store Trial Feedback; Source: Self

According to customer feedback, the slim taper fit of Lee was looser than requirement at hip, thigh and knee.

6.10.3. Travis (Slim Straight)

6.10.3.1. Online Review

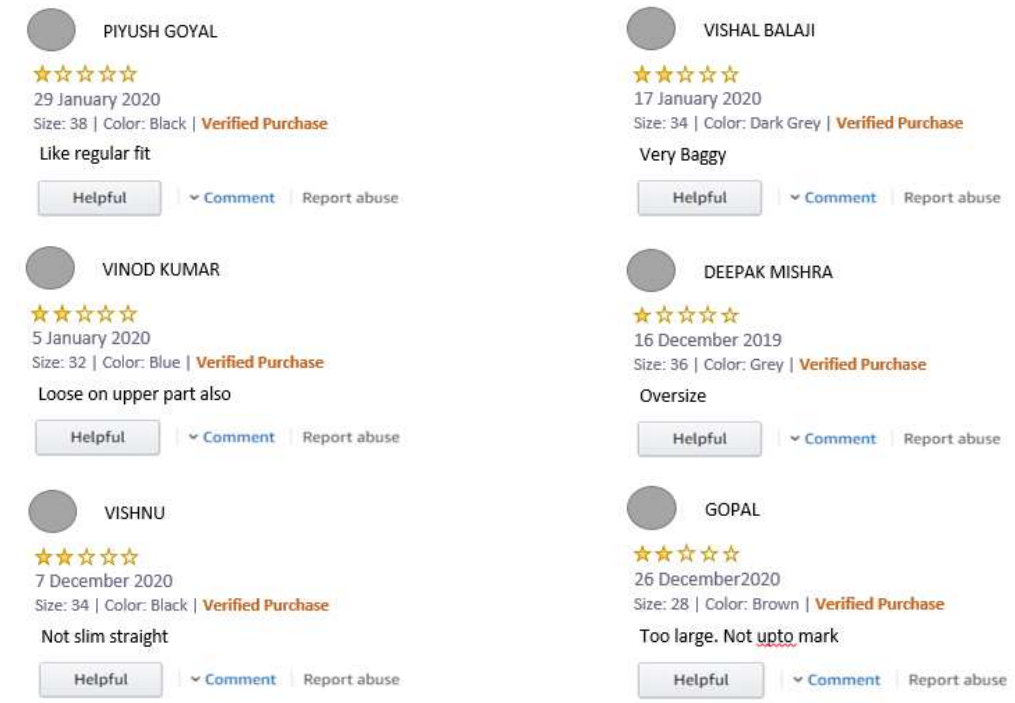


Figure 39: Online Review for Travis (Slim Straight Fit); Source: Amazon

6.10.3.2. In-store Trial

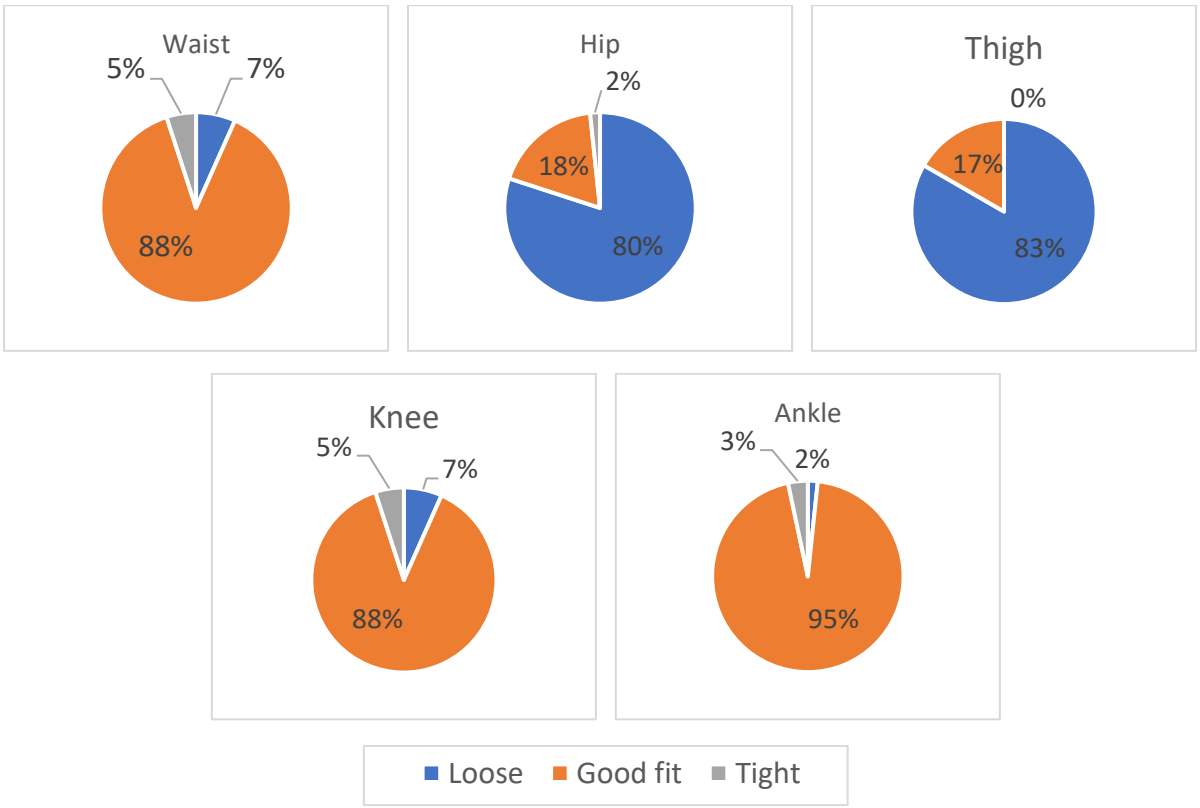


Figure 40: In-store Trial Feedback; Source: Self

According to customer feedback, the slim straight fit could be tighter at the hip and thigh.

6.10.4. Rodeo (Regular)

6.10.4.1. Online Review

Figure 41: Online Review for Rodeo (Regular Fit); Source: Amazon

6.10.4.2. In-store Trial

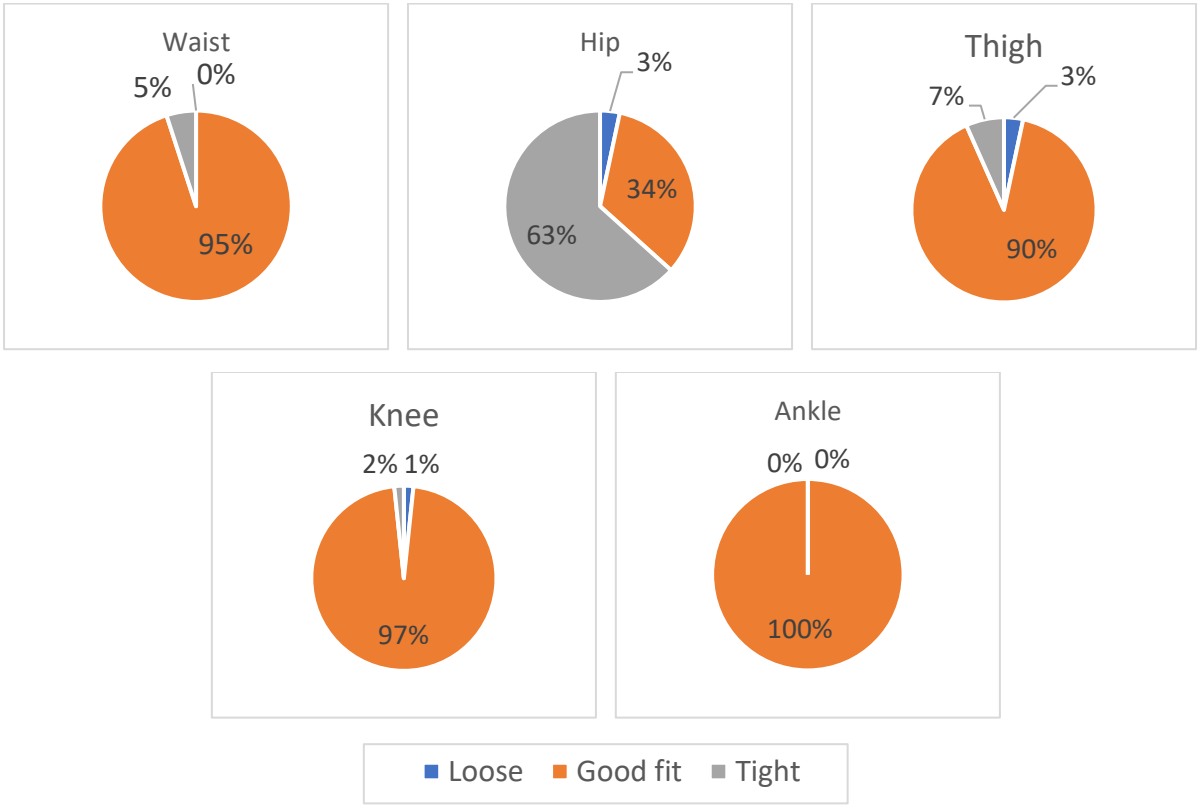


Figure 42: In-store Trial Feedback; Source: Self

According to customer feedback, the regular fit of Lee was good with just a few complaints about slight discomfort at the hip due to tightness.

6.11. Development of New Size Chart

Upon discussion with experts, studying the previous size chart, analysis of conclusion of competitor analysis and examination of consumer feedback, a new size chart with improved fit was proposed.

6.11.1. Bruce (Skinny Fit)

		Previous		Revised	
Parameter	Body	Ease	Garment	Ease	Garment
Waist	33	1	34	1/2	33 1/2
Hip	38 1/2	1 5/8	40 1/8	1/2	39
Thigh	22	1 3/4	23 3/4	1/2	22 1/2
Knee	15	1/2	15 1/2	1/2	15 1/2
Ankle	9 1/2	3 3/4	13 1/4	3	12 1/2

Table 22: New Size Chart for Bruce (Skinny Fit); Source: Self

6.11.2. Anton (Slim Taper)

		Previous		Revised	
Parameter	Body	Ease	Garment	Ease	Garment
Waist	33	1/2	33 1/2	1/2	33 1/2
Hip	38 1/2	2 1/2	41	1 1/2	40
Thigh	22	1 1/2	23 1/2	1	23
Knee	15	1	16	3/4	15 3/4
Ankle	9 1/2	3 1/4	12 3/4	3 1/4	12 3/4

Table 23: New Size Chart for Anton (Slim Taper Fit); Source: Self

6.11.3. Travis (Slim Straight)

		Previous		Revised	
Parameter	Body	Ease	Garment	Ease	Garment
Waist	33	1/2	33 1/2	1/2	33 1/2
Hip	38 1/2	2 3/8	40 7/8	1 1/2	40
Thigh	22	1 5/8	23 5/8	1	23
Knee	15	1 1/8	16 1/8	1 1/8	16 1/8
Ankle	9 1/2	4 1/2	14	4 1/2	14

Table 24: New Size Chart for Travis (Slim Straight Fit); Source: Self

6.11.4. Rodeo (Regular)

		Previous		Revised	
Parameter	Body	Ease	Garment	Ease	Garment
Waist	33	1	34	1	34
Hip	38 1/2	2	40 1/2	2 1/2	41
Thigh	22	2 3/4	24 3/4	2 3/4	24 3/4
Knee	15	1 1/2	16 1/2	1 1/2	16 1/2
Ankle	9 1/2	6 1/2	16	6 1/2	16

Table 25: New Size Chart for Rodeo (Regular Fit); Source: Self

6.11.5. Revised Size Chart

	Bruce (Skinny)	Anton (Slim Taper)	Travis (Slim Straight)	Rodeo (Regular)
Waist	33 1/2	33 1/2	33 1/2	34
Front Rise	10	10 3/8	10 3/8	10 1/2
Back Rise	14 1/4	13 7/8	13 7/8	14 5/8
Hip	39	40	40	41
Thigh	22 1/2	23	23	24 3/4
Knee	15 1/2	15 3/4	16 1/8	16 1/2
Ankle	12 1/2	12 3/4	14	16
Inseam	32	32	32	32

Table 26: Revised Size Chart: Source: Self

7. Results & Discussion

First, factor analysis was performed which aided in understanding the factors that affect the sales of a garment. Through the comprehensive analysis it was understood the following were the most important factors considered while purchasing a garment:

Rank	Factor	Variables
1	Fit	Physical Fit, Aesthetic Fit, Functional Fit, Social Fit
2	Assortment	Variety, Latest Fashion, Style, Color
3	Perceived Value	Fair Price, Novel Product, Brand Name
4	Characteristics	Material, Finish, Distinction
5	Prolongation	Quality, Wash Care

The most important factor forms the basis of the project. Further analysis through online customer feedback and surveys showed that Lee lacked in terms of men's jeans fit.

Since factor analysis showed that fit was the most important factor and consumer survey showed that men's jeans lacked in terms of fit. A comprehensive research was done to find the body measurements of men's in India. Through K-means clustering, the body measurements of around 600 potential customers were divided into 8 clusters:

	Cluster							
	1	2	3	4	5	6	7	8
Waist	33.37	34.75	39.06	43.24	29.16	31.23	41.25	36.67
Hip	38.34	40.59	44.84	48.84	34.50	36.24	46.77	42.83
Thigh	21.70	23.37	25.85	28.10	19.35	20.75	27.26	24.20
Knee	15.11	15.60	16.60	17.36	14.15	14.57	17.10	15.99
Ankle	9.50	10.19	11.11	12.10	8.60	9.15	11.60	10.62
								Unit = Inches

Table 277: Number of cases in each cluster; Source: Self

After detailed analysis of previous size chart, competitor brands' size charts and feedback obtained from in-store trials a new size chart was created. The revised measurements are mentioned in the table below:

	Bruce (Skinny)	Anton (Slim Taper)	Travis (Slim Straight)	Rodeo (Regular)
Waist	33 1/2	33 1/2	33 1/2	34
Front Rise	10	10 3/8	10 3/8	10 1/2
Back Rise	14 1/4	13 7/8	13 7/8	14 5/8
Hip	39	40	40	41
Thigh	22 1/2	23	23	24 3/4
Knee	15 1/2	15 3/4	16 1/8	16 1/2
Ankle	12 1/2	12 3/4	14	16
Inseam	32	32	32	32

8. Conclusion

To begin with, the factor analysis performed showed what factors increased the salability of a garment. The most important factor was found to be fit.

A discrepancy was observed in the size chart of men's jeans which was supported by feedback from buyers during the roadshow and online reviews. Therefore, a thorough study was performed in order develop a new size chart. First body measurements of 596 potential customers were gathered from stores throughout India. Second, K-Means clustering was performed on the data to divide the data into 8 clusters for 8 sizes. Third, null hypothesis was rejected by performing kolmogorov-smirnov's test. Fourth, clustering was validated using average silhouette method. Fifth, descriptive statistics for every cluster were calculated to ensure the variation of data within clusters was minimum. Sixth, the existing size chart was analyzed to highlight discrepancies. Seventh, the size chart of Lee was compared with that of competitor brands. Eighth, in store trial feedback was gathered from customers for every fit. Finally, a new size chart was developed based on the information gathered in previous steps. With a more comfortable fit in terms of social fit, aesthetic fit, physical fit and functional fit customers would prefer Lee jeans making it stronger than its competitors.

In summary, the fit portfolio of men's jeans was improved to provide more comfort to the wearer. These changes would help the company gain positive customer feedback in the future and thereby, break the trend of dropping sales.

9. References

1. Shin, Eonyou, "Exploring consumers' fit perceptions and satisfaction with apparel fit in general" (2013). Graduate Theses and Dissertations. 13184
2. Ashdown, S. P. (2000). Introduction to sizing and fit research. Clemson, SC: Clemson Apparel Research.
3. Beazley, A. (1999). Size and fit: The development of size charts for clothing - Part 3. Journal of Fashion Marketing and Management, 3(1), 66-84.
4. Brown, P., & Rice, J. (2001). Ready-to-wear apparel analysis. Upper Saddle River, NJ: Prentice Hall.
5. Chattaraman, V., & Rudd, N. A. (2006). Preferences for aesthetic attributes in clothing as a function of body image, body cathexis, and body size. Clothing and Textiles Research Journal, 24(46), 46-61.
6. Esterberg, K. G. (2002). Qualitative methods in social research. Boston: McGraw-Hill.
7. Fan, J., Yu, L., & Hunter, L. (2004). Clothing appearance and fit: Science and technology. Cambridge, England: Woodhead
8. Field, A. (2005). Discovering statistics using SPSS. Thousand Oaks, CA: Sage Publications.
9. Frost, K. (1988). Consumer's perception of fit and comfort of pants. (Unpublished master's thesis), University of Minnesota, St. Paul.
10. Jourard, S. M., & Secord, P. F. (1955). Body cathexis and personality. British Journal of Psychology, 46, 130-138.
11. Kim, H., & Damhorst, M. L. (2010). The relationship of body-related self-discrepancy to body dissatisfaction, apparel involvement, concerns with fit and size of garments, and purchase intentions in online apparel shopping. Clothing and Textiles Research Journal, 239-254.
12. Kinley, T. R. (2010). Fit and shopping preferences by clothing benefits sought. Journal of Fashion Marketing and Management, 14(3), 397-411.
13. Technopak 2018, Indian Apparel Market, viewed 14 Feb 2020, <http://www.technopak.com/Files/indian-apparel-market.pdf>
14. Statista Research Department 2019, Indian Menswear Apparel Market, viewed 15 Feb 2020, < https://www.statista.com/statistics/share-of-men-s-apparel-market-by-category-india/>
15. Philip Kotler (2011). "Kotler on Strategic Market Research" 14th Edition Chapter-4 , Page 59
16. Kala, M. (2015). To study gaps and customer perception for Menswear Private Label. Mumbai.
17. Lew, M. Y. (2015). Analysis of Merchandise Mix of the brand-Honey and Commpetitive positioning of the brand- Candies. Mumbai.
18. Adepeju Abimbola Opaleye, Adekunle Kolawole, Oliver Ekepre Charles-Owaba (2019). Application of Fuzzy Clustering Methodology for Garment Sizing. American Journal of Data Mining and Knowledge Discovery. Vol. 4, No. 1, 2019, pp. 24-31
19. Online product reviews, 2020, Myntra, viewed 18th Feb 2020, <https://www.myntra.com>
20. Company overview,2020, viewed 10th Feb 2020, <https://www.jackjones.in/about.html>
21. Company overview 2020, viewed 11th Feb 2020, <https://www.aeo-inc.com/aboutus.html>
22. Company overview 2020, viewed 13th Feb 2020, <https://www.pepejeans.com/about.html>
23. Company overview 2020, viewed 14th Feb 2020, < https://www.levi.in/about-us.html>
24. Company overview 2020, viewed 16th Feb 2020, <https://uspoloassn.com/whoweare>
25. Company overview 2020, viewed 10th Feb 2020, < https://www.calvinklein.us/en/about-us>
26. Company overview 2020, viewed 18th Feb 2020, <https://www.celio.in/discover-celio>
27. Company overview 2020, viewed 19th Feb 2020, < http://www.benettongroup.com/>
28. Company overview 2020, viewed 20th Feb 2020, <https://www.lee.com/about/history.html>

10. Limitations & Future Scope

The study has attempted to divulge into some of the important issues. However, there are some limitations in the conduct of this study which are discussed below.

The measurements were collected manually and therefore are subject to human error. Through the use of 3D body scanning technology, the scope of these errors can minimized or even completely eliminated.

The size chart developed based on the data collected from k-means clustering could be used for further research and development of size chart for all menswear bottoms such as formal pants, joggers, shorts and so on. It could also be used in a plethora of anthropometric studies as a representative of lower body measurements of Indian men.

11. Annexure

11.1. Information about Measurement Collection

S.No.	State	Address	Measurements Collected
1.	Andhra Pradesh	Ground floor-35,37, PVP square, MG Road, Moghalrajpuram, opp. petrol bunk, Vijayawada, Andhra Pradesh 520010	23
2.	Bihar	Rajendra Nagar Over Bridge, Kankarbagh Main Rd, Kankarbagh, Patna, Bihar 800020	45
3.	Chattisgarh	Kotwali, Near City, Malviya Rd, Raipur, Chhattisgarh 492001	13
4.	Goa	Ground Floor, Baboy Commerce Center, Malbhat, Margao, Goa 403601	28
5.	Gujarat	SHOP NO : 16A, Alpha One Mall, F-41, near VastrapurLake, Vastrapur, Ahmedabad, Gujarat 380015	53
6.	Haryana	MGF Metropolitan Mall, Shop No. 9 &10 Ground Floor, Gurgaon Rd, Gurugram, Haryana 122002	29
7.	Himachal Pradesh	67-69, Mall Rd, Middle Bazar, The Mall, Shimla, Himachal Pradesh 171001	21
8.	Jharkhand	G-15, Alokapuri Complex, Opp Amrawati Complex, Lalpur Chowk, Circular Rd, Lalpur, Ranchi, Jharkhand 834001	18
9.	Karnataka	No. 777/F, 100 Feet Road, Opposite New Horizon School, Indiranagar, Bengaluru, Karnataka 560038	67
10.	Kerala	#5, 1st Floor, Kannur Mall, OPP Kavitha Theatre,, SN Park Road, Kannur, Kerala 670001	12
11.	Madhya Pradesh	103-104, Mahatma Gandhi Rd, , South Tukoganj, Indore, Madhya Pradesh 452001	34
12.	Maharashtra	High Street Phoenix Mall, 462, Senapati Bapat Marg, Lower Parel, Mumbai, Maharashtra 400013	29
13.	Odisha	B-53, Shaid Nagar, Opposite Road Womans College, Janpath, Janpath, Bhubaneswar, Odisha 751007	25
14.	Punjab	Shop No. 27B, FF, Alpha Mall, G T Road, MBM Farm, Rajinder Nagar, Maqbool Pura, Amritsar, Punjab 143001	43
15.	Rajasthan	Ground Floor, City Mall, Jhalawar Road, Kota, Rajasthan 324005	26
16.	Tamil Nadu	4/3, Indira Gandhi St, HIG, Nolambur, Ambattur Industrial Estate, Chennai, Tamil Nadu 600037	23
17.	Telangana	Harmony Plaza, Gagan Mahal, Domalguda, Himayatnagar, Hyderabad, Telangana 500029	19
18.	Uttar Pradesh	Shop No. 19A, Taj Rd, Near Bachumal, Sadar Bazar, Agra Cantt, Idgah Colony, Agra, Uttar Pradesh 282001	27
19.	Uttarakhand	Main Post Office Road, Civil Lines, Roorkee, Uttarakhand 247667	34

20.	West Bengal	City Center 2, AA-Iid, Major Arterial Road(East-West), Newtown, Kolkata, West Bengal 700157	27
		Total	596

11.2. Measurements Collected

S.NO	Waist	Thigh	Knee	Ankle
1	32.6	22	15.1	9.1
2	43.4	28	17.2	12.1
3	29	19.3	14.3	8.7
4	38.8	25.33	16.5	11.1
5	39	26.05	16.6	11.2
6	38.6	26.09	16.7	11.2
7	39.5	25.45	16.5	11.2
8	29.1	19.5	14.3	8.5
9	43.4	28.2	17.4	12.1
10	38.9	26.09	16.6	11.2
11	34.9	23.33	15.6	10.3
12	41.2	27.1	17.1	11.6
13	41.1	27.1	17.1	12
14	43.5	28	17.5	12.1
15	33.9	22.5	15.1	9.7
16	39	25.84	16.6	11.1
17	32.5	22.3	15.1	8.7
18	33.2	21.7	15.1	8.9
19	34.4	23.5	15.5	10.3
20	39.3	25.73	16.6	11.1
21	38.5	25.21	16.6	11.1
22	31.2	20.7	14.3	9.2
23	43.2	28.07	17.5	12
24	34.2	23.44	15.6	10.2
25	36.8	23.5	16.2	10.7
26	43	28	17.2	12.1
27	33.5	22.5	15	9.3
28	36.4	24.9	16.1	10.8
29	41.3	27.2	17.1	12
30	43	28.12	17.7	12
31	36.4	23.6	15.6	10.7
32	39.2	25.78	16.5	11.1
33	36.4	24.8	15.8	10.5
34	34	21.4	15.1	10.5
35	29.1	19.7	14	8.7
36	31.1	21.3	14.9	9.1
37	29.3	18.7	14.3	8.6

S.NO	Waist	Thigh	Knee	Ankle
38	34.2	23.33	15.6	10.3
39	39.1	25.21	16.6	11.1
40	34	22.5	15.1	10.2
41	31.4	20.7	15	9.2
42	41.1	27.4	17	11.1
43	43.5	28.03	17.3	12.1
44	41	27	17.2	11.4
45	31.2	20.2	14.4	9.2
46	31.1	20.5	15.1	9.2
47	33.9	21.8	15.2	10.1
48	39.4	26.41	16.5	11
49	29.3	19.2	14.1	8.6
50	37.1	24.9	16.4	10.8
51	33.1	21	15.1	10.1
52	36.4	23.6	15.7	10.6
53	32.9	22.3	15.2	8.6
54	31	21.1	15.1	9.2
55	29.2	19.6	14.1	8.6
56	36.2	25	15.6	10.7
57	34.6	23.3	15.5	10.3
58	37	24	16.1	10.6
59	36.4	24.5	16.4	10.6
60	36.6	23.5	16.1	10.7
61	31	20.1	14.6	9.3
62	38.6	25.77	16.6	11.1
63	41.1	27.2	17.2	12.1
64	31.3	20.5	15.1	9.3
65	29.3	19.5	14.2	8.6
66	29.2	19.5	14.2	8.6
67	43.4	28.04	17.7	12.2
68	43	28.02	17.6	12
69	29.2	19.7	14.3	8.7
70	33.7	21.5	15.1	9.3
71	33.9	21	15.2	10.2
72	36.6	24.1	16	10.6
73	38.7	25.77	16.5	11.2
74	29.2	19.5	14.2	8.5

S.NO	Waist	Thigh	Knee	Ankle
75	35.2	23.29	15.6	10
76	34	21.3	15	9.9
77	31	21.4	14.4	9.1
78	29.1	19	14.2	8.6
79	31.3	20.5	14.8	9.1
80	33.1	21.3	15.1	10.1
81	29.2	19.4	14.1	8.6
82	34.1	23.44	15.7	10.2
83	32.8	21.1	15.1	10.3
84	29.2	19.3	14.1	8.5
85	36.5	23.8	16.3	10.6
86	32.9	21.7	15.1	9
87	36.6	23.6	15.8	10.5
88	31.4	20.1	14.4	9.1
89	41.3	27.5	17.1	11.3
90	31.1	21.4	14.3	9.2
91	32.5	21.2	15.1	9
92	33.4	22.2	15.2	10
93	41.5	27.2	17.2	12
94	43.4	28.14	17.4	12.1
95	29.2	19.6	14.2	8.6
96	33.4	22.4	15.1	9.2
97	38.7	26.22	16.7	11.2
98	31.2	20.5	14.1	9.2
99	29.3	19	14	8.7
100	31.2	21.2	14	9.2
101	31.3	20.3	14.9	9.1
102	33.9	21.1	15.2	9.7
103	31.4	21.2	14	9.1
104	33.7	22.3	15.2	8.8
105	36.8	24	16.4	10.5
106	34.3	23.38	15.7	10.1
107	41.4	27.4	17.1	11.5
108	31.4	20.9	15.2	9.2
109	31.2	20.9	15	9.1
110	43.2	28.17	17.3	12.1
111	41.4	27.4	17.1	12.1
112	41.2	27.2	17.1	11
113	39.4	25.29	16.6	11.1
114	37	24.9	15.8	10.5
115	36.7	24.9	15.5	10.6
116	31.3	21	14.3	9

S.NO	Waist	Thigh	Knee	Ankle
117	41.4	27.1	17.2	12.1
118	31.1	20.6	14.4	9.2
119	29	19.2	14	8.7
120	34.4	23.38	15.6	10.1
121	34.3	23.37	15.6	10.3
122	29.1	19	14.1	8.6
123	37.2	23.6	16.1	10.6
124	37.4	24	16	10.7
125	29	19.8	14.3	8.6
126	41.2	27.2	17.1	11
127	41.3	27.2	17	11.1
128	38.9	25.96	16.5	11.1
129	43.4	28.16	17.1	12
130	32.8	21.8	15	9.5
131	35.4	23.49	15.7	10.1
132	29.1	19.3	14.3	8.6
133	29.1	18.8	14	8.7
134	35.2	23.46	15.7	10.2
135	34.1	23.25	15.5	10.1
136	41.4	27.1	17.1	11.4
137	35.2	23.27	15.7	10.1
138	37.1	24.3	15.7	10.5
139	29	19.4	14.1	8.6
140	41.3	27.2	17	11.1
141	41	27.1	17.2	11
142	36	24.5	16.5	10.6
143	33.8	21.2	15.2	10.1
144	34.3	23.48	15.7	10.3
145	29.2	19.6	14.2	8.5
146	34.2	23.31	15.7	10.3
147	34.9	23.25	15.5	10.1
148	41.2	27.1	17	11.4
149	39.2	26.29	16.7	11
150	41.5	27.2	17.1	11.3
151	32.8	21.4	15.1	10.1
152	43.1	28.06	17.1	12.1
153	37.1	24.8	16.4	10.6
154	31.3	21.3	14.4	9
155	37.1	24.1	16.2	10.6
156	31.1	21.4	14	9.3
157	41.2	27.1	17.1	11.2
158	34.1	21.6	15.1	8.6

S.NO	Waist	Thigh	Knee	Ankle
159	31.1	20.4	14.3	9.3
160	43.4	28.16	17.6	12
161	33.1	22.1	15.1	8.7
162	39.5	25.21	16.6	11.1
163	34.8	23.35	15.5	10.1
164	37.1	24	16.1	10.5
165	43.1	28.17	17.1	12
166	29	19.2	14.2	8.6
167	33.1	22.1	15.1	9.3
168	38.6	26.56	16.7	11
169	31	20.6	14.4	9.2
170	29.3	19.2	14.3	8.7
171	36.4	24.3	16.2	10.6
172	36	24.4	15.6	10.6
173	29.2	19.2	14.2	8.6
174	37	24.3	16.5	10.5
175	35.4	23.3	15.5	10.1
176	34	23.38	15.5	10.3
177	41.5	27.4	17.1	11.7
178	43	28.18	17.3	12.1
179	39.1	26.39	16.6	11.1
180	31.4	20.3	14.2	9
181	43	28.03	17.6	12.1
182	33.2	21.3	15.1	8.8
183	35.3	23.39	15.7	10
184	29.2	19.9	14.2	8.7
185	39.4	25.2	16.7	11.2
186	29.2	19.7	14.2	8.6
187	33.2	22.5	15.1	9.7
188	41.1	27.2	17.1	11.2
189	31.1	20.5	14.9	9
190	31.3	21.2	14.8	9
191	37.1	24.2	16.1	10.6
192	31.3	20.6	14.7	9.2
193	37.3	24.6	15.5	10.8
194	31.2	20.2	15	9
195	36.7	24.5	15.8	10.5
196	38.9	25.89	16.5	11.2
197	34.5	23.47	15.5	10
198	31	20.8	14.9	9.1
199	43.2	28.1	17.3	12.1
200	29.1	18.9	14.2	8.6

S.NO	Waist	Thigh	Knee	Ankle
201	33.3	21.3	15.2	10.5
202	41.5	27.5	17.2	11.3
203	33.3	22.4	15	9.9
204	39.1	25.27	16.7	11.2
205	29.2	19.4	14.1	8.6
206	34.8	23.28	15.7	10.3
207	29.2	19.7	14.2	8.5
208	43.2	28.01	17.3	12.2
209	34	21.1	15.1	9.1
210	36.1	24.8	16.1	10.7
211	36.1	23.5	15.6	10.6
212	41.3	27.1	17.1	11
213	38.5	25.8	16.5	11.1
214	36.1	24.6	16.5	10.8
215	34.9	23.29	15.5	10.2
216	31.1	21.2	15	9.1
217	31.4	21.5	14.2	9.3
218	34	22.2	15.2	10.2
219	29.3	19.6	14.3	8.7
220	39.1	26.16	16.5	11
221	29.2	19.5	14.1	8.5
222	29.1	19.4	14.1	8.6
223	41.1	27.3	17.2	12
224	31.3	21	14.7	9.3
225	29.2	19.1	14.1	8.5
226	36.3	23.8	16.3	10.5
227	35	23.41	15.5	10.1
228	36.7	24.1	15.7	10.7
229	38.8	25.31	16.6	11.1
230	29.2	19	14.1	8.6
231	36.9	24.5	15.9	10.7
232	35	23.34	15.5	10.3
233	31.1	21.4	15.1	9.1
234	41.1	27.4	17.1	12.1
235	41.4	27.2	17.1	11.9
236	38.9	26.23	16.6	11.2
237	31.1	21.4	14.5	9
238	31.2	21.3	14.3	9.2
239	33.4	22.5	15.1	10.1
240	34.6	23.4	15.6	10.2
241	35	23.3	15.5	10.1
242	43	28.2	17	12.2

S.NO	Waist	Thigh	Knee	Ankle
243	37.5	24.5	16.5	10.6
244	39	25.03	16.5	11.2
245	29.1	19.6	14.2	8.5
246	31.4	20.2	14.7	9.1
247	31.1	20.1	15	9.1
248	37.3	24.8	15.6	10.8
249	39	25.42	16.6	11
250	34.7	23.44	15.7	10.1
251	41.4	27.3	17.1	11.1
252	39.2	25.28	16.6	11.2
253	29.1	19.5	14.3	8.6
254	29.2	18.8	14	8.5
255	34.2	23.29	15.6	10.4
256	41.2	27.4	17	11.8
257	36.4	24.3	16	10.6
258	32.8	22.4	15.1	9.9
259	38.5	26.13	16.6	11.1
260	37.3	24.5	15.7	10.5
261	37.3	24.5	15.8	10.6
262	29.3	19.6	14.2	8.6
263	31.2	21	14.9	9.2
264	39.5	26.72	16.5	11.1
265	41.1	27.2	17.2	11.9
266	31.1	20.2	14.1	9.1
267	33.3	22.4	15.1	9.4
268	29.2	19.7	14.1	8.6
269	33.5	21.1	15.1	9.1
270	34.8	23.26	15.5	10.2
271	35.3	23.34	15.6	10.1
272	31.2	21.1	14.7	9.1
273	39	26.14	16.7	11.2
274	29.1	19.3	14.1	8.6
275	43.5	28.01	17.2	12.1
276	33.6	21.9	15	10.3
277	39.2	26.19	16.6	11.1
278	29.1	20	14	8.6
279	31.1	20.4	14.1	9.1
280	38.6	26.34	16.5	11.1
281	34.5	23.48	15.5	10.3
282	33	21.3	15.2	10.2
283	39.1	26.72	16.7	11.1
284	41.5	27.4	17.2	11.1

S.NO	Waist	Thigh	Knee	Ankle
285	29.1	18.9	14.2	8.5
286	36.9	24.3	16.1	10.6
287	35.3	23.44	15.6	10.1
288	43.2	28.05	17.7	12.1
289	37.1	24.4	16.1	10.8
290	31.2	20.3	14.9	9.1
291	41.3	27.5	17	12.2
292	29.1	19.7	14.1	8.6
293	33.2	21.7	15	8.7
294	33.9	21.7	15.2	10.1
295	32.6	21.2	15.1	10.1
296	43.2	28.09	17.1	12.1
297	31.2	20.4	14.6	9.1
298	34.7	23.37	15.6	10.2
299	29.3	18.9	14.3	8.7
300	41.1	27.3	17	12.1
301	43.1	28	17.5	12.1
302	29.2	19.6	14.1	8.6
303	31.1	20.6	14.6	9.2
304	32.7	22	15.1	9.5
305	29.1	19.9	14	8.6
306	43.3	28.03	17.5	12.2
307	41.1	27.4	17	11.1
308	35	23.28	15.6	10.4
309	31.3	21	14.5	9.2
310	34	22.3	15.2	8.5
311	34.2	23.31	15.6	10.2
312	33.6	22.1	15	10.3
313	43.1	28.2	17.7	12.1
314	34.4	23.31	15.5	10.2
315	34	21.1	15	9.1
316	41.2	27.3	17.1	12.2
317	34.9	23.37	15.6	10.3
318	37.4	24.5	15.8	10.5
319	38.8	25.62	16.6	11.1
320	31.4	20.1	14.3	9.3
321	43.2	28.03	17.1	12
322	31.3	20.6	14.7	9.3
323	41.1	27.5	17.2	11.4
324	29.1	18.7	14.1	8.5
325	41.3	27.1	17.1	11.1
326	34.9	23.28	15.5	10.2

S.NO	Waist	Thigh	Knee	Ankle
327	35.3	23.37	15.6	10.1
328	31.2	20.1	15.1	9.2
329	29	19.5	14.3	8.6
330	37.2	24.2	16.2	10.6
331	33.6	22.4	15.1	9.5
332	33	21.1	15.2	9.2
333	41.2	27.3	17.1	11.4
334	39.5	25.52	16.6	11.1
335	33.9	21.6	15.1	8.6
336	43.3	28.21	17.4	12
337	43.4	28.11	17.6	12.1
338	33.5	21.5	15.1	8.8
339	41.3	27.2	17.1	11.3
340	36	24.3	15.6	10.5
341	43.3	28.02	17.1	12.1
342	36.5	23.8	16.1	10.7
343	31.1	20.8	14.5	9.2
344	29.3	19.2	14.2	8.7
345	34.9	23.38	15.7	10.4
346	33.8	21.9	15	10
347	31.4	21	14.2	9.1
348	36	23.6	16	10.8
349	33.5	21.7	15.2	9.2
350	43.4	28.1	17.4	12.2
351	41.4	27.1	17.2	11.4
352	32.7	21.6	15.1	8.9
353	31.2	21.4	14.5	9
354	41.4	27	17.1	11.6
355	33.2	21.1	15.2	9.6
356	38.9	25.97	16.6	11
357	43.5	28.06	17.2	12.2
358	36.2	24.3	16.5	10.6
359	37.4	23.7	16.1	10.6
360	39.2	26.31	16.6	11
361	36.1	23.6	15.6	10.6
362	31.1	20.1	14.2	9.3
363	39.3	25.54	16.6	11.1
364	34.1	21.1	15.2	10.1
365	41.1	27.2	17.1	11.6
366	35.3	23.42	15.7	10.1
367	29.2	19.8	14.3	8.7
368	41.3	27.1	17.1	11.2

S.NO	Waist	Thigh	Knee	Ankle
369	33.9	21.7	15.1	9.1
370	36.4	23.6	16.4	10.6
371	36.6	24.4	15.7	10.6
372	29.2	19.6	14.2	8.6
373	43.3	28.16	17.7	12.1
374	33.3	21.2	15.1	10
375	33.2	21.9	15.1	10.3
376	41.1	27.2	17.1	11
377	31.2	20.8	14	9.1
378	31.2	20.6	14.2	9.3
379	35.3	23.29	15.6	10.3
380	41.2	27.5	17.1	11
381	29.2	18.8	14	8.5
382	31.2	20.2	14.4	9.1
383	33.4	21.1	15	9.7
384	38.6	26.04	16.6	11.2
385	35.4	23.3	15.6	10.3
386	35.3	23.49	15.7	10.1
387	34.3	23.48	15.6	10.3
388	36.9	23.9	15.9	10.6
389	38.8	25.21	16.6	11.1
390	41.4	27.1	17.1	11.9
391	39.4	26.59	16.5	11.1
392	34.1	21.2	15.1	8.7
393	34.6	23.38	15.6	10
394	36.9	23.9	16.5	10.6
395	29.3	19.7	14	8.7
396	36.5	24.8	15.6	10.6
397	33.2	22.1	15	8.9
398	34.1	23.49	15.5	10
399	43.2	28.21	17.5	12.2
400	39.2	26.12	16.5	11.2
401	41.2	27.4	17	11.1
402	29.1	19.3	14	8.7
403	31.4	21.1	15	9.2
404	34.4	23.41	15.6	10.3
405	29.3	19.7	14.2	8.6
406	32.8	21.6	15.2	9.7
407	41.2	27.3	17	12.2
408	41	27.3	17.2	12.1
409	41.2	27.2	17.2	12
410	29	20	14.2	8.6

S.NO	Waist	Thigh	Knee	Ankle
411	31.1	20.7	14.5	9.2
412	31.2	21.2	14.4	9.1
413	29.2	19.8	14	8.6
414	43	28.23	17.4	12.1
415	41.2	27.4	17	11.5
416	43.2	28.08	17	12.1
417	36.7	24	16	10.7
418	36.5	23.7	16.4	10.8
419	33.5	21.6	15.2	8.6
420	41.5	27.3	17.1	12
421	33.8	22.2	15.1	9.3
422	34.3	23.34	15.5	10.3
423	39.5	26.4	16.6	11.1
424	41.2	27.4	17.2	11.9
425	29.1	19.9	14.2	8.6
426	29.1	19.3	14	8.6
427	29.3	19.9	14.1	8.5
428	29.2	19	14	8.6
429	41	27.2	17.2	12.3
430	33.5	21.3	15	8.8
431	33.9	21.1	15.2	9.6
432	29.3	19	14.2	8.6
433	29	19.8	14.2	8.5
434	34.5	23.49	15.7	10.1
435	31.4	20.5	14.7	9
436	29.2	18.8	14	8.7
437	39.2	26.43	16.6	11.2
438	43	28.14	17.2	12.1
439	43.5	28.1	17.3	12.2
440	39.4	26.61	16.7	11
441	43.2	28.02	17.5	12.1
442	33.5	22	15.1	9.1
443	43.1	28.22	17.7	12.1
444	36.8	23.9	16.1	10.5
445	38.9	26.28	16.5	11
446	34.4	23.44	15.6	10.1
447	43.2	28.14	17.7	12
448	29.3	19.6	14.2	8.5
449	41	27.2	17	11.5
450	35.4	23.28	15.6	10.3
451	41.1	27.3	17.1	11.5
452	29	19.1	14	8.7

S.NO	Waist	Thigh	Knee	Ankle
453	36.3	25	16.4	10.6
454	34	23.49	15.6	10.1
455	29.2	19.5	14.1	8.7
456	34.9	23.26	15.6	10.2
457	35.2	23.46	15.6	10.4
458	39	26.08	16.6	11.1
459	31.1	20.6	14.9	9
460	36.1	24.6	15.5	10.7
461	35.2	23.41	15.6	10.1
462	41.5	27.1	17.1	11.4
463	41.4	27.5	17.1	11.7
464	35.3	23.39	15.7	10.1
465	31.5	20.7	14.7	9.1
466	41.3	27.3	17.1	11.6
467	31.5	20.1	15.2	9
468	35	23.34	15.7	10
469	43.2	28.19	17.5	12.1
470	31.4	21.4	14.8	9
471	35.1	23.48	15.5	10.4
472	29	18.9	14	8.6
473	32.7	21.5	15	9.4
474	32.9	21.7	15	10.1
475	36.7	24	16.4	10.6
476	41	27.3	17.1	12.2
477	36.3	23.6	16.3	10.6
478	29.1	19.2	14.2	8.5
479	31	20.9	14.8	9.3
480	33.6	21.3	15.2	9.8
481	43.3	28.06	17.5	12.2
482	34.6	23.25	15.6	10.2
483	39.3	26.06	16.5	11.2
484	29.2	18.7	14.3	8.6
485	39.3	25.1	16.5	11.1
486	35	23.37	15.5	10.2
487	39.1	26.22	16.5	11.1
488	39.4	26.16	16.6	11.1
489	31.3	20.1	14.4	9.2
490	31.4	20.7	14.2	9.1
491	33	22.4	15	10.3
492	41.1	27.4	17.1	12.2
493	29.2	18.9	14.2	8.6
494	39	25.32	16.7	11.2

S.NO	Waist	Thigh	Knee	Ankle
495	31.3	21	15	9
496	39.4	26.57	16.6	11
497	41.3	27.5	17.1	12.1
498	35.4	23.27	15.7	10
499	34.9	23.46	15.7	10.1
500	36.2	24	15.7	10.7
501	31.3	20.4	14.7	9.2
502	41.2	27.2	17.1	11.7
503	38.7	25.71	16.7	11.1
504	39	26.66	16.7	11
505	41.2	27.2	17.1	11.2
506	34.4	23.35	15.7	10.3
507	36	24.4	15.8	10.6
508	36.2	23.8	15.6	10.6
509	39.2	25.03	16.6	11
510	35.4	23.33	15.5	10
511	43.2	28.16	17.1	12.2
512	37	24.3	15.8	10.6
513	43.3	28.03	17	12.2
514	39.2	25.51	16.7	11
515	39.5	25.31	16.6	11.1
516	36.3	24.2	15.5	10.6
517	32.7	22.1	15.1	9.2
518	41.2	27.4	17.1	12
519	36.9	24.5	15.8	10.7
520	41.4	27.2	17.1	11.6
521	33.2	22.1	15.1	9.1
522	33.2	21	15.1	9
523	36.5	23.7	15.8	10.6
524	41.3	27.1	17.1	11.5
525	31	21.1	14.4	9
526	33	21.3	15.2	10.3
527	33.4	21.3	15.1	9.3
528	31.3	20.3	14.4	9.1
529	43.2	28.18	17	12.1
530	34.7	23.38	15.6	10.2
531	34.6	23.37	15.6	10.1
532	29	19	14.1	8.6
533	36.4	24	16.1	10.7
534	31.5	21.3	14.3	9.2
535	29	19.6	14	8.5
536	41.3	27.2	17	11.2

S.NO	Waist	Thigh	Knee	Ankle
537	41.1	27.4	17.1	11.6
538	32.7	22.1	15.1	10.5
539	34.9	23.45	15.6	10.2
540	33.8	21.5	15.2	9.9
541	31.3	21.3	14.1	9.3
542	34.6	23.35	15.6	10.2
543	34.1	23.48	15.6	10
544	41.1	27.3	17	11.1
545	41.4	27.1	17	11.8
546	38.5	26.03	16.7	11
547	34.8	23.26	15.7	10.2
548	29	18.8	14.2	8.5
549	38.6	25.07	16.7	11.1
550	43.5	28.08	17.2	12.1
551	31.4	21.2	15	9.1
552	41.5	27	17.1	11.9
553	39.3	25.78	16.6	11.2
554	31.4	20.7	14.8	9.2
555	31.1	20.3	14.5	9.2
556	29.2	19	14.2	8.6
557	33.8	21.6	15.1	9.3
558	41.2	27.4	17.1	11.7
559	33.2	21.8	15.1	8.6
560	29.1	19.5	14.2	8.5
561	36.8	24	15.7	10.6
562	31.3	20.9	14.1	9.1
563	29.2	18.9	14.3	8.5
564	32.7	21	15.1	10
565	31.2	21.2	14.6	9.1
566	31.2	20.6	15.1	9.2
567	41.2	27.3	17.2	12.2
568	43.2	28.17	17.3	12.1
569	36.5	23.9	15.8	10.6
570	29.2	18.9	14.1	8.6
571	29	20	14.1	8.6
572	41.4	27.3	17.1	11.8
573	33.7	21.6	15	8.6
574	39.4	25.41	16.7	11.2
575	31.5	20.8	14.4	9.2
576	39.5	25.25	16.5	11.1
577	32.7	22.3	15	8.9
578	33.4	21.2	15.2	8.9

S.NO	Waist	Thigh	Knee	Ankle
579	33.8	21.8	15	9.6
580	34.3	23.46	15.7	10.2
581	37.4	23.9	16.2	10.7
582	31.1	20.9	14.1	9
583	35.1	23.27	15.7	10.4
584	34.2	23.37	15.7	10.4
585	33.6	22	15.1	9.8
586	33.5	21.3	15.2	9.2
587	41.2	27.3	17	12

S.NO	Waist	Thigh	Knee	Ankle
588	29.1	19.2	14.2	8.7
589	33.1	21.8	15.1	10.2
590	34.8	23.26	15.5	10.3
591	36.7	24.8	16	10.6
592	34.3	23.28	15.7	10.2
593	31.4	21.1	14.1	9.2
594	31.1	20	14.3	9.1
595	31.2	21	14.1	9.2
596	31.3	20.3	15.2	9.2

11.3. Customer Feedback on Previous Fit

Bruce (Skinny Fit)

	Loose	Good Fit	Tight
Waist	47	12	1
Hip	56	4	0
Thigh	52	8	0
Knee	12	41	7
Ankle	43	13	4

Anton (Slim Taper)

	Loose	Good Fit	Tight
Waist	4	48	8
Hip	52	7	1
Thigh	46	12	2
Knee	42	18	0
Ankle	2	57	1

Travis (Slim Straight)

	Loose	Good Fit	Tight
Waist	4	53	3
Hip	48	11	1
Thigh	50	10	0
Knee	4	52	4
Ankle	1	57	2

Rodeo (Regular)

	Loose	Good Fit	Tight
Waist	0	57	3
Hip	2	20	38
Thigh	2	54	4
Knee	1	58	1
Ankle	0	60	0